DEVELOPMENT OF A BEST PRACTICE MODEL FOR TEACHING AND LEARNING EVIDENCE-BASED HEALTH CARE AT STELLENBOSCH UNIVERSITY, SOUTH AFRICA

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Declaration

By submitting this dissertation electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the sole author thereof (save to the extent explicitly otherwise stated), that reproduction and publication thereof by Stellenbosch University will not infringe any third party rights and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

This dissertation includes 5 original papers published or accepted for publication in peer reviewed journals, 1 PhD linked original paper and 1 unpublished work. The development and writing of the papers (published and unpublished) were the principal responsibility of myself and for each of the cases where this is not the case a declaration is included in the dissertation indicating the nature and extent of the contributions of co-authors.

Date: March 2016

Abstract

This thesis used a mixed-methods approach to investigate how teaching and learning of Evidence-based Health Care (EBHC) could best be integrated in medical student training to enhance student EBHC knowledge, attitude and skills.

An overview of systematic reviews assessing the effects of teaching EBHC showed that clinically integrated multifaceted strategies with assessment were more effective than single interventions or no interventions for enhancing knowledge, attitude and skills.

Implementation of clinically integrated EBHC teaching and learning was further explored through interviews with programme coordinators from around the world. Informants were requested to provide data on the various approaches used, and on barriers and facilitators encountered with programmes aimed at teaching and learning EBHC in an integrated manner. By far the most common challenges were lack of space in the clinical setting, EBHC misconceptions, resistance of staff and lack of confidence of tutors, time, and negative role modelling. Critical success factors identified were pragmatism and nimbleness in responding to opportunities for engagement and including EBHC learning into the curriculum, patience, and a critical mass of the right teachers who have EBHC knowledge, attitudes and skills and are confident in facilitating learning. In addition, role modelling within the clinical setting and the overall institutional context were found to be important for success.

The next phase involved conducting a set of studies to determine the opportunities for, and barriers to, implementing EBHC teaching and learning at Stellenbosch University's (SU) Faculty of Medicine and Health Sciences. This included a curriculum document review, survey of recent graduates and interviews with faculty. EBHC teaching was found to be fragmented and recent graduates called for more teaching of certain EBHC competencies. Module convenors identified a number of factors that needed to be addressed: contextual factors within the faculty (e.g. recognition for teaching), health sector issues (e.g. clinical workload), access to research evidence, and issues related to educators (e.g. competing priorities) and learners (e.g. motivation). Interviewees also emphasised the importance of educators as facilitators and role models.

A cross-sectional study of SU was conducted to assess SU educators' knowledge of, attitude to and confidence in practicing and teaching EBHC as well as perceived barriers to practicing and teaching EBHC. Limitations to practicing EBHC identified included lack of time, clinical workload, limited access to internet and resources, knowledge and skills. Respondents' called for reliable internet access, easy point-of-care access to databases and resources, increasing awareness of EBHC, building capacity to practice and facilitate learning of EBHC, and a supportive community of practice.

Finally, drawing on the findings of the preceding quantitative and qualitative studies, and taking into account the context of various EBHC initiatives in the African region, an outline proposal is presented for a cluster randomised trial to evaluate alternative options for implementing a clinically integrated EBHC curriculum in an African setting.

Abstrakt

In hierdie tesis is ’n gemengdemetode-benadering gebruik om ondersoek in te stel na die manier waarop die onderrig en leer van bewysgebaseerde gesondheidsorg (BGGS) die beste in die opleiding van mediese studente geïntegreer kan word om studente se kennis, houding en vaardighede met betrekking tot BGGS te bevorder.

’n Oorsig van stelselmatige evaluerings waarin die uitkomste van die onderrig van BGGS geassesseer is, het getoon dat klinies geïntegreerde meervlakkige strategieë met assessering doeltreffender is as enkelintervensies of geen intervensie vir die bevordering van kennis, houdings en vaardighede.

Die implementering van klinies geïntegreerde BGGS-onderrig en -leer is verder ondersoek in onderhoude met programkoördineerders oor die wêreld heen. Informante is versoek om data te verskaf oor die onderskeie benaderings wat gebruik word, asook oor hindernisse en fasiliteerders wat gepaard gaan met programme gemik op die geïntegreerde onderrig en leer van BGGS. Die algemeenste uitdagings was verreweg gebrek aan ruimte in die kliniese omgewing, wanopvattings oor BGGS, weerstand van personeel en gebrek aan selfvertroue van tutors, tyd en negatiewe rolmodellering. Kritieke suksesfaktore wat geïdentifiseer is, was pragmatisme en behendigheid in reaksies op geleenthede vir betrokkenheid en insluiting van BGGS in die kurrikulum, geduld en ’n kritieke volume van die regte opvoeders wat kennis, houdings en vaardighede met betrekking tot BGGS het en leer met selfvertroue in die hand werk. Hierbenewens is rolmodellering in die kliniese omgewing en die algehele institusionele konteks as belangrik vir sukses bevind.

Die volgende fase het ’n stel studies behels om die geleenthede en hindernisse met betrekking tot die implementering van BGGS-onderrig en -leer by die Universiteit Stellenbosch (US) se Fakulteit Geneeskunde en Gesondheidswetenskappe te bepaal. Dit het ingesluit ’n kurrikulumdokumentoorsig, ’n opname onder nuwe graduandi en onderhoude met die fakulteit. Die bevinding was dat BGGS-onderrig gefragmenteerd plaasvind en nuwe graduandi het ’n behoefte verwoord aan meer opleiding in sekere BGGS-vaardighede. Modulesameroepers het ’n aantal faktore geïdentifiseer wat aandag verg: kontekstuele faktore in die fakulteit (bv. erkenning vir leer), gesondheidsektorkwessies (bv. kliniese werklading), toegang tot navorsingsbewyse, en kwessies verbonde aan opvoeders (bv. mededingende prioriteite) en studente (bv. motivering). Die ondervraagdes het ook klem gelê op die belang van opvoeders as fasiliteerders en rolmodelle.

’n Deursneestudie van die US is uitgevoer om US-opvoeders se kennis van, houdings teenoor en vertroue in die toepassing en onderrig van BGGS asook waargenome hindernisse tot die toepassing en onderrig van BGGS te assesseer. Die geïdentifiseerde beperkings tot die toepassing van BGGS sluit in gebrek aan tyd, kliniese werklading, beperkte toegang tot die internet en hulpbronne, kennis en vaardighede. Respondente vra om betroubare internettoegang, maklike versorgingspunt-toegang tot databasisse en hulpbronne, verhoogde bewustheid van BGGS, kapasiteitsbou om BGGS toe te pas en te fasiliteer, en ’n ondersteunende praktykgemeenskap.

Op grond van die bevindings in die voorafgaande kwantitatiewe en kwalitatiewe studies, en met inagname van die konteks van verskeie BGGS-inisiatiewe in die Afrika-streek, is ’n konsepvoorstel opgestel vir ’n kluster- verewekansigde proef om alternatiewe opsies vir die implementering van ’n klinies geïntegreerde BGGS-kurrikulum in ’n Afrika-omgewing te evalueer.

Acknowledgements

This project is dedicated to my late mum, Noeline Young. My inspiration and my rock.

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Abbreviations

CI	Confidence interval
EBHC	Evidence-based Health Care
EBM	Evidence-based Medicine
EBP	Evidence-based Practice
FMHS	Faculty of Medicine and Health Sciences
HPCSA	Health Professions Council of South Africa
LMICs	Low- and middle income countries
MBChB	Bachelor of Medicine, Bachelor of Surgery
RCT	Randomised controlled trials
SU	Stellenbosch University

Definition of terms

Academic programmes	A higher education programme for any healthcare professional.
Clinically integrated teaching and learning	Teaching and learning of EBHC integrated in clinical practice, whether interactive or didactic, compared to classroom based teaching.
Evidence-based health care	Evidence-based medicine (EBM) was first defined by Gordon Guyatt as "*an ability to assess the validity and importance of evidence before applying it to day-to-day clinical problems"*. David Sackett (1996) then furthered this definition as "*the conscientious, explicit and judicious use of the current best evidence in making decisions about the care of individual patients"*. As EBM is not restricted to medical doctors, the term "evidence-based health care" (EBHC) is used. The process of EBHC starts with formulating an answerable question when faced with a scenario of uncertainty. This is followed by searching for and finding the best available evidence applicable to the problem, critically appraising the evidence for validity, clinical relevance and applicability, interpreting and applying the findings in the clinical setting, taking into consideration professional experience and patient values, and evaluating the performance.
Health professions	All health professionals including doctors, dentists, nurses, occupational therapists, physiotherapists, dieticians, audiologists, mental health professionals, psychologists, counsellors, social workers.
Medicine or health professions student	A college or university student who has not yet received a health professions degree (this included both undergraduate and graduate medical programmes) and excluded postgraduate students.

Chapter 1. Introduction and scope of work

This chapter provides an introduction to the project. It provides information on the central research theme, short background literature, the problem statement, study objectives and scope of work. More detailed background is provided in the introductions of each of the later chapters. This format is in line with the university requirements for PhD by publication so as to avoid repetition.

In the African region, where there is a significant burden of infectious diseases, a rising epidemic of chronic diseases of lifestyle, and the ongoing burden of violence and injuries, there is a need to enhance human and research capacity to address the prevention and management of these conditions, and to use scarce resources effectively and efficiently. Evidence-based medicine (EBM), defined by Gordon Guyatt as "*an ability to assess the validity and importance of evidence before applying it to day-to-day clinical problems"* [1], involves integrating clinical expertise acquired through clinical practice and experience with patient values and current best evidence within the broader healthcare context. It is a systematic approach which involves lifelong self-directed learning and reflective practices in which caring for patients creates the need for important information about clinical and other healthcare issues. New research evidence is constantly emerging and therefore, to provide optimal care, healthcare professionals need to keep abreast of new developments to be able to offer care that works and eliminate the use of interventions shown to be harmful or ineffective [2]. Practicing EBM promotes critical thinking and typically involves five essential steps: first, converting information needs into answerable questions; second, finding the best evidence to answer these questions; third, critically appraising the evidence for its validity and usefulness; fourth, applying the results of the appraisal into clinical practice; and fifth, evaluating performance [3].

An evidence-based approach to healthcare is recognized internationally as a key competency for healthcare professionals. In the United States, the Association of American Medical Colleges through the Medical School Objectives Project initiative specifically recommends the incorporation of EBM principles throughout medical education. In South Africa, the Colleges of Medicine of SA includes critical appraisal skills in curricula for medical specialist training while the Medical and Dental Professional Board of the Health Professions Council of South Africa (HPCSA) states in its regulation for Registration of Students, Undergraduate Curricula and Professional Examinations in Medicine and Dentistry that *"The emphasis in teaching should be on fundamental principles and methods that promote understanding and problem-solving skills and not only on the purely factual knowledge which, in any event, becomes outdated…. They should be taught at all times to be critical of old and new knowledge and to evaluate data, statistics, thinking and methods objectively."*

It is thus recommended that EBM becomes a core part of learning in the curriculum of all healthcare professionals, as this learning supports successful EBM implementation and subsequent improvement in quality of healthcare and health outcomes [4]. The EBM model has also been adopted by many allied healthcare professionals, and the Sicily statement of evidence-based practice[1] proposed that the concept of EBM be changed to evidence-based practice (EBP). In the broader health setting, the term evidence-based health care (EBHC) is often used. EBHC is seen as beneficial for the entire healthcare team, allowing a more holistic, effective approach to health care.

However, despite the recognition of EBHC as a key competency for healthcare professionals, EBHC teaching and learning, at both student and professional levels, is often haphazard, fragmented or non-existent. Where offered, input is conducted as isolated teaching sessions instead of being integrated throughout the curriculum. The focus is often on whether to teach EBHC or not, rather than on how best to learn EBHC[5,6]. Consequently, there is a need for better integration and implementation of EBHC teaching and learning throughout the curriculum of both under and postgraduate training of doctors, nurses and other health professionals trained [7].

The principles and role of EBHC are not without criticism [6,8]. Frequently, EBHC is misconceived as being merely the implementation of findings from randomised trials, implying that this is the only evidence to inform healthcare decision making. In reality, EBHC provides an approach to answer various healthcare questions – burden of disease, treatment, prevention, risk factor, diagnostics, prognostic, and qualitative questions – thus drawing on various study designs which can best answer these questions. EBHC also aims to combine best evidence with clinical expertise, patient values, and various contextual factors to allow evidence informed healthcare decisions.

The Faculty of Medicine and Health Sciences (FMHS), Stellenbosch University (SU), following a process of determining the desired graduate attributes of a newly qualified healthcare professional, decided to adopt a modified version of the CanMEDS framework (Appendix 1). This framework, developed in Canada and first implemented in 1997, has since been widely adopted in medical education internationally [9] including by authorities in South Africa. It serves as a guide to the essential abilities of a medical doctor to optimise patient outcomes and defines the attributes of the graduate according to seven interdependent roles: Medical Expert, Scholar (which includes EBHC), Professional, Communicator, Collaborator, Manager and Health Advocate. Following review of these attributes, which have also been formally accepted by the Committee for Undergraduate Education and Training of the HPCSA, the undergraduate medical training programme in South Africa is being revised. This period of change to the curriculum provides a window of opportunity to introduce, strengthen and integrate EBHC teaching.

The research forming part of this PhD contributes to the existing knowledge base regarding the integration of EBHC as a core competency in undergraduate medical education. As many training institutions are grappling with the challenge of finding the best approach for implementing the teaching and learning of EBHC, this work has global relevance.

Overarching research question:

How can the teaching and learning of EBHC best be integrated in undergraduate medical training at Stellenbosch University to enhance student EBHC knowledge, attitude and skills?

Sub-questions (Figure 1):

i. What are the effects of teaching EBHC to health professions at under- and postgraduate levels?
ii. What are the approaches used to clinically integrate EBHC teaching and learning in medicine and health science programmes, nationally and internationally, and what are the barriers and facilitators in teaching and learning EBHC in an integrated manner?
iii. What are the opportunities for, and barriers to implementing EBHC in the MB,ChB clinical rotations at SU?
iv. What are SU educators' confidence in practicing and teaching EBHC, their attitude to EBHC, and the perceived barriers to practicing and teaching EBHC?
v. How can the findings in i-iv above be used to inform clinically integrated EBHC teaching and learning?

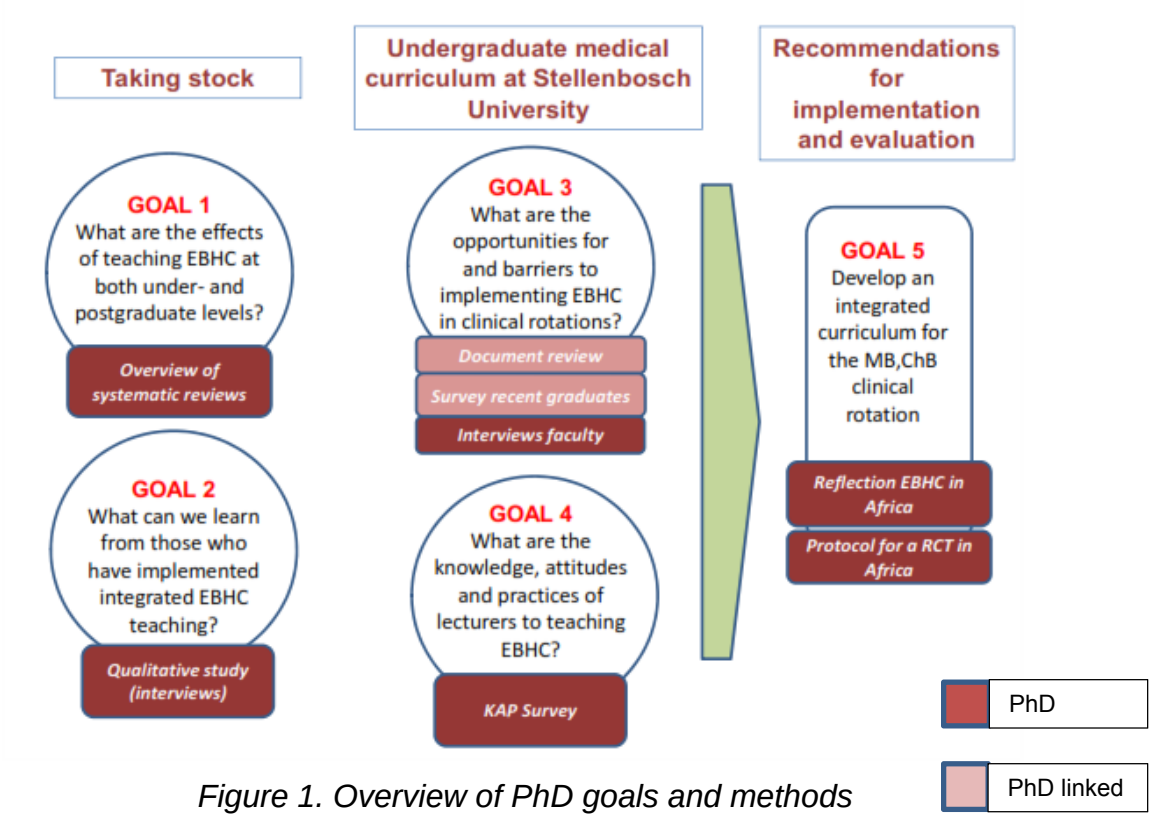

Figure 1. Overview of PhD goals and methods

Overview of objectives and methods

Aligned with the pragmatic paradigm[10] mixed methods combining both quantitative and qualitative research methods were used. An overview of the objectives and methods are provided in Table 1.

Table 1. Summary of objectives and methods

OBJECTIVES	OVERVIEW OF METHODS
1. To prepare an overview of systematic reviews of the effects of teaching EBHC at both under- and postgraduate levels.	Systematic reviews which evaluated educational interventions teaching EBHC to under- and postgraduate health professions' students compared to no intervention or a different strategy were included. Outcomes included EBHC knowledge, skills, practices and attitudes, as well as health outcomes.
2. To describe approaches used, successes and challenges faced by existing national and international academic programmes who have implemented integrated EBHC teaching in the undergraduate health care curricula.	A qualitative study using purposive sampling to describe the experiences and lessons learnt of national and international programmes who have implemented integrated teaching of EBHC to undergraduate health professions students.
3. To assess the opportunities for and barriers to implementing EBHC in the MB,ChB clinical rotations at SU.	A document review and survey of recent graduates were conducted. Interviews were then used to collect data from module convenors/coordinators involved in the SU undergraduate medical programme on opportunities and barriers to implement EBHC teaching and learning.
4. To assess the knowledge, attitudes and practices of educators at the FMHS, SU, to teaching and practicing EBHC	As the educators play a critical role in the delivery of EBHC teaching, their knowledge, attitudes and practices of EBHC were assessed using an online survey.
5. To draw on findings of research to make recommendations for EBHC teaching and learning	A reflection on EBHC in the African region combined with a recommendation for the implementation and evaluation of EBHC teaching and learning to undergraduate medical students.

Ethics

The research conducted aligned with good ethical principles to ensure respect for participants (participants were informed about the purpose and nature of the studies, asked to give written informed consent and their identities were kept confidential), to not do harm and to ensure dissemination of the study findings. The proposals to answer objectives 1 to 4, which included detailed informed consent procedures and forms as well as the details of dissemination of results, were submitted to the SU Human Research Ethics Committee, for ethical approval.

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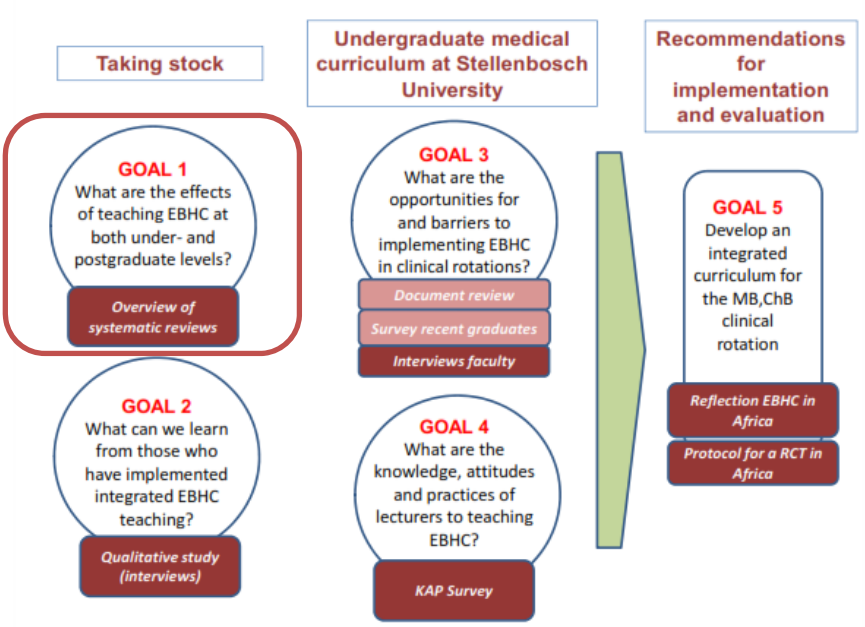
Chapter 2: What are the effects of teaching EBHC at both under- and postgraduate levels? Overview of systematic reviews



Summary: This overview of systematic reviews evaluated interventions for teaching EBHC to health professionals compared to no intervention or different strategies. Two reviewers independently selected eligible reviews, extracted data and evaluated methodological quality. We included 16 systematic reviews. The evidence in the reviews showed that multifaceted, clinically integrated interventions, with assessment, led to improvements in knowledge, skills and attitudes.

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Involvement of PhD candidate: The PhD candidate developed the protocol, independently screened search outputs, selected studies for inclusion, extracted data and assessed methodological quality of included systematic reviews. She also compared the findings of the data extraction with those of a second reviewer, led the interpretation of the data and wrote the manuscript.

Involvement of co-authors: Anke Rohwer contributed to the protocol development, independently screened search outputs, extracted data, assessed methodological quality of included systematic reviews and provided input on the results, discussion and conclusions. Jimmy Volmink and Mike Clarke provided comments on the protocol for the overview, provided methodological guidance and critically evaluated the manuscript. All authors approved the final manuscript.

The ethics approval, data extraction form and supplementary tables are in Appendices 2.1 –2.3.

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PLOS ONE

What Are the Effects of Teaching Evidence-Based Health Care (EBHC)? Overview of Systematic Reviews

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Abstract

Background: An evidence-based approach to health care is recognized internationally as a key competency for healthcare practitioners. This overview systematically evaluated and organized evidence from systematic reviews on teaching evidence-based health care (EBHC).

Methods/Findings: We searched for systematic reviews evaluating interventions for teaching EBHC to health professionals compared to no intervention or different strategies. Outcomes covered EBHC knowledge, skills, attitudes, practices and health outcomes. Comprehensive searches were conducted in April 2013. Two reviewers independently selected eligible reviews, extracted data and evaluated methodological quality. We included 16 systematic reviews, published between 1993 and 2013. There was considerable overlap across reviews. We found that 171 source studies included in the reviews related to 81 separate studies, of which 37 are in more than one review. Studies used various methodologies to evaluate educational interventions of varying content, format and duration in undergraduates, interns, residents and practicing health professionals. The evidence in the reviews showed that multifaceted, clinically integrated interventions, with assessment, led to improvements in knowledge, skills and attitudes. Interventions improved critical appraisal skills and integration of results into decisions, and improved knowledge, skills, attitudes and behaviour amongst practicing health professionals. Considering single interventions, EBHC knowledge and attitude were similar for lecture-based versus online teaching. Journal clubs appeared to increase clinical epidemiology and biostatistics knowledge and reading behavior, but not appraisal skills. EBHC courses improved appraisal skills and knowledge. Amongst practicing health professionals, interactive online courses with guided critical appraisal showed significant increase in knowledge and appraisal skills. A short workshop using problem-based approaches, compared to no intervention, increased knowledge but not appraisal skills.

Conclusions: EBHC teaching and learning strategies should focus on implementing multifaceted, clinically integrated approaches with assessment. Future rigorous research should evaluate minimum components for multifaceted interventions, assessment of medium to long-term outcomes, and implementation of these interventions.

Citation: Young T, Rohwer A, Volmink J, Clarke M (2014) What Are the Effects of Teaching Evidence-Based Health Care (EBHC)? Overview of Systematic Reviews. PLoS ONE 9(1): e86706. doi:10.1371/journal.pone.0086706

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Introduction

Evidence-based medicine (EBM) involves integrating clinical expertise acquired through clinical practice and experience, with patient values and current best evidence within the broader healthcare context [1,2]. It is a systematic approach that includes lifelong self-directed learning in which caring for patients creates the need for important research-based information about clinical and other healthcare issues. As research evidence is constantly changing, healthcare professionals wishing to provide optimal care need to keep abreast of new developments to be able to offer interventions that work and eliminate the use of those shown to be harmful or ineffective [3]. Practicing EBM promotes critical thinking and typically involves five essential steps: first, converting information needs into answerable questions; second, finding the best evidence with which to answer the questions; third, critically appraising the evidence for its validity and usefulness; fourth, applying the results of the appraisal into clinical practice; and fifth, evaluating performance [4].

The concept of EBM has also been adopted by many allied healthcare professionals, and the Sicily statement of evidence-based practice [1] proposed that the concept of EBM be changed

to evidence-based practice (EBP). In the healthcare setting, the term evidence-based health care (EBHC) is often used, as it is seen as beneficial for the entire healthcare team, allowing a more holistic, effective approach to the delivery of health care.

The importance of knowledge, skills and attitudes acquired through applying the principles of EBHC are emphasized in the Lancet commission report: *Education of health professionals for the 21st century* [5], which highlights the need for healthcare professional training to be transformative. One of the key shifts of transformative learning aligns well with the steps of EBHC - the shift from memorization of facts to *"critical reasoning that can guide the capacity to search, analyze, assess and synthesize information for decision-making"* [5].

Teaching and Learning EBHC

It is recommended that EBHC becomes a core component of the curriculum for all healthcare professionals, since learning the fundamentals of research and how to apply an evidence-based approach are essential for successful implementation of EBHC and subsequent improvement in the quality of health care [6].

Various learning and teaching strategies exist. Teaching can be done as standalone sessions or be integrated with clinical practice. It may include journal clubs, bed-side teaching, workshops, lectures, etc. Furthermore, it may be offered using face:face contact sessions, online learning or both, and can include both individual and group teaching and learning. The teaching approach may use directed learning or self-directed (problem-based) learning. The content of EBHC curricula is based on the five steps of EBHC and key competencies required to practice EBHC (Figure 1) also build on these steps [1,7]. Expert teachers and facilitators pay a role in influencing learning and teaching in EBHC [8].

Educational activities can impact on EBHC knowledge, skills, attitudes and practice and, ultimately, the quality of health care and outcomes for patients. This links to Kirkpatrick's four recommended levels (reaction, learning, behavior and results) for assessing training programme outcomes [9]. Validated tools to assess knowledge and skill acquisition exist and have been widely used [10], but similar, validated tools to determine the extent to which attitudes change after an educational intervention are lacking. Most studies reporting change in attitude or behavior rely on student self-reports as measurement tools, but this is not a reliable method for measuring long-term changes in attitude or effects on patient outcomes [10,11].

In the clinical setting the ultimate goals are behavior change and improved patient outcomes [12–14] and these measures should ideally be used to assess whether teaching and learning of EBHC have been successful. A framework suggested by Michie et al. [15] describes a *"behaviour change wheel"*, where capability, opportunity and motivation are the three essential conditions that influence behaviour. In applying this to EBHC, capability could be viewed as a specific set of knowledge and skills; opportunity would refer to the available resources; and motivation would come from the individual attitudes towards EBHC.

Evaluation of EBHC-related educational activities should take into account the unique features of health professional education. This should include the different settings where learning takes place (bed-side, clinical, remote, outpatient, ambulatory), the background and learning style of the learners, the delivery format of courses (for example, large lectures, small groups, one-to-one tuition), and the structure of courses within the larger curriculum (stand-alone courses, integrated teaching) [16].

Why It is Important to Do This Overview

Various systematic reviews assessing different teaching approaches, and including different target populations, have examined the effects of teaching EBHC. This overview synthesized evidence from systematic reviews of studies of teaching EBHC at undergraduate or post-graduate level and the impact of this teaching on EBHC competencies. We took a systematic approach to gather, evaluate and organize the review-level evidence on teaching EBHC, taking into consideration factors such as type of teaching and target audience, in order to improve access to the evidence and to inform EBHC teaching approaches. The objectives were to assess the effects of teaching EBHC to undergraduate and postgraduate health professionals.

Methods

Criteria for Considering Systematic Reviews for Inclusion

Systematic reviews which included randomized trials, quasi-randomized trials, controlled before-and-after studies and interrupted time series were eligible. Systematic reviews were defined as those that had predetermined objectives, predetermined criteria for eligibility, searched at least two data sources, of which one needed to be an electronic database, and performed data extraction and risk of bias assessment. Reviews were eligible if they evaluated any educational intervention (defined as a coordinated educational activity, of any medium, duration or format) to teach any component of EBHC (defined as the process of asking questions, accessing (literature searching), assessing and interpreting evidence by systematically considering its validity, results and relevance to ones' own work) compared to no intervention or a different strategy in both undergraduate and postgraduate health professionals (at both student and professional levels). All health professionals including doctors, dentists, nurses, occupational therapists, physiotherapists, dieticians, audiologists, mental health professionals, psychologists, counsellors, and social workers were considered. Outcomes of interest were EBHC knowledge, skills, attitudes and practice as well as health outcomes.

Search Methods for Identification of Systematic Reviews

A search for systematic reviews was conducted using a variety of electronic sources including *The Cochrane Library* (April 2013), *The Campbell Library* (April 2013), MEDLINE (April 2013), SCOPUS, the Educational Resource Information Center (ERIC), the Cumulative Index to Nursing and Allied Health Literature (CINAHL) (June 2013), and BEME. No language restrictions were used. Search terms included the following (modified appropriately for the various resources).

1. meta-analysis.mp,pt. OR review.pt OR systematic review.tw.
2. Teaching/OR teach$.mp OR Education/OR educa$.mp OR learn$ OR instruct$ OR medical education.
3. Evidence Based Practice/OR evidence based pract$.mp OR Evidence Based Health Care.mp OR Evidence Based Medicine.mp OR EBM.mp.

Experts in the field were contacted and reference lists of included reviews were checked to identify further potential reviews for inclusion [17].

Systematic Review Selection, Data Collection, Quality Assessment and Analysis

Two authors (TY and AR) independently assessed eligibility of potentially relevant articles, extracted data and assessed quality of included systematic reviews. Titles, abstracts and descriptor terms

Figure 1. EBHC competencies.
doi:10.1371/journal.pone.0086706.g001

of the records retrieved by the electronic searches were screened independently for relevance, based on the participant characteristics, interventions, and study design. Full text articles were obtained of all selected abstracts, as well as those where there was disagreement with respect to eligibility, to determine final selection. Differences in opinion were resolved by discussion.

Data were extracted independently using a predefined and piloted data extraction form. Data extracted included: the key characteristics of the systematic reviews, including information about the objectives; participant characteristics; intervention features including content, learning outcomes, teaching strategies, intervention intensities (frequency and duration); setting; outcomes assessed and instruments used to assess outcomes (including information regarding their reliability and validity); comparisons performed and results.

Using guidance from The Cochrane Collaboration [18], the quality of the included reviews was assessed. We aimed to discuss differences in quality between reviews, and use the review quality assessment to interpret the results of reviews synthesized in this overview. Quality of the reviews was not used as inclusion criteria, providing that it met the definition of a systematic review, as set out above. The methodological quality of each included systematic review was assessed using the AMSTAR (A MeaSurement Tool to Assess Reviews) instrument [19], which has been shown to have good face and content validity. AMSTAR assesses the degree to which review methods avoided bias by evaluating the methods reported against 11 distinct criteria. Each item on AMSTAR is rated as yes (clearly done), no (clearly not done), can't answer, or not applicable. For all items, except item 4 (which relates to the exclusion of grey literature), a rating of 'yes' is considered adequate. For item 4, a rating of 'no' (that is, the review did not exclude unpublished or grey literature) is considered adequate. A review that adequately meets all of the 11 criteria is considered to be a review of the highest quality. Summary scores are typically

classified as 3 or lower (low quality), 4 to 7 (medium quality) and 8 to 11 (high quality) [19].

Where there were discrepancies or data queries related to included studies within the systematic reviews, we searched for and reviewed the data that had been reported in the source article for the included study. We resolved differences by discussion and consensus.

We planned to report the effects of strategies to teach EBHC using relevant measures of effect and related 95% confidence intervals. However, as most findings were poorly reported, with many reviews not reporting effect sizes, we reported a descriptive summary of review findings taking into consideration the participants, educational interventions, comparisons and outcomes assessed, and reported effect measures that were available. The conceptual framework used in this overview aimed to clarify "what works for whom under which circumstances and to what end" (Table 1) [20].

The protocol for the overview was developed and approved by Stellenbosch University Research Ethics Committee S12/10/262.

Results

Results of the Search

Our electronic searches identified 584 article citations and a further seven records were found from other sources. After the initial screening of titles and abstracts, we retrieved 23 full text articles for formal eligibility assessment. Of these, we excluded four articles that did not meet the eligibility criteria (three were not systematic reviews and one did not assess teaching of EBHC) [21–24] (Table 2) and included 16 completed (reported in 17 articles) systematic reviews. Figure 2 details the process of selecting systematic reviews for inclusion using the 'preferred reporting items for systematic reviews and meta-analyses' (PRISMA) flow diagram [25].

Description of Included Systematic Reviews

Fifteen published [26–40] and one unpublished [41] systematic review met the inclusion criteria (Tables 3A and 3B). One systematic review [27] was published in French. Furthermore, two ongoing systematic reviews [42,43] are at the protocol development phase and two reviews are awaiting assessment [44,45].

Some of the systematic reviews were not limited to randomised controlled trials (RCT), controlled trials (CT) and controlled before-and-after studies (CBA) but also included other types of studies. For these reviews, we extracted data only on the findings from RCTs, CTs, CBAs and before after (BA) studies.

Included systematic reviews were published between 1993 and 2013. The first published in 1993, 6 more until 2006, and then 1 to 2 per year for the last seven years. One systematic review focused on undergraduate students [41], nine on both undergraduates and postgraduates [27,29,33,35–40] and six on postgraduates only (including continuing professional development (CPD)) [26,28,30–32,34].

The reviews evaluated many different educational interventions of varying duration, frequency and format (lectures, tutorials, journal clubs, workshops, online courses and integrated methods) to teach various components of EBHC (Tables 3 and 4). We categorized interventions into single interventions (SI) covering a workshop, journal club, lecture or e-learning, and multifaceted interventions (MI) where a combination of strategies had been assessed (e.g. lectures, tutorials, e-learning, journal clubs, etc.). The reviews also assessed a range of outcomes with a focus in many instances on acquisition of critical appraisal skills. Outcome assessment tools used varied considerably within and between systematic reviews.

Details of the characteristics of each included systematic review are presented in Tables S1 to S16. Details of the ongoing systematic reviews are presented in Table S17.

Quality of Systematic Reviews

The methodological quality of included systematic reviews varied widely (Table 5). The median AMSTAR score was 5 with a range of 3 to 10. Only four of the 16 had a high AMSTAR score [30,34–36] (Table 5). The key methodological aspects which scored poorly included lack of a comprehensive search, not providing a list of both included and excluded studies, inappropriate methods to combine studies, not using scientific quality appropriately in formulating conclusions, not assessing publication bias and not declaring conflicts of interest. In some instances, AMSTAR items were not reported and were assessed as unclear.

Effects of Various Educational Interventions

In many instances, the systematic reviews did not report effect sizes or significance tests. Outcomes were narratively reported as improved or not, and vote counting was used. The focus was on short term outcomes, such as knowledge and skills, and none of the reviews found studies which reported on practice outcomes.

Systematic review level findings. One high quality review assessing interventions for improving frequency, quality and/or answerability of questions by healthcare professionals [34] reported that three of the four included studies, using mostly MI, showed improvements in question formulation in the short- to medium term. This improvement, assessed in one study, was however not sustained at one year. The authors of this review found no studies on interventions to increase the frequency or quality of questions generated explicitly and specifically within the context of reflective practice.

Four reviews, two high quality [35,36] and two medium quality [27,39], found that teaching critical appraisal improved partici-

Table 1. Conceptual framework for data synthesis [20].

What works?	Learning objectives, interventions, teaching methods
For Whom?	Learners targeted by the intervention
Under which Circumstances?	Intervention setting, duration, frequency
To what end?	**Desired learner outcomes**
	Short term – knowledge and awareness
	Medium term – attitude
	Long term – practice

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Table 2. Excluded systematic reviews.

Study ID	Reason for exclusion
Alguire 1998 [21]	Not a systematic review
Malick 2010 [22]	Assessing assessment tools not effects of teaching interventions
Mi 2012 [23]	Not a systematic review
Werb 2004 [24]	Not a systematic review

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pants knowledge on critical appraisal [27,35,36,39], skill [27,36], reading habit [27,39] and attitude [36,39]. Another review, which was judged to be of low quality, also found increased knowledge when teaching critical appraisal at undergraduate level [38] with a smaller increase in knowledge amongst residents.

Amongst postgraduates and healthcare professionals attending continuing medical education activities, a review of low quality

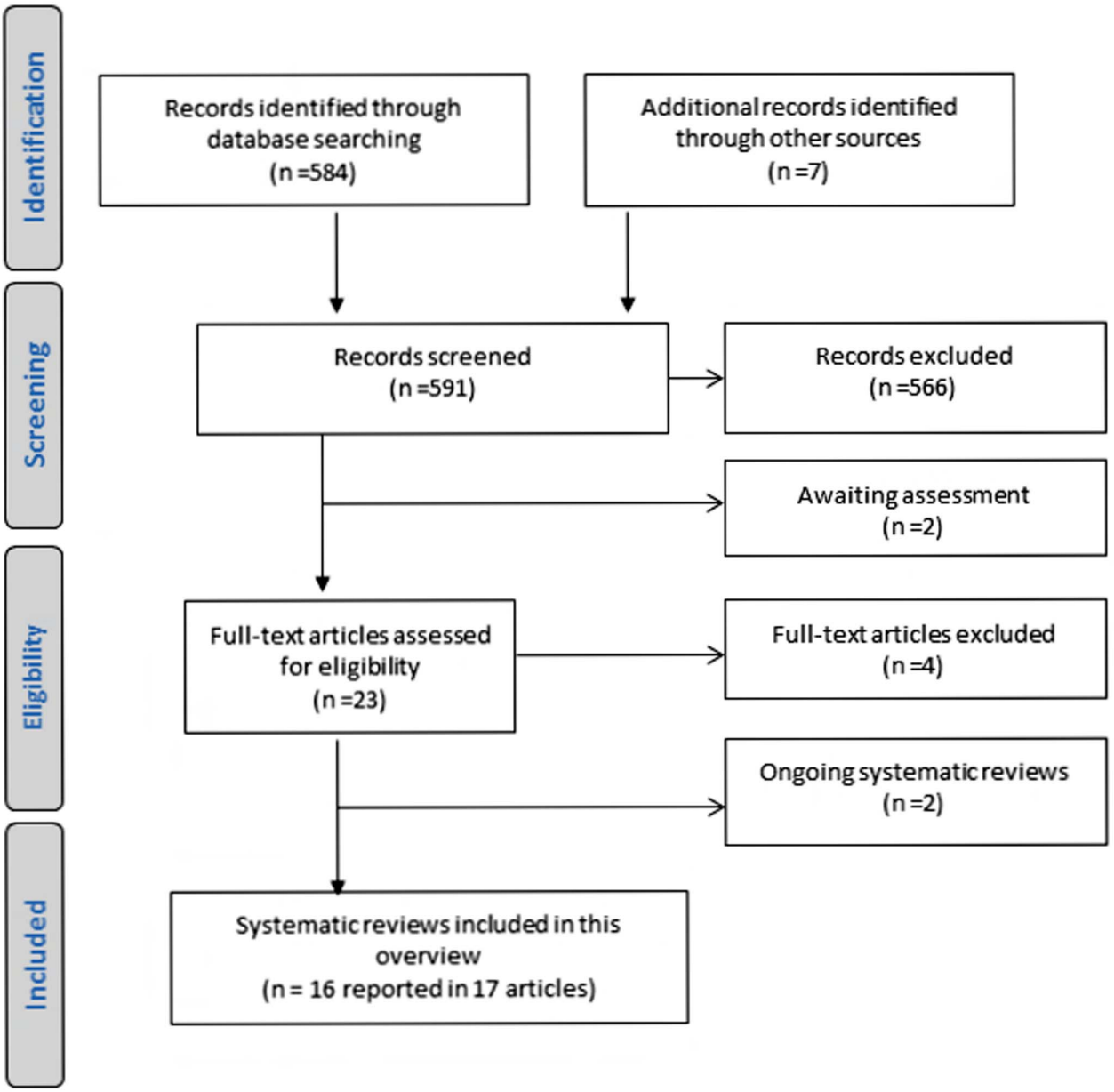

Figure 2. Flow diagram: Identification, screening and selection of systematic reviews.
doi:10.1371/journal.pone.0086706.g002

Table 3. Characteristics of included systematic reviews: Undergraduate and postgraduate.

Review ID	Types of participants	Interventions	Studies included	Outcomes
Audet 1993 [27]	Residents; UG medical students	Journal clubs; Weekly lectures; Once-off sessions; Biostatistics module	3 RCT; 5 CT; 1 BA	Increased knowledge; Reading habits; Critical appraisal skills
Baradaran 2013 [41]	Medical students (from 1st to final year); Clinical clerks; Interns	EBM lectures; EBM workshops; Integrated teaching of EBM; Online teaching of EBM	10 RCT; 5 CT; 7 CBA; 4 BA	EBM knowledge; EBM skills; EBM behaviour; Critical appraisal skills; EBM attitude
Deenadayalan 2008 [29]	UG, graduates, PG and clinicians	Journal clubs	3 RCT; 2 CT; 2 BA	Reading habits; Critical appraisal skills; Knowledge of current medical literature; Research methods; Statistics
Harris 2011 [33]	UG; PG	Journal clubs in different formats	2 RCT; 2 CT; 5 BA	Change in reading behaviour; Confidence in critical appraisal; Demonstrated knowledge and critical appraisal skills; Ability to apply findings to clinical practice
Horsley 2011 [35]	Interns in Internal Medicine, Health care professionals	Journal club supported by a half-day workshop; critical appraisal materials, list serve discussions and articles; Half-day workshop based on a Critical Appraisal Skills Programme	3 RCT	Knowledge scores; Critical appraisal skills
Hyde 2000 [36]	Medical students; Residents; Midwives; Intern doctors; qualified doctors, managers and researchers	Critical appraisals skills using Tutorial, Workshop, Lecture, Seminar, Study day or Journal club	1 RCT; 8 CT; 7 BA	Skills; Knowledge; Behaviour; Attitude
Ilic 2009 [37]	UG/PG medical students or under/PG allied health professionals	Half day workshop; 7 week-2hour EBP workshop; Multimedia package; Supplemented EBP teaching (directed vs. self-directed); Tutorials	3 RCT; 3 CT	EBP competency; EBP knowledge, skills and behaviour; Critical appraisal skills; Formulating questions; Searching skills
Norman 1998 [38]	UG medical residents or residents	Undergraduate: EBM teaching in internal medicine clerkship (part of course credit); Residents: Variation of journal club format	2 RCT; 8 CT	Knowledge and skills; Self-reported use of the literature
Taylor 2000 [39]	Medical students and newly qualified physicians	Educational interventions ranging from a total of 180 min over a 1-week period to 16 h over the period of a year	1 RCT; 8 CT	Knowledge of epidemiology/statistics; Attitudes towards medical literature; Ability to critically appraise and reading behaviour
Wong 2013 [40]	Medical, Nursing and Physiotherapy students; PG physiotherapy and UG occupational therapy students	Mix of lecture-based and clinically-integrated EBP training covering different steps of EBP	2 CT; 4 BA	Knowledge; Attitudes; Skills

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[28] reported improved knowledge with both standalone and integrated teaching, while skills, attitudes and behaviour (changes in reading habits, choice of information resources as well as changes in management of patients and guidelines) improved with integrated methods. Another review of medium quality, amongst postgraduates [31] also found improved knowledge, skills and behaviour with workshops. Four reviews [29,30,32,33], medium quality, assessed the effect of journal clubs amongst undergraduates and post graduates and found that they led to improved knowledge and reading behaviour [30,33] however the included RCTs found no effect on critical appraisal skills [30,32,33].

One medium quality review [41] assessing a variety of teaching strategies for undergraduates, found improved knowledge, attitude and skills with e-learning compared to no intervention, no difference between e-learning and lectures, and improved knowledge and attitudes with MIs. Amongst residents, there was also no difference between e-learning and lectures [26]. Another medium quality review [40] assessed a MI amongst undergraduates and postgraduates consisting of a mix of lecture-based and clinically-integrated EBP training covering different steps of EBP and reported increased knowledge, attitude and behavior while another review [37], also of medium quality, found mixed results and no difference between directed and self-directed learning.

None of the reviews found evidence on process of care or patient outcomes.

Overlap between included systematic reviews. We found considerable overlap in the studies included within the 16 systematic reviews (Table S18). Collectively, 171 studies were included in the reviews but these relate to a total of only 81 separate studies, of which 37 are included in more than one review. The breakdown of these studies by type of participant shows that 31 studies (9 RCTs, 10 CTs, 7 CBAs and 5 BAs) were amongst undergraduates, three studies (2 RCTs and 1 CT) were amongst interns, three studies (2 CTs, 1 BA) included undergraduates and residents, 24 studies (7 RCTs, 8 CTs and 9 BAs) were in residents, 18 studies (7 RCTs, 1 CT and 10 BAs) were in health professionals and two studies (2 BAs) included both residents and health professionals (Figure 3). As many of the source studies were included more than once (Table 5), and in an effort to organize and present a clear picture of the review level findings of the various educational interventions, and avoid double counting which would have given extra weight to findings from studies that had been used more than once, the following section provides a narrative summary of the findings from the 81 source studies as reported in the systematic reviews, and using the information provided on them within the reviews. This did not include the assessment of the methodological quality of these studies.

Findings from source studies. For undergraduate students, findings from the nine RCTs (sample size ranging from 77 to 238) indicated that MI, which included various combinations of

Table 4. Characteristics of included systematic reviews: Postgraduate and continuing professional development.

POSTGRADUATE AND CONTINUING PROFESSIONAL DEVELOPMENT

Review ID	Types of participants	Interventions	Studies included	Outcomes
Ahmadi 2012 [26]	Residents	EBM teaching; Journal club	2 RCT; 5 BA	EBM knowledge, EBM attitude, participants' satisfaction; Critical appraisal knowledge, knowledge of EBM, knowledge of statistics and study design, self-assessed skills, research productivity, participants' satisfaction
Coomarasamy 2004 [28]	PG and healthcare professionals attending continuing medical education activities	Postgraduate EBM or critical appraisal teaching compared to control or baseline before teaching	4 RCT; 9 CT; 10 BA	Knowledge, critical appraisal skills, attitude and behaviour
Ebbert 2001 [30]	PG students	Journal club (small-group meeting to discuss one or more journal articles)	2 RCT; 2 CT; 1 BA	Critical appraisal skills, reading habits, knowledge of clinical epidemiology and biostatistics, use of medical literature in clinical practice
Flores Mateo 2007 [31]	PG healthcare workers	Workshops; Multifaceted interventions; Internet-based intervention; Journal club (most common); Course and clinical preceptor; Educational presentation; Literature search course; Seminars	10 RCT; 6 CT; 8 BA	EBM knowledge; EBM skills; EBM behaviour; EBM attitudes; Therapy supported by evidence
Green 1999 [32]	Residents	Teaching critical appraisal skills using seminars, multifaceted interventions including seminars and journal clubs	1 RCT; 4 CT; 2 BA	Residents' knowledge of clinical epidemiology and critical appraisal; Students' self-reported EBM behaviour
Horsley 2010 [34]	Residents; Doctors, nurses, allied health professionals; Occupational health physicians	Lecture and input from librarian; Live demonstrations, hands on practice sessions; Didactic input, hands-on practice; Questionnaire with written instructions and examples	3 RCT; 1 CT	Quality of questions; Increased success of answering questions; Knowledge-seeking practices; Self-efficacy; Types of questions generated

RCT – Randomized Controlled Trial.
CT – Controlled Trial.
CBA – Controlled Before After study.
BA – Before After study.
PG – Postgraduate.
UG - Undergraduate.
doi:10.1371/journal.pone.0086706.t004

strategies such as lectures, computer lab sessions, small-group discussions, journal clubs, use of real clinical issues, portfolios and assignments, presented over a few weeks, were more likely to improve knowledge, skills and attitudes compared to SI offered over a short duration or to no interventions. Twelve CTs (sample size ranging from 17 to 296) also found improved skill with MI. Some CTs found that SI had no effect on outcomes in the short term, while others found that searching skills and knowledge of appraisal improved when comparing interactive sessions with didactic sessions; and critical appraisal sessions with no interventions. The seven CBAs (sample size: 36 to 132 participants) found that knowledge and skills improved with MI (lectures, small group discussions, appraisal of various study types, real examples, computer lab sessions, feedback on appraisal) especially when measured over the few weeks after the MI. One CBA assessed a three month e-course and found improved knowledge, while two CBAs of short workshops that covered asking, acquiring and applying found improved knowledge, skills and attitude. The five BAs (sample size: 18 to 203 participants) also found improved skills after MI and improved knowledge and skills after a short workshop (3–4 days duration). In one BA, the MI included 18 weeks access to six online modules, plus supervised assignments in asking, acquiring, appraising various study types, and applying, linking to real patients. In another BA, it consisted of two sessions in EBM resources and appraising plus electronic exploratory notes, 6×2 hour small-group bedside sessions to exercise asking, self-searching, presenting critical appraisal topics in journal clubs, and developing EBM reports in portfolios.

Amongst interns, 2 RCTs (sample size: 55 to 237 participants) found no difference in knowledge and attitude towards EBM when comparing a face:face teaching session with access to e-learning modules. One CT (n = 30) assessing a short seminar, found no difference in the number of hours interns read per week, in confidence in evaluating articles, and critical appraisal, compared to no intervention.

For postgraduates and continuing professional development, seven RCTs (sample size: 10 to 441 participants) assessed mainly SI amongst residents. There were no significant differences in EBM knowledge and attitudes when comparing lecture-based teaching versus online modules in one trial (n = 61). Another RCT (n = 441) compared a monthly traditional journal club with a monthly internet journal club over eight months. Participation in the internet journal club was poor, even though it was a compulsory learning activity for all residents (18% in the internet group compared with 96% in the moderated group), and there was no significant difference in critical appraisal skills. A comparison of journal club versus standard conference (n = 44) found a significant increase in clinical epidemiology and biostatistics knowledge (reported p = 0.04), no change in critical appraisal skills (reported p = 0.09), no impact on articles read or read "completely" but more participants in the intervention group reported changes in reading behaviour and in the way they incorporated the literature into their practice (80% vs. 44%).

Table 5. AMSTAR scores of included systematic reviews.

CRITERIA	Ahmadi 2012 [26]	Audet 1993 [27]	Baradaran 2013 [41]	Coomarasamy 2004 [28]	Deenadayalan 2008 [29]	Ebbert 2001 [30]	Flores Mateo 2007 [31]	Green 1999 [32]	Harris 2011 [33]	Horsley 2010 [34]	Horsley 2011 [35]	Hyde 2000 [36]	Ilic 2009 [37]	Norman 1998 [38]	Taylor 2000 [39]	Wong 2013 [40]
Was an a priori design provided?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Was there duplicate study selection and data extraction?	Y	?	?	N	?	Y	Y	N	Y	Y	Y	Y	N	N	?	N
Was a comprehensive literature search performed?	N	N	Y	Y	Y	Y	N	N	Y	Y	Y	Y	N	N	N	N
Was the status of publication (i.e. grey literature) used as an inclusion criterion?	?	N	?	?	?	N	Y	Y	?	N	N	N	?	?	N	?
Was a list of studies (included and excluded) provided?	N	N	N	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	N
Were the characteristics of the included studies provided?	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
Was the scientific quality of the included studies assessed and documented?	N	Y	Y	N	Y	Y	Y	Y	?	Y	Y	Y	?	Y	Y	N
Was the scientific quality of the included studies used appropriately in formulating conclusions?	N	Y	?	N	N	Y	N	?	N	Y	Y	Y	N	N	?	N
Were the methods used to combine the findings of studies appropriate?	?	Y	N	?	Y	?	?	Y	Y	Y	Y	Y	Y	N	?	Y
Was the likelihood of publication bias assessed? (where relevant)	?	N	N	?	N	N	Y	N	N	N	N/A	Y	N	N	N	N
Was the conflict of interest stated?	N	N	N	N	N	N	Y	N	Y	Y	Y	N	N	N	N	Y
AMSTAR scores	3	6	4	3	6	8	6	4	6	10	10	10	4	3	4	4

Y – Yes; N – No; ? – Unclear; N/A – Not applicable.

doi:10.1371/journal.pone.0086706.t005

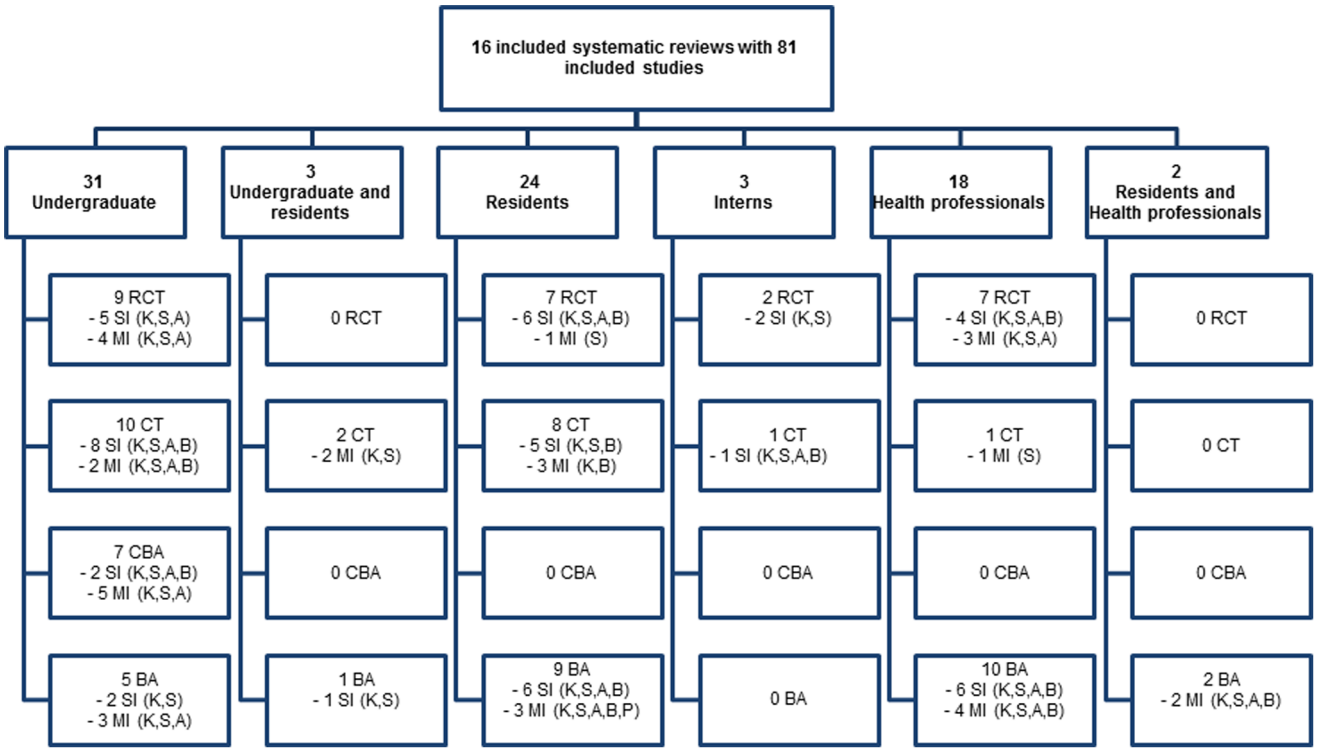

Figure 3. Summary of source studies included in the systematic reviews. K- Knowledge; S – Skills; A – Attitude; B – Behaviour; P – Practice; SI – Single intervention; MI – Multifaceted intervention; BA – Before After study; CBA – Controlled Before After study; CT – Controlled Trial; RCT – Randomized Controlled Trial.
doi:10.1371/journal.pone.0086706.g003

Another RCT (n = 85) found no difference in clinical epidemiology and biostatistics knowledge and reading habits when journal club was led by faculty compared to being led by a chief medical resident. A comparison of informative lectures with librarian input on search question accuracy versus observed searches (without feedback from a librarian) (n = 10) found improved question formulation in the intervention group but with no statistical significance at six months. Results of the other two RCTs were not reported in the included systematic review.

Of the eight CTs amongst residents (sample size: 27 to 83 participants), one (n = 32) found no difference in reading habits, use of medical literature in clinical practice and critical appraisal skills when comparing journal club using critical appraisal techniques to traditional unstructured journal clubs. Another CT (n = 27) found no difference in pre-test versus post-test or between group scores for clinical epidemiology and biostatistics knowledge when comparing didactic sessions and journal clubs to no journal clubs. One further CT (n = 24) found no change in knowledge with journal club interventions. An eight hour seminar (n = 35) improved critical appraisal skills compared to no intervention (74% vs. 64%; p = 0.05) and a critical reading seminar with small group discussion (n = 83) significantly improved epidemiology and statistics knowledge (reported p = 0.019). Similarly, an EBM course (2 hours per week over 7 weeks) (n = 55) significantly improved skills. A CT of a MI of tutorials and one-on-one teaching (n = 34) found increased frequency of reading methods and results sections of articles, but no change in the hours reading; increased frequency of referral to an original article when faced with a clinical question; and significant improvement in critical appraisal skills and integration of results into patient decision making (reported p = 0.001). The result of the CT (n = 48), which assessed 10 workshops lasting 1–2 hours, was not reported in the systematic review.

Of the nine BAs (sample size: 8 to 73 participants) amongst residents, three evaluated MI and six SI. Results are available for two of the three BAs assessing MI. One (n = 8) assessed workshops on teaching critical appraisal skills as well as sessions on search skills prior to participating in weekly journal clubs. For each journal club session, residents identified articles relevant to a clinical question, critically appraised the articles, and presented a summarized critique. Comparing pre- and post-course scores, EBM knowledge and reading time increased significantly, but there were no differences in the number of literature searches and the number of articles read per week. The other BA (n = 14) evaluated small group sessions to teach library skills and journal club meetings and found an increase in EBM knowledge and number of literature searches. Of the BAs which assessed SI, one (n = 203) evaluated a EBM course delivered through small groups and found a significant increase in knowledge when comparing pre- and post-test scores, and two assessed journal clubs. One BA (n = 9) evaluated face:face monthly journal clubs over one year and found that EBM knowledge significantly improved while another (n = 29) assessed a quarterly journal club where participants reported improvement in skills, however, lowest perceived improvement occurred in the ability to critically appraise and assimilate evidence into clinical care.

Seven RCTs (sample size ranging 10 to 800 participants) assessed teaching interventions amongst practicing health professionals. One study (n = 81) assessed provision of articles, questions designed to guide critical appraisal, one-week listserv discussions on methodology of articles, and comprehensive methodological review of the article compared to just receiving articles and access

to major journals, and found a significant increase in knowledge scores and critical appraisal skills. Another study (n = 148), evaluating a MI of a workshop in evidence-based public health, a newsletter, access to a specially designed information service, to relevant databases, and to an electronic discussion list, found a significant change in knowledge and behaviour but not in attitude; while another RCT (n = 392) evaluated a two-hour course and clinical preceptor (results not reported in systematic review). One RCT (n = 145) evaluated a three-hour workshop based on critical appraisal using problem based approaches which included didactic sessions, small group work, and a plenary session compared to no intervention and found a significant increase in knowledge scores, but no significant difference in critical appraisal skills. In assessing clinically integrated teaching, one RCT (n = 10) assessed "EBM teaching rounds" (daily ward rounds (except Mondays) focusing on development of searchable questions, literature search, critical appraisal, and application of evidence based on cases presented on clinical rounds) and found improvement in knowledge and behaviour. Two RCTs assessed interventions to enhance question formulation. One of these (n = 800) evaluated question formulation and live demonstrations, with hands-on practice sessions related to concepts of searching compared to no intervention and found a significant increase in the quality of questions phrased, increased success in answering questions and increased knowledge seeking practice. However, at 12 months, computer search logs revealed that search skills had eroded over time. The other study (n = 52) compared a questionnaire with the addition of an explanation of the importance of proper question formulation, written instructions, and a diagrammatic example of how dimensional elements may be arranged, to a questionnaire without any instructions or examples and found that the intervention group was significantly more likely to explicitly describe patients (reported p = 0.028), comparisons (reported p = 0.014), and outcomes (reported p = 0.008).

One CT (n = 125) compared a four-day intensive EBM course which included didactic sessions, practical hands-on training in searching the Internet, training in critical appraisal and the provision of a flow chart of ways to consider relations between risk factors and disease and suggested search terms, to no flow chart provided or extra stimulants to use the flow chart. It found no significant differences in quality of question formulation, no differences between groups for mean time spent searching PubMed, and in retrieval of relevant articles. Of the 10 BAs (sample size: 12 to 1880 participants) amongst health professionals, three assessed workshops, one a study day, one a course and two assessed seminars. Knowledge and attitude increased with the workshops, while reading behaviour and critical appraisal skills increased with the study day. MI including EBM ward rounds led by clinical specialists and epidemiologists covering asking, searching, appraisal and summarising evidence on cases, and all weekly sessions based on problems encountered in clinical practice, found improved skills, attitude and behaviour. Two BAs included both residents and health professionals (sample size: 29 and 70 participants). One of these found improved skills after lectures and journal clubs while the other found no change in knowledge, skills and attitude after seminars followed by journal clubs.

Discussion

The Sicily statement outlines that the content of EBHC curricula should be based on the five steps of EBHC [1]. This overview synthesized evidence from systematic reviews of studies of teaching EBHC at undergraduate or postgraduate level and the impact of this teaching on EBHC competencies. It took a systematic approach to gather, evaluate and organize the evidence that had been brought together in several systematic reviews [46,47] on teaching EBHC, taking into consideration factors such as type of teaching and target audience, in order to improve access to the evidence and to inform EBHC teaching approaches.

Summary of Main Results

Fifteen systematic reviews published between 1993 and 2013, one unpublished review and two on-going systematic reviews met the inclusion criteria. The systematic reviews evaluated many different educational interventions of varying duration, frequency and format (lectures, tutorials, journal clubs, workshops, online courses and integrated methods) to teach the various components of EBHC in a variety of settings. A range of outcomes were assessed with a focus in many systematic reviews on critical appraisal skills. Outcome assessment tools used varied considerably within and between systematic reviews. The 16 completed systematic reviews had considerable overlap in included studies and referred to a total of 81 source studies that had used one of the four study designs we pre-specified (RCTs, CTs, CBAs and BAs).

Most findings from the source studies were poorly reported in the included systematic reviews, without effect sizes or significance tests, and outcomes were often only described narratively as improved or not, with vote counting used. Consequently, and due to heterogeneity between studies, this overview reported results narratively. Findings from the studies amongst undergraduates were consistent. Multifaceted interventions (MI), with combinations of methods including lectures, computer lab sessions, small-group discussions, journal clubs, use of real clinical issues, and portfolios and assignments, were more likely to improve knowledge, skills and attitude compared to single interventions or no interventions. Amongst residents, these multifaceted clinically integrated interventions also improved critical appraisal skills and the integration of results into patient decision making, and improved knowledge, skills, attitude and behaviour amongst practicing health professionals. Considering SIs, for residents, EBHC knowledge and attitude were similar when comparing lecture-based teaching versus online modules. RCTs found that journal clubs increased clinical epidemiology and biostatistics knowledge and reading behavior, but not critical appraisal skills, whereas the CTs found no change in outcomes with journal clubs. Seminar/EBM courses improved critical appraisal skills and knowledge. Amongst practicing health professionals, an interactive online course with guided critical appraisal had a significant increase in knowledge and critical appraisal skills. Compared to no intervention, a short workshop using problem based approaches increased knowledge but not critical appraisal skills.

Overall Completeness, Quality and Applicability of Evidence

The systematic reviews assessed a variety of educational interventions evaluated in many different settings and populations. Despite the notion that there is a lack of RCTs on educational interventions [20], the systematic reviews in this overview included 25 RCTs and a further 22 CTs. These studies had been conducted in high-income countries, and were published between 1984 and 2011. Outcome assessment methods ranged from validated tools [10] to those based on self-reports of participants. The content of some interventions, especially the single interventions, focused on critical appraisal which only covers part of the recommended EBHC curricula [1]. Multifaceted integrated interventions were more likely to include the application in patient decision making

and how this can be implemented is being explored in ongoing research.

The focus of the systematic reviews was on EBHC knowledge, skills, attitudes and behaviour as outcomes, especially in the short term, and not assessing practice outcomes. These outcomes however were in line with three of the four recommended Kirkpatrick's levels (reaction, learning and behaviour), which are widely accepted for assessing training programme outcomes [9]. It is important to be mindful that patient health outcomes, the fourth Kirkpatrick level, are influenced by many different factors of which health professional behaviour is only one component [48]. Glasziou and Haynes [49] outline several factors which influence translation of evidence to action. This starts with healthcare professionals being aware of the best evidence and accepting this evidence. Next, a decision needs to be made regarding the applicability of the evidence to the local setting and whether a particular intervention is available and can be implemented by healthcare professionals. As habits take time to change, high quality evidence, may not always be adopted by practitioners for translation into practice. Furthermore, patients may not agree to certain treatment approaches and even if they do, may not adhere to them. Considering the multitude of factors impacting on practice outcomes, teaching EBHC could conceivably impact on practitioners' EBHC knowledge, skills, attitudes and behaviour, without necessarily influencing practice. This makes it difficult to design robust studies of appropriate sample size [50] and difficult to assess and attribute improved health outcomes to any single factor [48].

The methodological quality of the included systematic reviews varied. Most did not conduct a comprehensive literature search, did not report on both included and excluded studies, did not use the scientific quality of the included studies appropriately in formulating conclusions and did not assess for publication bias. Furthermore, the findings for the source studies, which were generally of small sample size, were generally poorly reported in the systematic reviews. In many instances, the reviews did not report effect sizes and results from significance tests, and reported summarised results narratively and in tabular format [20]. When we compared the information on studies that were included in more than one systematic review, there were discrepancies in data extracted and we obtained the original reports of these studies for the correct information. We found discrepancies in number of participants, outcomes reported, and the type of study design. Collectively, though, as presented in this overview, the included systematic reviews do give a good representation of studies that have assessed the effects of various educational interventions for teaching EBHC over the last two decades.

Potential Biases in the Overview Process

Overviews of systematic reviews have been criticised for lack of methodological rigor, especially related to inadequate searching, bias in review selection, and lack of assessment of methodological quality of included reviews [47,51,52]. Drawing on methodology to conduct rigorous systematic reviews, the methods followed for this overview aimed to reduce selection, language, publication and indexing biases [18,47]. We followed a pre-specified protocol. A comprehensive search, without language limitations, was conducted in various electronic databases, and we searched for on-going and unpublished systematic reviews. Additional searches were conducted to resolve discrepancies related to the studies included in the systematic reviews. We did not conduct additional searches for studies published after 2011. Two reviewers independently applied pre-defined eligibility criteria to select systematic reviews for inclusion, extracted data and evaluated the methodological quality of each included systematic review. PRISMA reporting guidelines were followed [25].

Agreements and Disagreements with Other Studies or Reviews

Khan and colleagues [53] assessed evidence on interventions for changing clinician behaviour, educational effectiveness of CPD, and effective learning of EBM conclusions. Based on educational evidence, theory and principles Khan proposed a hierarchy of teaching and learning methods for EBM. Findings of this overview resonate with Khan's [53] hierarchy of EBHC teaching and learning activities - *"Level 1, interactive and clinically integrated activities; Level 2(a), interactive but classroom based activities; Level 2(b), didactic but clinically integrated activities; and Level 3, didactic, classroom or standalone teaching."*

Conclusions

Implications for Practice

EBHC competencies are necessary for providing high quality healthcare. Teaching and learning strategies to enhance these competencies need to focus on implementing multifaceted clinically integrated approaches with assessment.

Implications for Research

Systematic reviews and robust RCTs are both useful in assessing health professional education strategies [54]. Future studies and systematic reviews should focus on minimum components for multifaceted interventions, assessment of EBHC knowledge, attitude, skills and behaviour in the medium to long term, using validated assessment tools [10], and how best to implement these interventions. Further evaluation should consider the effectiveness of e-learning and the influence of various teaching and learning settings and the context within which teaching takes place. It is important that future research carefully considers the questions to be addressed and refines these, based on existing evidence from systematic reviews to avoid unnecessary duplication [55,56]. Adherence to rigorous methodological approaches [54] and good reporting practices [25,54] are important to ensure a contribution to evidence informed decisions on the teaching and learning of EBHC.

Supporting Information

Table S1 Characteristics of included systematic review Ahmadi 2012.
(DOCX)

Table S2 Characteristics of included systematic review Audet 1993.
(DOCX)

Table S3 Characteristics of included systematic review Baradaran 2013.
(DOCX)

Table S4 Characteristics of included systematic review Coomarasamy 2004.
(DOCX)

Table S5 Characteristics of included systematic review Deenadayalan 2008.
(DOCX)

Table S6 Characteristics of included systematic review Ebbert 2001.
(DOCX)

Table S7 Characteristics of included systematic review Flores-mateo 2007.
(DOCX)

Table S8 Characteristics of included systematic review Green 1999.
(DOCX)

Table S9 Characteristics of included systematic review Harris 2011.
(DOCX)

Table S10 Characteristics of included systematic review Horsley 2010.
(DOCX)

Table S11 Characteristics of included systematic review Horsley 2011.
(DOCX)

Table S12 Characteristics of included systematic review Hyde 2000.
(DOCX)

Table S13 Characteristics of included systematic review Ilic 2009.
(DOCX)

Table S14 Characteristics of included systematic review Norman 1998.
(DOCX)

Table S15 Characteristics of included systematic review Taylor 2000.
(DOCX)

Table S16 Characteristics of included systematic review Wong 2013.
(DOCX)

Table S17 Characteristics of ongoing systematic reviews.
(DOCX)

Table S18 Matrix of included systematic reviews and the studies included in each.
(DOCX)

Checklist S1 PRISMA checklist.
(DOC)

Acknowledgments

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Author Contributions

Conceived and designed the experiments: TY AR MC JV. Performed the experiments: TY AR. Analyzed the data: TY AR JV MC. Contributed reagents/materials/analysis tools: TY AR JV MC. Wrote the paper: TY AR MC JV. Developed the protocol: TY. Contributed to the background development: AR. Provided comments on the methods: AR. Screened search outputs: TY AR. Independently extracted data: TY AR. Assessed methodological quality of included systematic reviews: TY AR. Led the write up of the review: TY. Critically engaged and provided input on the results, discussion and conclusions: AR. Provided comments on the protocol for the overview: JV MC. Provided methodological guidance: JV MC. Critically evaluated the manuscript: JV MC.

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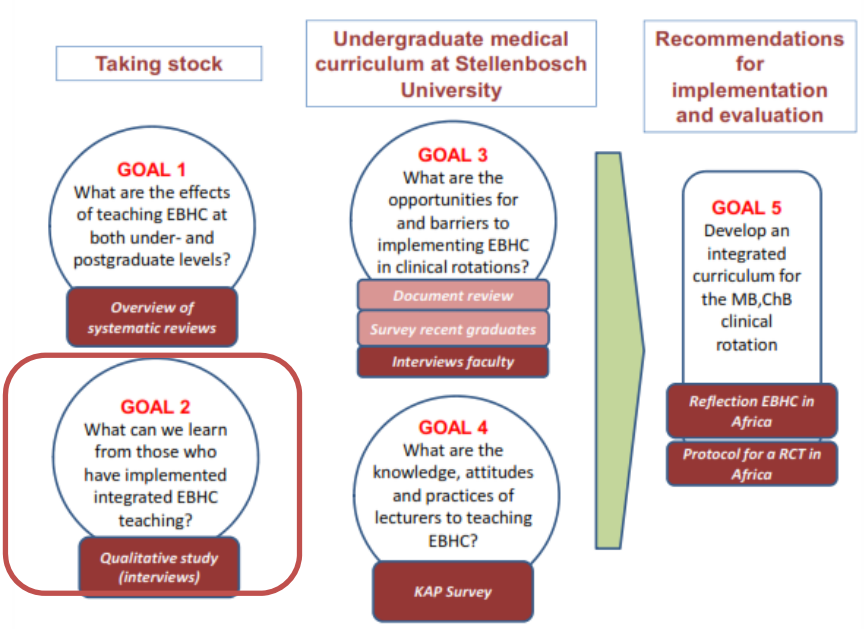
Chapter 3: *Patience, persistence and pragmatism*: Experiences and lessons learnt from the implementation of clinically integrated teaching and learning of EBHC – a qualitative study



Summary: The overview of systematic reviews identified that multifaceted clinically integrated teaching and learning strategies with assessment were the best approaches for teaching EBHC. This study, in an attempt to understand how this strategy can be implemented, used semi-structured interviews to gather views of EBHC programme coordinators from around the world on their experiences in implementing clinically integrated teaching and learning of EBHC. Information was obtained on their successes and challenges, their views on critical success factors, and on the typical EBHC curriculum for clinically integrated teaching and learning of EBHC.

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Involvement of PhD candidate: The PhD candidate developed the protocol, submitted the protocol for ethics approval, conducted the interviews, checked and coded the data, conducted thematic analysis, interpreted the data and wrote the manuscript.

Involvement of co-authors: Anke Rohwer and Susan van Schalkwyk contributed to protocol development, checked the data coding, contributed to data interpretation and contributed to the manuscript. Jimmy Volmink and Mike Clarke contributed to protocol development, data interpretation and the manuscript development. All authors approved the final version of the manuscript.

The ethics approval and supplementary tables are in Appendices 3.1-3.2.

PLOS ONE

RESEARCH ARTICLE

Patience, *Persistence and Pragmatism*: Experiences and Lessons Learnt from the Implementation of Clinically Integrated Teaching and Learning of Evidence-Based Health Care – A Qualitative Study

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Abstract

Background

Clinically integrated teaching and learning are regarded as the best options for improving evidence-based healthcare (EBHC) knowledge, skills and attitudes. To inform implementation of such strategies, we assessed experiences and opinions on lessons learnt of those involved in such programmes.

Methods and Findings

We conducted semi-structured interviews with 24 EBHC programme coordinators from around the world, selected through purposive sampling. Following data transcription, a multidisciplinary group of investigators carried out analysis and data interpretation, using thematic content analysis. Successful implementation of clinically integrated teaching and learning of EBHC takes much time. Student learning needs to start in pre-clinical years with consolidation, application and assessment following in clinical years. Learning is supported through partnerships between various types of staff including the core EBHC team, clinical lecturers and clinicians working in the clinical setting. While full integration of EBHC learning into all clinical rotations is considered necessary, this was not always achieved. Critical success factors were pragmatism and readiness to use opportunities for engagement and including EBHC learning in the curriculum; patience; and a critical mass of the right teachers who have EBHC knowledge and skills and are confident in facilitating learning. Role modelling of EBHC within the clinical setting emerged as an important facilitator. The institutional context exerts an important influence; with faculty buy-in, endorsement by institutional

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leaders, and an EBHC-friendly culture, together with a supportive community of practice, all acting as key enablers. The most common challenges identified were lack of teaching time within the clinical curriculum, misconceptions about EBHC, resistance of staff, lack of confidence of tutors, lack of time, and negative role modelling.

Conclusions

Implementing clinically integrated EBHC curricula requires institutional support, a critical mass of the right teachers and role models in the clinical setting combined with patience, persistence and pragmatism on the part of teachers.

Introduction

In many low and middle income countries, healthcare professionals and decision makers are often simultaneously challenged by a significant burden of infectious diseases, a rising epidemic of chronic diseases of lifestyle, and the on-going consequences of violence and injuries [1]. This creates the need for enhancing human, health systems and research capacity to address the prevention and management of multiple conditions [2], and to ensure that scarce resources are used effectively and efficiently [3, 4].

Evidence-based health care (EBHC) is an approach to delivering health care which has the potential to address these needs by fostering specific skills needed to access, appraise, interpret and apply knowledge. While widely recognised as an important competency for the health professional of the 21st century, EBHC teaching and learning, at both student and professional levels, is often haphazard, fragmented or non-existent. The focus is often on whether or not to teach EBHC, rather than on how best to teach EBHC [5, 6].

Although various teaching and learning strategies exist, EBHC remains difficult to teach [7] perhaps because in some instances the conceptualisation of the EBHC model lacks complete and clear description. Teaching of EBHC can be done as standalone sessions or be integrated within clinical practice. It may be offered using face:face contact sessions, online learning or both, and can include both individual and group teaching and collaborative learning. Furthermore, the teaching approach may use directed learning or self-directed (e.g. problem-based) learning. The content of EBHC curricula usually emphasises the five steps of EBHC (acknowledge uncertainty and phrase clear question, search for research evidence, critically appraise and interpret the evidence, consider application and evaluate) and key competencies required to practice EBHC also build on these steps [8, 9]. Findings from an overview of systematic reviews on the effects of EBHC teaching and learning approaches [10] and a recent randomised trial [11] show that clinically integrated teaching and learning strategies, with assessment, are the best options for improving EBHC knowledge, skills and attitudes. In addition, a hierarchy of EBHC teaching and learning has been described which proposes three levels of EBHC teaching and learning activities—"*Level 1*, *interactive and clinically integrated activities; Level 2(a)*, *interactive but classroom based activities; Level 2(b)*, *didactic but clinically integrated activities; and Level 3*, *didactic*, *classroom or standalone teaching*." [12]

Yet, little is known about how to implement clinically integrated EBHC teaching and learning. A popular textbook on practicing and teaching EBHC [13] identifies approaches that should be foregrounded in teaching and those that should be avoided. It highlights actual learning needs, balancing active and passive learning, connecting new knowledge with what is already known and seamlessly integrating EBHC into patient care decisions (Table 1).

Table 1. EBHC teaching and learning tips and mistakes to avoid [13].

Teaching and learning strategies to include	Mistakes to avoid
Base teaching on real clinical decisions and actions	Emphasis on doing research instead of using research to inform decision making
Focus on learners actual learning needs	When learning how to do statistics is emphasised over how to interpret statistics
Passive and active learning used in balanced manner	Only finding fault with research
Involves everyone in the team	Promoting EBHC instead of clinical expertise
What is already known connected with new knowledge	Focus on critical appraisal only
Teacher explicit about appraisal of evidence	Disconnect from clinical process and team's learning needs
EBHC seamlessly integrated into patient care decision	Amount of teaching exceeds available time and learners' attention
Provides foundation and tools for lifelong learning	Not including time to learn in between formal sessions

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Furthermore, it is emphasised that one needs to focus teaching and learning on real clinical decisions [14].

As part of a process to enhance EBHC teaching and learning at an academic institution in South Africa, we assessed lessons learnt from those who have successfully implemented, or who have attempted and failed to implement, clinically integrated EBHC teaching and learning locally and in other parts of the world. The study objectives were to describe approaches used to clinically integrate EBHC teaching and learning in medicine and health sciences programmes, and to determine barriers and facilitators in the teaching and learning of EBHC in an integrated manner.

Methods

Our study was situated within an interpretivist paradigm which sought to understand specific phenomena, recognising that meaning is constructed during the research process and as a result of engagement between researcher and participants [15]. This was a qualitative study based on the perceptions of key informants generated during a series of semi-structured interviews. We used purposive sampling to select key informants with experience in implementing clinically integrated teaching and learning of EBHC involving health professions students studying for their first degree (Table 2). The Faculty of Medicine and Health Sciences, Stellenbosch University, Health Research Ethics Committee provided ethics approval for the study (S12/10/262b). The consolidated criteria for reporting qualitative research (COREQ) [16] (S1 file) and the standards for reporting qualitative research [17] guided the reporting of the study.

Participants

We invited EBHC academic programme course convenors/coordinators from training institutions for health professionals across the world by email to participate in the interviews. This purposive selection was informed by considering those publishing on this topic and those participating in an online list-serve on EBHC, administered by the Centre for Evidence-based Medicine, University of Oxford, United Kingdom (www.cebm.net). The aim was to obtain input from a spectrum of programmes covering different health professionals in various countries. We also requested invited participants to nominate key members of their faculty who are

Table 2. Key definitions.

Clinically integrated teaching and learning	Teaching and learning of EBHC integrated in clinical practice, whether interactive or didactic, compared to classroom based teaching. [12]
Academic programmes	A higher education programme for any healthcare professional.
Medicine or health sciences student	A college or university student who has not yet received a health professions degree (this included both undergraduate and graduate medical programmes) and excluded postgraduate students.
Evidence-based health care	Evidence-based medicine (EBM) was first defined by Gordon Guyatt as *"an ability to assess the validity and importance of evidence before applying it to day-to-day clinical problems"* [9]. David Sackett (1996) then furthered this definition as *"the conscientious, explicit and judicious use of the current best evidence in making decisions about the care of individual patients"*. As EBM is not restricted to medical doctors, the term "evidence-based health care" (EBHC) is used. The process of EBHC starts with formulating an answerable question when faced with a scenario of uncertainty. This is followed by searching for and finding the best available evidence applicable to the problem, critically appraising the evidence for validity, clinical relevance and applicability, interpreting and applying the findings in the clinical setting and evaluating the performance [9, 29].
Health professions	All health professionals including doctors, dentists, nurses, occupational therapists, physiotherapists, dieticians, audiologists, mental health professionals, psychologists, counsellors, social workers.

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involved in EBHC teaching and learning and recommend additional academic programmes, national and international, that could be contacted. We informed participants about the purpose of the interview and asked them to provide written informed consent for participation in the study, for digital recording of the interviews, and for using and disseminating the anonymous information they provided. Participation was voluntary.

Data collection

Data collection was undertaken using individual semi-structured interviews. An interview guide (Table 3), developed by the investigators through consensus and to align with the objectives, was used to ensure that the same topics of inquiry were covered with each respondent, but at the same time allowing for further exploration of areas of particular interest or concern to respondents, thus creating a rich data set [18]. The interview covered EBHC teaching approaches, and the successes and challenges faced in implementing and evaluating clinically

Table 3. Interview guide for semi-structured interviews.

Describe your role within the academic programme
What is the definition of EBHC that underpins what you seek to include in your programme?
How would you describe clinically integrated teaching of EBHC?
How is the teaching and learning of EBHC covered in your programme? Give us a short description of the programme and how and when EBHC is covered throughout the course of the programme. What are the objectives? Which EBHC competencies are covered? Please describe the context in which learning take place. Which teaching and learning methods are used? How is EBHC assessed?
What are successes of the programme?
Which challenges have you encountered?
What do you see as the barriers to the integrated teaching of EBHC?
What are the factors that facilitate integrated teaching of EBHC?
What are the lessons you have learnt in teaching EBHC in an integrated manner [if this is being done in the particular programme]

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integrated EBHC student programmes, as well as general information on lessons learnt. Interviews lasted an average of 45 minutes and we conducted these in person or by telephone/Skype, at a time convenient for the participant. The interviewer recorded the interview using a digital voice recorder and took additional field notes to ensure full and accurate data capturing. Data saturation was reached by interview 22.

Data management and analysis

An external company transcribed the interview data for the purpose of analysis. Names of participants did not appear in the transcriptions. The lead researcher (TY) checked all transcriptions by listening to interviews while reading the transcripts, and developed codes and code definitions afterwards. To ensure the transparency of the data coding process, three researchers (TY, SvS and AR) with different backgrounds met to finalise the code book after a preliminary round of independent coding. This code book guided the subsequent coding process [19]. Data were then imported into *Atlas.ti*, a software package that facilitates the process of coding qualitative data. The lead researcher coded all transcripts and two co-researchers checked the coding. The researchers then did the data analysis and interpretation using thematic content analysis to identify key emerging themes ultimately relating these to each study objective. This iterative process of aggregation and interpretation was undertaken by the lead researcher and discussed with the rest of the research team. During the discussions, these themes and their relevance to the study objectives were highlighted. Findings were based on individual perceptions while keeping in mind that the teaching and learning context plays a key role. Any lessons learnt were therefore interpreted within these specific contexts.

Findings

Twenty-four course coordinators from five continents (countries: Australia, Canada, China, Netherlands, New Zealand, Norway, Philippines, Scotland, South Africa, United Kingdom, and the USA) participated in the interviews (Table 4). Interviewees, from mainly medical programmes, were senior academics from a variety of different disciplines, including dentistry, emergency medicine, general practice, internal medicine, nephrology, paediatrics, physiotherapy, and public health. Many had completed postgraduate programmes in clinical epidemiology, had conducted systematic reviews, and linked their initiation into EBHC teaching to attending courses at institutions that championed EBHC, or being supervised for postgraduate studies by international leaders in the field of EBHC. Some had been involved in teaching EBHC to health professionals for more than 10 years, with their own experience in teaching EBHC typically starting at postgraduate level and then extending to undergraduate or graduate medical programme level.

Our findings are presented below in separate sections dealing with the description of the programmes, staff supporting the teaching of EBHC, challenges in integrating EBHC and the critical success factors for successful implementation of clinically integrated teaching and learning of EBHC.

Programmes structure and process of integrating EBHC

The medical programmes were typically either undergraduate or graduate programmes divided into preclinical and clinical years. Undergraduate medical programmes are 5 to 6 years in duration with students entering directly from school, while graduate medical programmes (GMP) offer 4 years of training to students who have completed an undergraduate bachelor's degree and may in addition have had some work experience. The size of the student groups taught by

Table 4. Characteristics of participants.

Participant number	Gender	Continent	Type of programme
P1	Male	Australia	Medical
P2	Male	Africa	Medical
P3	Male	Australia	Medical
P4	Male	Europe	Medical
P5	Male	Europe	Medical
P6	Male	Australia	Medical
P7	Male	Africa	Medical
P8	Male	Australia	Allied Health
P9	Female	Europe	Medical, Allied and Nursing
P10	Male	Africa	Medical
P11	Female	North America	Medical
P12	Male	North America	Medical
P13	Male	Australia	Medical
P14	Male	Australia	Medical
P15	Male	Europe	Medical
P16	Male	North America	Medical
P17	Female	Asia	Medical
P18	Male	North America	Medical
P19	Male	Europe	Medical
P20	Male	Africa	Medical
P21	Female	Asia	Medical
P22	Male	North America	Medical
P23	Female	Asia	Medical
P24	Male	Africa	Dentistry, Medical

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participants in our study ranged from 50 students, at a private medical school, to as many as 300 students.

Some EBHC teaching programmes have been running for more than 10 years. Typically in our sample, EBHC teaching started as specific modules coordinated and driven by volunteers, using didactic teaching and with a focus on critical appraisal of research evidence. Over time, opportunities such as curriculum revisions and reform were used to enhance, integrate and formalise EBHC teaching. During these revisions, curriculum assessment, which mapped what was done where, and involvement of those who had been teaching these components, guided joint planning on how EBHC could be integrated. A substantial number of these planning activities were driven by champions *'planning in (their) backyards'* (P4).

Interviewees explained that the underlying aim with integrated curricula was to have EBHC learning longitudinal, instilled, embedded and part of mainstream. The typical approach for an integrated EBHC curriculum involved laying the foundation in the preclinical years, and linking EBHC learning to specific clinical rotations thereafter. Table 5 provides a summary of the typical content covered, teaching and learning approaches, and assessments used by interviewees.

Typical EBHC content covered. Generally, the foundation was laid in the preclinical years with topics including the history of EBHC and introduction to EBHC principles and practice, epidemiological principles, basic biostatistics, introduction to library services and searching, and the approach to critical appraisal. During the clinical years, the focus was on asking, finding, appraising, interpreting and considering the use of research evidence related to

questions about risk factors, diagnosis, treatment, and prognosis that arose from seeing patients in the clinical rotations–i.e. integrated within clinical rotations and not focusing only on critical appraisal but linking it to interpretation, application and communication of findings. Within the preclinical years, teaching was often included in modules where there was thematic 'fit' (e.g. personal and professional development) and, in the clinical rotations, the emphasis was on linking EBHC learning to patients and clinical queries arising within the clinical setting and linking to existing initiatives such as quality improvement projects. Most felt that inserting EBHC into the clinical setting work better with longer clinical rotations i.e. 6 weeks instead of 4 weeks.

Teaching and learning approaches. Various approaches were described which had evolved over time. In the preclinical years, much of the teaching took place in large groups and some lecturers employed innovative strategies, such as using videos of clinical scenarios and in class tutorials, to make lectures clinically relevant, more interesting, and interactive. Where resources were available, large group lectures were followed with small group, discipline specific (if a diverse group of students) tutorials where the content covered in the lecture was consolidated. Here, facilitators often chose clinical topics they were comfortable with. In addition, the teaching of EBHC was often linked to either problem based learning or competency based education (e.g. CanMeds). A number of tools (Table 6) [20–22], such as the graphic appraisal tool for epidemiological studies (a tool to guide the appraisal of epidemiological studies), were also used as a way to help students, and faculty, to remember EBHC approaches–'*something memorable*, *something that's easy to remember so that it stays with them*.' (P6)

Participants highlighted the importance of teaching being relevant to students explaining that students start their training motivated to become healthcare professionals and, especially in the preclinical years, need to see the relevance of EBHC to being a healthcare professional. This increases their interest and facilitates learning. Outlining the clinical context and how EBHC fits into healthcare decision making were therefore identified as being important. This was, however, not easy to achieve during the preclinical years. Some lecturers found that using

Table 5. Typical integrated EBHC curriculum[#].

Period of study	EBHC content covered	Teaching and learning approach	Assessment	Selected quotes
Preclinical years	History of and introduction to EBHC principles and practice; Epidemiology principles; Basic statistics; Introduction to library and searching; Approach to critical appraisal	Large group lectures; Small group tutorials; Practical sessions on how to search	Standalone assessments in form of multiple choice questions or short questions	*'..get them to think through problem solving and clinical decision making early.. give them basic epidemiology, and basic statistics within the whole framework of the doctor / patient relationship, and of the doctor and the patient trying to make decisions about their health care and about, you know, how to achieve that objective'* (P23) *'You can't get them to do the critically appraised topics, that's the really integrated part of it if you like, unless you've got the building blocks in place, otherwise they just do it badly, so they have to have slowly built up all of the skills so that then they can rapidly do the stuff when they get to the clinical rotations'* (P1)

(*Continued*)

Table 5. (*Continued*)

Period of study	EBHC content covered	Teaching and learning approach	Assessment	Selected quotes
Clinical years	EBHC linked to specific clinical rotations. Based on a patient seen students phrase a clear question, search for the best evidence, appraise that article using the appropriate appraisal form, interpret findings and consider application to patient. Focus on Diagnosis, Therapy (often main focus), Prognosis, and Risk factor. Communication and implementing evidence in practice.	On the wards / in clinical setting; Small groups doing clinical rotations; Spread out over blocks; Online material to support learning	CATs* submitted as written documents and also presented. Minimum number to successfully complete within clinical years e.g. six over the period. Cover the five core articles types—therapy, harm, diagnosis, prognosis and systematic review. Presented in portfolios which include reflection	*'Usually where there is a level of uncertainty it's a good way of leading them into the literature directly from the bedside. I hardly ever see a student that doesn't have a cellphone with internet access. . .so we would search right then and there to get an answer on a certain topic at risk if it comes up in that, on the ward rounds'*. (P10) *'They have free choice. They can pick whatever patient struck them with an interesting patient with an interesting issue. Say for example, a student was doing a block on surgery, at the end of the surgery block; they would have to submit a one-page summary on the standardised form of a question that arose with a patient. What their literature search was, what their strategy was, what paper they found and then a validation and interpretation of the paper they found. Then finally, how they would explain in their findings in that paper to their patient'* (P16). *'. . .. so we actually look at every paper and every article and provide our comments about things that the students may not be capturing or particularly good insights that they have developed we try and reinforce those and then we send those back to them. So not only do they pass the assignment if it's appropriate, but regardless of whether they pass or don't pass, we trying to provide them some written feedback as well.'* (P12)

*Critically Appraised Topic

This table provides a summary of the typical content covered, teaching and learning approaches used, as well as assessments used. This is drawn from content, approaches and assessments named and described by interviewees.

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topical examples, technology (e.g. using videos of clinical scenarios) or both was helpful in bringing the clinical setting into the lecture room.

In the clinical years, critically appraised topics (CATs), where students apply the various steps of EBHC to a patient seen in the clinical setting, were typically done in small groups with a tutor linked to the group. Students started by identifying topics based on patients they had seen, then phrased a clear question, searched for evidence, appraised and interpreted the evidence and considered issues related to application of the evidence to the patient. The approaches used, in both preclinical and clinical phases, however were often dependent on the size of the class, available resources and available teaching opportunities. Despite recognition

Table 6. Examples of commonly used tools.

Tool	Short description
AMSTAR	A measurement tool to assess the methodological quality of systematic reviews.[22]
CARL	Clinical Appraisal Research and Lifelong Learning–An approach linking critical appraisal, interpretation of research and application to patients seen in clinical setting
CATS	Critically Appraised Topics–An approach linking critical appraisal, interpretation of research and application to patients seen in clinical setting.
GATE	Graphic Appraisal Tool for Epidemiological studies - A tool to guide the appraisal of epidemiological studies. [20]
PEARLS	Presentations of Evidence Abstracted from the Research Literature to Solve the real patient problems—15-minute presentations given by students addressing a focused clinical question raised by their contact with a real patient during a recent clinical attachment. [21]
PICO	Approach to phrase a clear question: P- Participants I–Intervention/Issue C- Comparison/ Context O- Outcome

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of the potential value of using technology such as use of mobile phones, tablets, etc., this was not a key approach described by participants.

Assessment. Both formative and summative assessment was used. Typically, standalone assessments were used in the preclinical years and more integrated assessments in the clinical years. In the preclinical years, assessment examples included short questions, online quizzes and multiple choice questions (MCQ) while in the clinical years the submission, and in some instances individual or group presentations, of CATs were a curriculum requirement. During the presentation of CATs, students presented to their peers and lecturers, and peer assessment of these was used at some institutions. Individual as well as group feedback was given to highlight key issues that students were struggling with, mostly related to critical appraisal. As these were completed over various clinical rotations, some institutions included the CATs, the feedback and a reflective report by the students within a longitudinal portfolio.

Who is supporting the teaching of EBHC?

Interviewees had dedicated roles with regard to EBHC teaching, which were linked to new programmes or involved curriculum reform in an established curriculum. Their roles included teaching, curriculum review, evaluation, setting and grading assessments, and working with others to ensure continuity in the programme. For established clinically integrated programmes, the interviewees perceived their main role to be ensuring quality assurance. EBHC teaching was however just one component of their general academic or clinical responsibilities. *'I mean it's only a small part of what I do'* (P6).

Staff involved in facilitating EBHC learning typically fell into three groups–the core EBHC team, clinical lecturers and clinicians working in the clinical setting (Fig 1). The number and extent of people involved depended on how integrated the EBHC programme was, the size of classes and the availability of funding to support teaching. Core EBHC team members were few in number and usually trained in EBHC, experienced in conducting systematic reviews and other research, committed, enthusiastic, and comfortable with uncertainty. They were supported, in some cases, by tutors or teaching assistants (e.g. PhD epidemiology students), librarians and, rarely, by administrators. This team typically initiated EBHC teaching and learning and continued to drive the process.

The clinical lecturers were often academics from various disciplines, who were teaching students. They usually had postgraduate qualifications in clinical epidemiology or epidemiology and an interest in EBHC, clinical epidemiology or public health. Some were medical or non-medical researchers working in a clinical setting. Their involvement usually started through

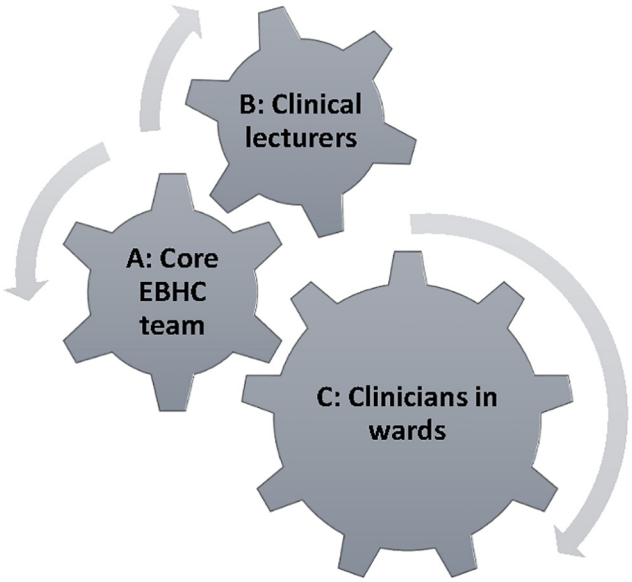

Fig 1. Staff involved in facilitating learning of EBHC.

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either participating in continuing professional development or postgraduate training in clinical epidemiology or EBHC.

Clinicians working on the wards play a critical role in facilitating the learning of EBHC as students look up to them as role models. The core EBHC team and clinical lecturers in some cases teamed up with the clinicians in the wards and, through their complementary backgrounds and roles, facilitated linkage between EBHC and clinical expertise.

What challenges did they experience in integrating EBHC in clinical settings?

Despite dedicated attempts to integrate EBHC learning in clinical settings, not all programmes were truly integrated. Some were running EBHC as separate courses within the programme e.g. 8 weeks of EBHC with lectures and tutorials where all the activities are classroom based. By far the most common challenges related to lack of space in the clinical setting, EBHC misconceptions, resistance of staff and lack of confidence of tutors, time, and negative role modelling. Issues that were also noted in some instances were student commitment and quality assurance.

Lack of 'space' in the clinical setting. *'. . .treading on someone else's curriculum real estate.'* (P11); *'..my content, my space'; 'Well the politics of treading on other people's territory'* (P1) Curricula were typically full with each discipline jealously guarding the inclusion of their content in the curriculum. In addition, competition for teaching time and space, while dealing with the patient responsibilities in the clinical setting, was a key challenge faced by many.

Misconception or lack of knowledge of EBHC. Knowledge and attitudes towards EBHC varied amongst faculty members at the different institutions. Misconceptions that EBHC was only based on evidence from randomised controlled trials, or only focused on the evidence and critical appraisal and ignored patient values and clinical experience, hampered the facilitation of learning of EBHC in the clinical setting.

'The faculty are not to the standard of the students, and so when the students get into that clinical environment, they basically are not supported by faculty, except in a few departments, and a few individuals.' (P20)

'The other major challenge I mentioned is that as long as we're not able to teach the teachers, or make sure the teachers integrate this in clinical teaching, then our efforts are, if not futile, they're not very effective.' (P19)

'Many of the old guys (are) traditional and very difficult to move especially clinicians and it is clear that they don't sort of keep up to date in this field'. (P24)

'..the blind leading the blind, because you know a lot of clinical teachers are not well trained in evidence based medicine, critical appraisals, so you kind of have the students in a way, sometimes know more theoretically than their clinical teachers.' (P6)

Resistance among clinical staff and negative role modelling. As a consequence of workload, limited knowledge (and also feeling threatened) or misconceptions about EBHC, some staff in the clinical environment did not see the need, value or relevance of EBHC teaching in the clinical setting. As a consequence, they blocked or inhibited attempts at clinical integration. As students do what they see, and pick up that clinicians do not practice EBHC, the impact and influence of negative role modelling in the clinical setting may be far-reaching.

'So what we fear is that we teach them, they learn quite a lot in the classroom, they can even practice it on paper and pencil exercises, but when it actually comes to the clinical time, it tends to be undone by the negative role model of people who don't do it, whom they revere as teachers, clinical teachers'. (P3)

'So the resistance was–we don't believe you, we think it's worthless. . .' (P5)

'However, some of the older consultants I think experience it really as a threat and especially if the students start knowing more about that than they do and then they sometimes feel threatened by and often make it as unimportant or ignore it' (P10)

'They don't do it, they don't know how to do, they don't see any value in it and so the students pick that up very quickly. They see that they, you know, we do it this way because we've always done it this way, because I know its best' (P3)

Staff lack of confidence to facilitate learning of EBHC. Lack of confidence impacted on integration in the clinical setting as staff in clinical departments were not comfortable to teach EBHC, to encourage critical enquiry, to facilitate EBHC learning or administer related assessments.

'. . .what's compounded it is that none of these skills are being demanded of them by the clinicians in the ward, and so basically we deliver a curriculum that doesn't–that does demand in terms of assessment and marks, but is not carried forward into the clinical years to any real degree, and the student skills are . . . I think they appreciate the concepts, but I don't think they're actively applying it, now in the day to day work.' (P20)

Lack of time. Lack of time for teaching EBHC, setting and grading assessments, providing feedback to students on their assessment performance, or for faculty development initiatives, etc. was identified as a further challenge. Dedicated time was seen as important to develop and standardize teaching resources and material, assessments, and marking schedules. Furthermore, on an ongoing basis, tutors need training, guidance and oversight, teaching material needs refinement, and teaching sessions require preparation, reflection, online engagement (in some cases), engagement with clinical staff, marking of assessments and feedback to students. All these are however only one part of academic life and participants highlighted the challenge of balancing academic life–teaching, research, grant writing, supervision of students and other priorities. Those involved in the teaching of EBHC enjoyed doing it and often did it out of a sense of passion but burnout was raised as a real concern.

'So it took a long time for each session when I first developed it . . . I have to read the paper and design the work sheet. I then have to mark the worksheets which takes me two hours for 15 worksheets and then, I have to you know develop slides based on the problems with the worksheets.' (P11)

'.. it was very important for us that there be a substantive feedback component to our evaluation.. . . The challenge with that is it is labor intensive and it is time intensive. That's a commitment it's an investment and you either have to have a lot of graders if you have a lot of students or you have to have substantial time commitment from the medical school.' (P12)

'. . . and then on an ongoing basis I would say that the whole thing is probably about a half day, not including the face time of teaching. You know tweaking the slides, putting out the materials, marking the worksheets and then going and doing the sessions and some of the sessions you know I have to update them.' (P11)

Student commitment. Students want to practice medicine and don't always see the relevance of EBHC within the curriculum. Where EBHC is seen as an add on and not as part of the core curriculum, their level of commitment in engaging in and preparing for EBHC activities varies. Those doing the GMP were found to appreciate the relevance of EBHC earlier than their undergraduate counterparts.

'I think that's the biggest challenge in undergraduate teaching in second year is that they don't have a context for it getting to understand the importance of it.' (P8)

'. . . teaching EBM to the undergraduate students is very, very difficult, because it's very abstract for them, ... it's very difficult for them to understand, ... what I do is in many instances I take a step backwards, give them a clinical scenario and try to explain to them in a practical way what they understand about it..' (P2)

'The trouble is that students don't terribly like it, you know, they want to get on and cure people. Learn how to make diagnoses and all that stuff and the stuff about looking up things on a computer and worry about what an odds ratio is and interpreting confidence intervals, it all seems rather remote from direct patient care'. (P3)

Quality assurance. Various levels of staff across different disciplines were involved in the teaching of EBHC. It was felt that standardisation and quality assurance of the teaching and learning of EBHC are needed to ensure that consistent messages are provided to students.

'think it's, you need to believe in EBM and I think you need to practice that and you have to believe in that, you know it's like a religion, you have to think of it and you have to practice it, . . . the core group which teaches the EBM, you don't have a capacity to go into every department and do this and it would have been ideal that every clinical departments have somebody who is championing EBM and teach them in their blocks, but that didn't happen. . ..' (P2)

What are the critical success factors in successful implementation of clinically integrated teaching of EBHC? (Table 7)

Those who successfully implemented clinically integrated teaching of EBHC shared what they regarded as key success factors. By far the most common factors were being pragmatic, and patient, starting early in the curriculum and building from there, leadership acknowledgment

Table 7. Critical success factors in successful implementation of clinically integrated teaching of EBHC.

Be pragmatic
Patience and persistence
Start early, build from there with relevant examples using a variety of delivery and assessment methods
Need the 'right' teachers
Role modelling
Evaluating teaching and curriculum renewal
Leadership acknowledgment, faculty engagement and institutional culture of EBHC

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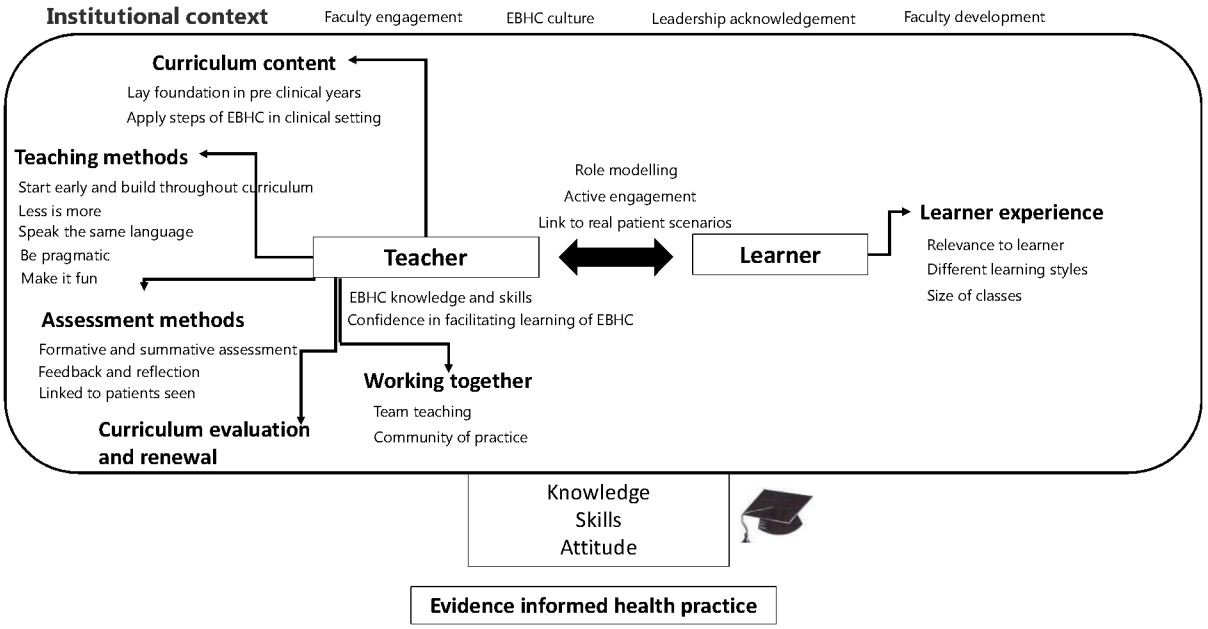

Fig 2. Concept map with key issues for integrated teaching and learning of EBHC.

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and the right teachers and role models. Issues that were also noted in some instances were evaluation and curriculum renewal, having a community of practice, and a culture of EBHC. We include some illustrative quotes in the text below. Fig 2 brings together the various findings in the form of an overarching concept map.

Be pragmatic. There is 'no one size which fits all' when it comes to clinical integration of EBHC. Taking the contextual factors into consideration, programme coordinators identified opportunities, such as when the curriculum was being revised, and used these to work with others to integrate EBHC teaching and learning. Linking and integrating EBHC with existing teaching was also considered important e.g. as part of quality improvement projects which was a good way of showing how EBHC links to existing healthcare processes and practice. Furthermore, not all clinicians are interested in EBHC and EBHC champions thus chose to start work with 'early adopters.'

'..you have what you have and you have to work within that . . . there's no one curriculum you can hand people, because of the structures of most medical curriculum's, you've got to sort of bend it into shape to make the principle's fit' (P1).

Patience and persistence. Integrating EBHC took time. Participants described the time it took to understand what was happening in the whole curriculum, what the needs were, what the programmes covered, to find space where EBHC could fit in, to encourage or convince others to link EBHC learning to their rotations and then work with them to integrate EBHC and build capacity and confidence in facilitating the learning of EBHC. This process of change management required patience and persistence.

'There's no quick fix. . ..it's a never-ending process, so we gradually put those building blocks in place over several years, it was getting better and better.' (P1)

'Then you just have to be patient, patience is very important in–if you're about to introduce something new. When I say patient, you cannot change everything in one flick of a finger. You, you know, change is actually very slow, but if you're patient you know, it will come. So, that's something that we have learned, and we've been doing it for 20 years, and now we don't even

have to do much, people just . . . people who have already learned about this, are the ones doing the talking, and incorporating the activities, wherever they are. . .' (P21)

'..don't give up or compromise on the larger goal and so what I mean by that is–in my opinion evidence based medicine—to be relevant as part of a curriculum absolutely has to be integrated. . . don't compromise that goal because it will be easier to compromise it because integrating is hard, but I think it would be to the detriment of your curriculum.' (P12)

'. . .take small steps at a time to build up to that stage. I think that's–to all of us that's a very desirable end point, but that may take some time to be achieved'. (P18)

Start early, build from there with relevant examples using a variety of delivery and assessment methods. The need to start EBHC teaching early in the pre-clinical years to lay the foundation and then to repeat and scaffold EBHC learning throughout the programme to ensure continuity came up consistently. In doing so, a few key approaches were highlighted. Interviewees mentioned linking teaching and learning to real patient scenarios to engage students and also to let them appreciate the relevance. They recommended that one must avoid linking it to 'boring' subjects, and should consider the different learning styles of students, and their diversity. A variety of delivery methods can be used, where one should try not to cover too much ('*less is more*'), and also make it fun. Furthermore, interviewees highlighted involving clinicians in the ward as part of the teaching team, speaking the 'same language', and including assessment (as it drives learning). Providing feedback to students on their performance was also highlighted.

'That student could consider using evidence-based medicine and looking articles up as much as they would consider listening to a patient's chest with a stethoscope or looking at their eyes with an ophthalmoscope.' (P16)

'So, I would say you have to make the, the key learning point, make the learning experience, spokes on the learning experience to make (it) fun, engaging, break up your sessions from, from larger groups to smaller groups, wherever possible. Engage the students to think for themselves.' (P15)

'..in a variety of formats so we'll do both face to face as well as online teaching like I mentioned before role play and integrating it with the existence PBL activities and clinical bedside teaching and activities as well so it's not just I guess one model of delivering the course . . ..a multifaceted approach which the students have enjoyed.' (P13)

'. . ..they're team taught. . .which brings credibility to the subject matter' (P11)

'I think the other successors of the program were the branding. . ..So branding and recognition for the students has been pretty key in their understanding that this is a skill that is woven throughout and reinforced at increasing levels of sophistication.' (P11)

The 'right' teachers. Interviewees felt that integrating EBHC relied on an enthusiastic and committed critical mass of teachers with requisite knowledge, attitudes and skills. To achieve this, there was a need for continuous sensitisation of staff to the importance of EBHC, provision of guidance and support in how best to integrate EBHC into a curriculum, and recognition or reward of EBHC champions. Faculty development initiatives were often targeted at the new generation of health professionals and focussed on improving understanding of EBHC and how to teach EBHC. It included dedicated capacity building sessions, sharing useful resources, and supported learning while part of the teaching team. Such initiatives enhanced knowledge, confidence, and attitudes towards EBHC and often served as an opportunity to identify potential tutors/teachers. Those working at institutions which had established postgraduate masters or doctoral programmes in clinical epidemiology described having achieved a critical mass of graduates working within clinical departments who were leading the teaching of EBHC in undergraduate programmes.

'We had a PhD programme for clinical epidemiology seniors, and most of these persons were involved afterwards, after they complete this programme. . ..And then you can keep them attached to your plans, and then these are people who can send a message in the hospital that they fare better.' (P5)

'.. I built up my own internal tutors and including tutors across the other programs, so I would get people in surgery interested in learning about evidence based medicine, would get a place in the workshop and that's a long-term program and that's building up the capacity that you have.' (P1)

'. . .how best we can teach, how can we teach teachers how to teach EBM in an attractive way, to our students' (P2)

'We've been embracing, if anyone shows an interest, they're welcome to join the team.' (P20)

'Stop devoting time on teaching the old ones, I'm going to devote my time particularly to scouting highly talented young ones. . .' (P5)

Role modelling. Seeing others, in particular their teachers, clinicians (especially those who they respect) and their peers, practicing EBHC was the most powerful tool to facilitate learning of EBHC by students.

'*The most important way of teaching students evidence based medicine is by example. . .. It is not what we say but what they see we're doing. . .'* (P10)

'If you don't read they can see that you are reading, if you don't look and do research. . . that they can see that you also do not know. I think the biggest illusion and the biggest problem with our training nowadays is we want students to believe that we know everything and that's our biggest shortcoming. The students need to know that their professors and their doctors or their teachers do not know everything and constantly seek to find out what is going on and go and read up and know where to get the information, I think that's the . . . probably the biggest place where you can teach your students to learn evidence based medicine is to acknowledge you don't know, you sit with a problem, with a patient, I don't know what it is, but let's find out.' (P10)

Evaluating teaching and curriculum renewal. Curriculum review played a key role in informing the integration process. It provided opportunity to map what was being taught where and identified opportunities for inclusion of EBHC. Ongoing evaluation of what works, what could be done differently, and being aware of new developments in the field, were key to keeping the EBHC curriculum up to date and relevant. Also highlighted was the need to 'move with the times'–keeping track of what is new, what content could be covered and modern approaches to teaching e.g. use of e-learning and social media as teaching tools.

'*I continue to modify and try to tweak it.'* (P6)

'So the first thing I did is, the lead of the thread, was to find out what other related teaching was appearing in all of the other disciplines, so I found out that some basics sciences were teaching some critical appraisal and statistics in the early years of the course, that the librarians were teaching a bit about searching but the surgeons in the fifth year had a critical appraisal afternoon within their program, etc., so I mapped all of that out and then got the people together who were doing this and said, OK, if we're going to have an integrated course, a thread that goes across all the years, what are the upper laps, what are the connections, what are the missing bits across this thread.' (P1)

Leadership acknowledgemnt, faculty engagement and culture of EBHC. EBHC is a philosophy –**'***it's about learning, we are all learners we can learn everything, we don't know everything'* (P21). This institutional culture of critical enquiry was considered an important contextual element to foster EBHC learning. Furthermore, the degree of recognition by faculty leadership, and the resources provided to support EBHC teaching initiatives were regarded as important. These ranged from some interviewees having little to no dedicated resources and teaching of EBHC being seen as an expected element of their academic work, to having

dedicated funding for both academic and administrative posts to support EBHC teaching. Formal acknowledgment and endorsement of the EBHC curriculum by senior leaders and management created enabling environments for the implementation of the teaching and learning. This translated into support, which could be verbal, monetary or related to provision of resources, and importantly, also influenced how students see EBHC. Engagement of senior faculty, from all disciplines, further supported implementation.

'..we have very good I mean superb support from our medical school leadership they understand that evidence based practice is something that our graduating students must be familiar with and they support that and because of that support that comes through to the students over time as well and they understand look, I have to be familiar with these principles, this curriculum is going to help me to be familiar with these principles and this is something that is going to be relevant to my clinical practice, this is not just make work for the student.' (P12)

'In terms of getting other people engaged, so you can have all the resources you like, but unless you can also use that resource to lever engagement in the other disciplines, then you don't encroach on the hidden curriculum.' (P1)

'*If you have leadership support . . ..everything else follows from that'* (P12)

'Other than saying it's, it may be . . . it's humbling to say that you don't' know and I think certain disciplines there's people that's . . . just afraid to say well I really don't know and I think that's the bottom line of evidence based is just acknowledge that you don't know' (P10).

Community of practice. Working and networking with like-minded people involved in the teaching and learning of EBHC–having an opportunity to reflect and engage regularly on these issues–within a community of practice not only as a support network but also as a group to further the teaching and learning of EBHC were raised by most participants. This included engaging on aspects such as how best to facilitate EBHC learning, standardise teaching resources, validate assessment procedures and tools, and building consensus around what the EBHC curriculum should include.

'*.. a national or international network of people . . . and some kind of forum where you could get together and talk about issues particular to EBHC, curriculum development'* (P11)

Discussion

Worldwide, academic institutions are including, or considering the inclusion of, teaching and learning of EBHC in health professions curricula [9]. The recent paper by Greenhalgh and colleagues [23] draws attention to clinical training playing a key role in supporting the delivery of 'real EBHC'. However, little is known about how to implement clinically integrated EBHC teaching and learning. This study reports on lessons learnt from those who have successfully implemented, or who have attempted and failed to implement, clinically integrated EBHC teaching and learning [10, 12]. It describes approaches used, successes and challenges faced, and lessons learnt in teaching and learning of EBHC in an integrated manner in order to better inform future implementation strategies. Participants were from various countries and the themes, both challenges and successes, were consistent across countries.

Implementation of clinically integrated teaching and learning of EBHC takes much time and many programmes did not have full integration of EBHC learning in all clinical rotations. Typically, learning started in pre-clinical years through the use of real clinical scenarios and subsequently was consolidated with application to real patient settings and assessment within the clinical years. The EBHC curriculum content needs to cover the full spectrum of EBHC and not be focused on critical appraisal only. On-going curriculum revision and renewal are needed before integration can become 'business as usual'. Medical curricula are however typically organised around disciplines and this is often a barrier to integrating cross-cutting issues

such as EBHC. A holistic approach to curriculum renewal, recognising that this might require a change management process, is needed. Critical success factors were adopting a pragmatic approach and being ready to use opportunities for engagement and for fitting EBHC learning within the curriculum, patience, and a critical mass of the right teachers who have EBHC knowledge, attitudes and skills and are confident in facilitating the learning. Role modelling within the clinical setting emerged as a critical facilitator. The institutional context has an important influence on what is possible [24]. Faculty buy-in, endorsement by institutional leaders and having an EBHC culture, together with a community of practice, create an enabling environment. By far the most common challenges were lack of space in the clinical setting, EBHC misconceptions, resistance of staff and lack of confidence of tutors, time, and negative role modelling.

Our study findings are consistent with those of similar studies. A survey conducted by Oude Rengerink and colleagues [14] on barriers and facilitators for teaching EBM in clinical practice (as part of continuing education) in various European countries found lack of teaching time and lack of EBHC requirements in curricula as key barriers, and train the trainer initiatives and access to relevant databases as the key facilitators. Dans [4] highlighted the lack of role models in the clinical setting as an important limitation which could be overcome over time through postgraduate EBHC programmes and train the trainer initiatives. Through interviews with undergraduate medical students, Ilic [25, 26] found that demonstrating applicability to clinical disciplines and mentorship are key facilitators while lack of application by senior clinicians was a main barrier. Issues which emerged however are not always unique to EBHC but resonate with teaching and learning in general especially related to other cross cutting themes such as ethics [27] and inter professional education [28].

Our study focused on the experience in EBHC teaching and learning at pre-service level, from the perspective of academic programme course convenors/coordinators from training institutions from across the world. Even though contextual factors, such as the culture of EBHC, change over time and barriers from 15 years ago might have reduced over time, this qualitative study sheds further light on both potential barriers and facilitators to the implementation of clinically integrated teaching and learning of EBHC. It adds to the knowledge base by sharing experiences and lessons learnt in how to implement clinically integrated EBHC teaching and learning, an issue many are, and should be, grappling with. EBHC provides an approach towards enhanced health care and thus fits within the calls for a shift in health professions education [2] and the shift from memorization of facts to *"critical reasoning that can guide the capacity to search, analyse, assess and synthesise information for decision-making"*.

Strengths of our study include the international scope of the participants who are linked to institutions in various regions, and the trans-disciplinary nature of the research team with postgraduate academic backgrounds in medicine, nursing, evidence-based health care, public health and higher education. The lead researcher, with a background in public health and EBHC, conducted all the interviews and led the coding after the lead researcher and two other researchers, with different backgrounds, discussed and finalised the code book. Members of the research team are involved with teaching and learning of EBHC at their local institution and therefore have a special interest in this research topic. While a potential limitation of our study is that most participants were involved with medical programmes, the experiences and lessons learnt from medical settings seemed to resonate with those reported within other programmes. We recognise that there may be differences between countries but we were limited by what was covered in the interviews and a deeper understanding of this requires a detailed study at institutional and national level.

Conclusions

Clinically integrated teaching and learning strategies are the best strategies to build EBHC knowledge, skills and attitudes of new health professionals. Implementing such a curriculum requires institutional support, a critical mass of the right teachers and role models in the clinical setting, and most of all patience, persistence and pragmatism.

Supporting Information

S1 File. Consolidated criteria for reporting qualitative research (COREQ) checklist.
(DOCX)

Acknowledgments

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Author Contributions

Conceived and designed the experiments: TY AR SvS JV MC. Performed the experiments: TY AR SvS. Analyzed the data: TY AR SvS. Contributed reagents/materials/analysis tools: TY AR SvS. Wrote the paper: TY AR SvS JV MC.

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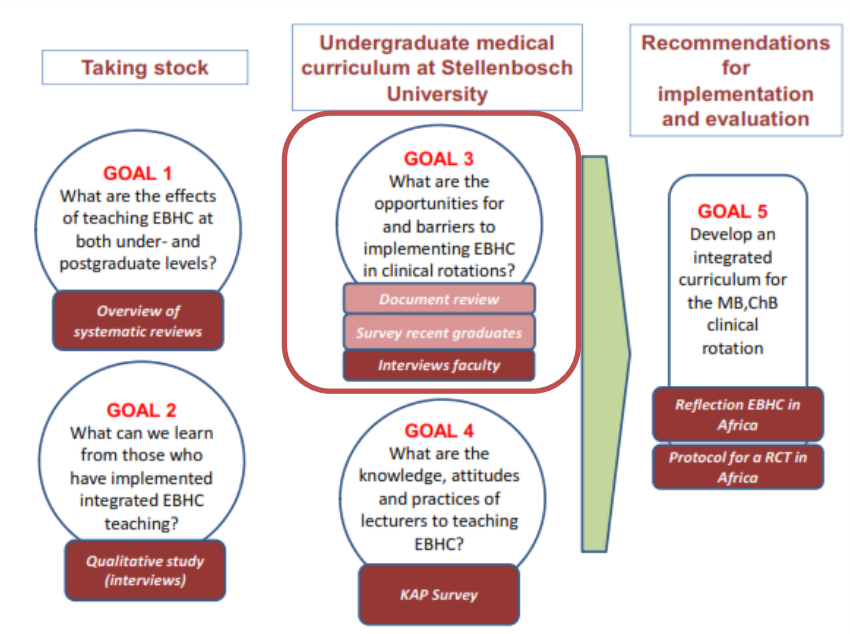
Chapter 4: Assessing the opportunities for and barriers to implementing EBHC in the MB,ChB clinical rotations at SU.



Summary: This assessment of the opportunities for, and barriers to implementing EBHC in the MB,ChB clinical rotations at SU included three components – a document review of the curriculum, a survey of recent graduates and interviews with module convenors at SU. The assessment found there was fragmented teaching of EBHC with no scaffolding of learning throughout the curriculum. Recent graduates called for more learning of EBHC and module convenors raised various issues which need to be addressed, especially the role of educators.

The PhD candidate was the senior author for the first two components (PhD linked work) and the lead and first author for the report of the interviews with faculty. In this chapter both the PhD linked publication and the interviews with faculty are presented to provide a comprehensive report of the findings.

4.1 Taking stock of EBHC in the undergraduate medical curriculum at SU: combining a review of curriculum documents and input from recent graduates

The paper has been published in African Journal of Health Professions Education.
Publication citation: Rohwer A, Willems B**,** Young T. Taking stock of evidence-based healthcare in the undergraduate medical curriculum at Stellenbosch University: Combining a review of curriculum documents and input from recent graduates. African Journal of Health Professions Education, [S.l.], v. 7, n. 1, p. 98-104, Jun. 2015. ISSN 2078-5127. Available at: http://hmpg.co.za/index.php/ajhpe/article/view/7977

Involvement of PhD candidate: The PhD candidate was the senior author on this article. She provided methodological leadership and guidance for the development of the methodology for the document review of the medical curriculum and provided input on the survey methodology. She analysed the data from both the document review and the recent graduate survey and interpreted the findings. She critically engaged with the content of the manuscript, provided input, and approved of the final version of this manuscript.

Involvement of co-authors: Bart Willems developed the methodology for the survey of recent graduates. Anke Rohwer (AR) developed the protocol for the document reviews, analysed the data from both the document review and the recent graduate survey, and interpreted the findings. AR also drafted the manuscript. All authors approved the final version of this manuscript.

The ethics approval is included as Appendix 4.1.

Research

Taking stock of evidence-based healthcare in the undergraduate medical curriculum at Stellenbosch University: Combining a review of curriculum documents and input from recent graduates

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Background. The Stellenbosch University Rural Medical Educational Partnership Initiative (SURMEPI) aims to increase the quality and retention of medical doctors, and regionally relevant research. Strengthening evidence-based healthcare (EBHC) knowledge and skills at an undergraduate level is important within this context.

Objectives. To assess and describe the current undergraduate medical EBHC curriculum in order to identify opportunities to enhance EBHC teaching, and to explore challenges related to EBHC experienced by recently graduated doctors.

Methods. We used methodological triangulation to assess current EBHC teaching and learning through a document review and a survey of recent graduates. We extracted learning outcomes from module guides that related to prespecified EBHC competencies. Our electronic survey collected quantitative data, which were analysed with SPSS, and qualitative data, which were coded with ATLAS.ti and grouped into emerging themes.

Results. EBHC teaching was fragmented and concentrated in the first and last phase of the medical curriculum. Most survey respondents agreed that it was important to learn EBHC at undergraduate level, and that there was a need for increased teaching of certain EBHC competencies. Recently graduated doctors identified lack of access to literature as the main challenge when practising EBHC. Other challenges included time constraints, work overload, lack of EBHC skills, lack of self-motivation, applicability of the evidence and the work environment.

Conclusion. Recent graduates felt that they needed more EBHC learning opportunities within the undergraduate medical curriculum. Existing EBHC teaching and learning for undergraduate medical students need to be enhanced by integrating EBHC into clinical modules and scaffolding it throughout all the phases of the curriculum.

Afr J Health Professions Educ 2015;7(1 Suppl 1):98-104. DOI:10.7196/AJHPE.501

South Africa (SA) faces a significant burden of: HIV/AIDS and tuberculosis (TB); chronic illness and mental health; injury and violence; and maternal, neonatal and child health. Because of the limited number of healthcare professionals, especially working in rural areas,[1-4] there is a need to enhance human and research capacity and to retain clinicians and researchers in these areas. Strengthening evidence-based healthcare (EBHC) competencies is particularly important to promote use of best care.[5] Glasziou *et al.*[6] recommend that EBHC becomes an integral part of learning in the curriculum of all healthcare professionals, since learning the fundamentals of research and the basic knowledge and skills of EBHC are essential for successful implementation of EBHC and subsequent improvement in quality of healthcare.

The Sicily statement on EBHC, which is a consensus statement from an international group of EBHC teachers and developers, advises that *'all health care professionals need to understand the principles of EBP (evidence-based practice), recognise it in action, implement evidence-based policies, and have a critical attitude to their own practice and to evidence'*. It also puts forward that EBHC curricula should be based on the five steps of EBHC, namely: formulating clear questions based on knowledge gaps; searching the literature to find answers to the questions; critically appraising the literature for validity and reliability; applying the results to the unique healthcare setting; and auditing the process.[7] The recent *Lancet* report on the health professional for the 21st century[8] echoes this by proposing that healthcare professional training should become transformative. Transformative learning aims to develop change agents – graduates with leadership attributes, who can function in a team within the local health systems. One of the fundamental shifts inherent in transformative learning is closely aligned to the steps of EBHC – the shift from memorisation of facts to *'critical reasoning that can guide the capacity to search, analyse, assess and synthesise information for decision-making'*.[8]

Although the design of EBHC curricula typically mirrors the five steps of EBHC as explained above, implementation of these curricula differs and is not standardised. Maggio *et al.*[9] reviewed the literature on recent educational EBHC interventions for undergraduate medical students and recommend, inter alia, that undergraduate teaching of EBHC should start in the early clinical years and that it should be integrated throughout the entire curriculum, providing learners with multiple exposures to EBHC in different contexts, thus strengthening their EBHC knowledge, skills and confidence.

With the goal of enhancing EBHC teaching at Stellenbosch University (SU), we conducted a situational analysis of current EBHC teaching in the undergraduate medical curriculum (MB,ChB), which we based on the six-step approach to curriculum development advocated by Kern *et al.*,[10] commencing with identifying the problem and doing a general needs assessment estimating the difference between the ideal and the current teaching approach. We made use of methodological triangulation: to assess and describe the content of and approach to EBHC teaching; to identify

potential gaps in the EBHC curriculum as well as opportunities to enhance EBHC teaching and learning (document review); to gather perspectives of recent graduates regarding the appropriateness of EBHC teaching (survey of recent graduates); and to assess the perspectives of lecturers involved in undergraduate teaching, on the extent to which EBHC competencies are integrated into the medical curriculum (interviews with lecturers).

This article reports the findings of the first two components of the situational analysis by addressing the overarching questions: Do medical graduates from SU have the necessary knowledge and skills to practise in an evidence-informed manner? What other challenges need to be addressed in order to encourage evidence-informed decision-making?

Methods

We developed key and enabling EBHC competencies, based on the CanMEDS framework[11] and further informed through a review of national and international literature on EBHC teaching and learning[7] to determine the ideal approach to teaching EBHC. We refined these competencies through discussion with local faculty members, as well as international experts in the field. The key competencies mirror the five steps of EBHC (asking questions, accessing the literature, critically appraising the literature, applying the results and auditing), while the enabling competencies encompass basic underlying knowledge like epidemiology and biostatistics, how to search medical databases and having a philosophy of critical enquiry (Fig. 1 provides a graphical representation of the EBHC competencies).[12] At undergraduate level, students should be able to identify and acknowledge knowledge gaps, ask clear questions, access the literature, appraise and interpret the evidence, and know the approach to applying the evidence. Applying evidence in practice and auditing are part of the postgraduate competencies.

Structure of the SU MB,ChB programme

The MB,ChB programme runs over six calendar years, divided into three phases, and aims to '*produce graduated Stellenbosch doctors who have the knowledge, skills and attitudes to optimally utilise the opportunities available during the two-year internship so as to function autonomously in the primary health care sector thereafter, and who have acquired the ability and insight to develop further personally and professionally*'.[13]

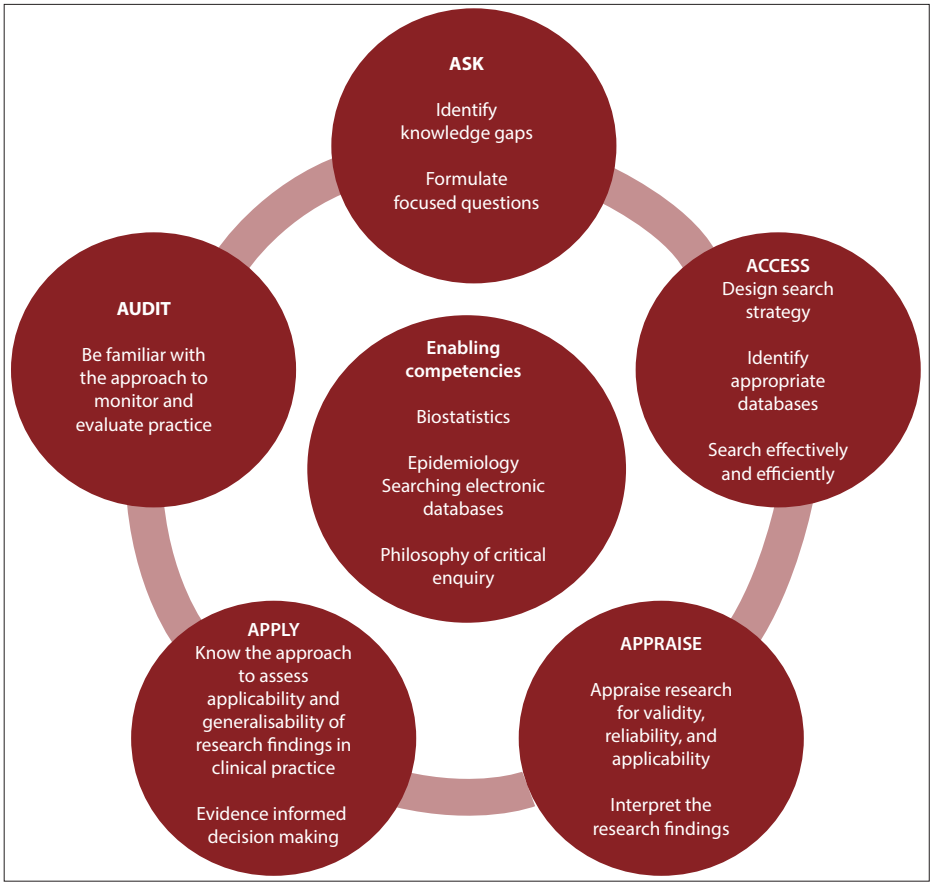

Fig. 1. Key and enabling EBHC competencies.

After the 6 years of training at the university, graduates have to complete 2 years of internship and 1 year of community service.

Document review

To assess and describe the current, formal content of and teaching approach to EBHC, we performed a document review of all the 2011 module guides relevant to the entire MB,ChB curriculum. These guides detail module objectives, outcomes and relevant course outlines. We used learning outcomes contained in the module guides as the unit of analyses and extracted any learning outcome that could be related to the pre-specified, undergraduate EBHC competencies (Fig. 1) with the help of a standardised, pre-piloted data extraction form.

We classified each learning outcome as knowledge, skill or attitude and assigned the corresponding level of cognitive functioning according to Bloom's taxonomy[14] to all the 'knowledge' outcomes. One author (AR) was responsible for extracting the learning outcomes relevant to EBHC, while two authors (AR, TY) analysed the extracted data and, for knowledge outcomes, made judgements of the corresponding level of cognitive functioning by matching the verbs contained in the learning outcome to those used for each level of Bloom's taxonomy[15] (Table 1). Discrepancies were resolved through discussion. A detailed description and examples of our methods are described elsewhere.[16]

Survey of recent graduates

We designed an electronic survey to assess the appropriateness of EBHC teaching and learning in the undergraduate medical curriculum. We invited recent graduates of the medical programme at SU to participate in the survey in 2011. We chose recent graduates (as opposed to current students) because they were able to tell us whether they were adequately equipped with the necessary knowledge and skills to practise in an evidence-informed manner. Likert-scale questions specifically assessed the extent to which pre-identified EBHC competencies were covered in the medical curriculum. Open-ended questions explored the opinions of graduates

Table 1. Bloom's levels of cognitive functioning and corresponding verbs

Bloom's level of cognitive functioning	Verbs describing the learning outcome
Knowledge	Define, describe, identify, know, label, list, match, name, outline, recall, recognise, reproduce, select or state
Comprehension	Comprehend, convert, defend, distinguish, estimate, explain, extend, generalise, give examples, infer, interpret, paraphrase, predict, rewrite, summarise, translate
Application	Apply, change, compute, demonstrate, discover, manipulate, modify, operate, predict, prepare, produce, relate, show, solve, use
Analysis	Analyse, break down, compare, contrast, diagram, deconstruct, differentiate, discriminate, distinguish, identify, illustrate, infer, outline, relate, select, separate
Synthesis	Categorise, combine, compile, compose, create, devise, design, explain, generate, modify, organise, plan, rearrange, reconstruct, relate, reorganise, revise, rewrite, summarise, tell, write
Evaluation	Appraise, compare, conclude, contrast, criticise, critique, defend, describe, discriminate, evaluate, explain, interpret, justify, relate, summarise, support

regarding EBHC teaching and learning during their undergraduate studies as well as the challenges and facilitators of practising EBHC experienced in the working environment (Table 2).

The survey was set up using the internet-based SUN Surveys tool, managed and hosted by SU. Recent graduates' contact details acquired through the alumni office were therefore secure. With the help of the SU Alumni Office, we managed to obtain 842 email addresses of the 980 MB,ChB students who graduated between 2004 and 2010. An invitation to complete the survey was sent to all the email addresses. After a lower than expected response rate we obtained permission to add a financial incentive for participants completing the survey.

We analysed quantitative data using SPSS statistical software. Qualitative data were analysed and coded with the help of ATLAS.ti software. One author (AR) coded all the answers, while the second author (TY) coded 25% of the same data independently. Both authors agreed on more than 80% of the codes and we thus relied on the coding of the first author. We grouped codes into emerging themes for each question.

Ethics approval was obtained for the document review and the survey.

Table 2. Open-ended questions contained in the survey

What other EBHC competencies would have helped you in improving patient care?
What, if any, EBHC component of the SU curriculum would you omit?
What, if any, EBHC component would you add to the SU curriculum?
What challenges in practising EBHC have you encountered since graduation?
What obstacles prevent you from resolving these challenges?
Do you have any recommendations to improve EBHC training at SU?

Table 3. Characteristics of survey respondents

Participant demographic details	*n* (%)	
Year graduated (MB,ChB)	2004	31 (10.8)
	2005	53 (18.5)
	2006	50 (17.4)
	2007	31 (10.8)
	2008	39 (13.6)
	2009	40 (13.9)
	2010	43 (15.0)
Current position	Internship	41 (14.2)
	Community service	39 (13.5)
	General practitioner	38 (13.2)
	Medical officer	82 (28.5)
	Registrar	70 (24.3)
	Specialist	3 (1.0)
	Other medical	6 (2.1)
	Other outside medical	2 (0.7)
	Unemployed	7 (2.4)

Results

Survey respondents

We received a total of 222 (26%) responses. The denominator for each answer was the number of participants who answered the specific question and not the total number of participants who participated in the survey.

A balanced response proportion was received from doctors who completed their degree in the years included in the study (Table 3). The most common responders graduated in 2005 (18.5%) followed by 2006 (17.4%) and 2010 (15.0%). Most of the participants were working as medical officers, i.e. independent medical practitioners working in a public hospital setting. The second largest group comprised registrars (young doctors currently specialising).

EBHC competencies in the medical curriculum

We found evidence of EBHC competencies in the medical curriculum, although they were fragmented and concentrated in phases I and III. Learning outcomes mostly focused on therapy questions. Fig. 2 illustrates the results of the document review plotted on the structure of the 6-year curriculum. The only two modules where students were required to go through the steps of EBHC to answer a clinical question were 'Health and disease in the community' (MB,ChB III) and 'Health, disease and disability in the community' (MB,ChB V).

The quantitative results of the survey echoed the findings of the document review. Most respondents (221/222; 99.5%) agreed that it was important to learn EBHC at undergraduate level. Most doctors (192/222; 86%) were also of the opinion that EBHC teaching at SU was adequate to prepare them for

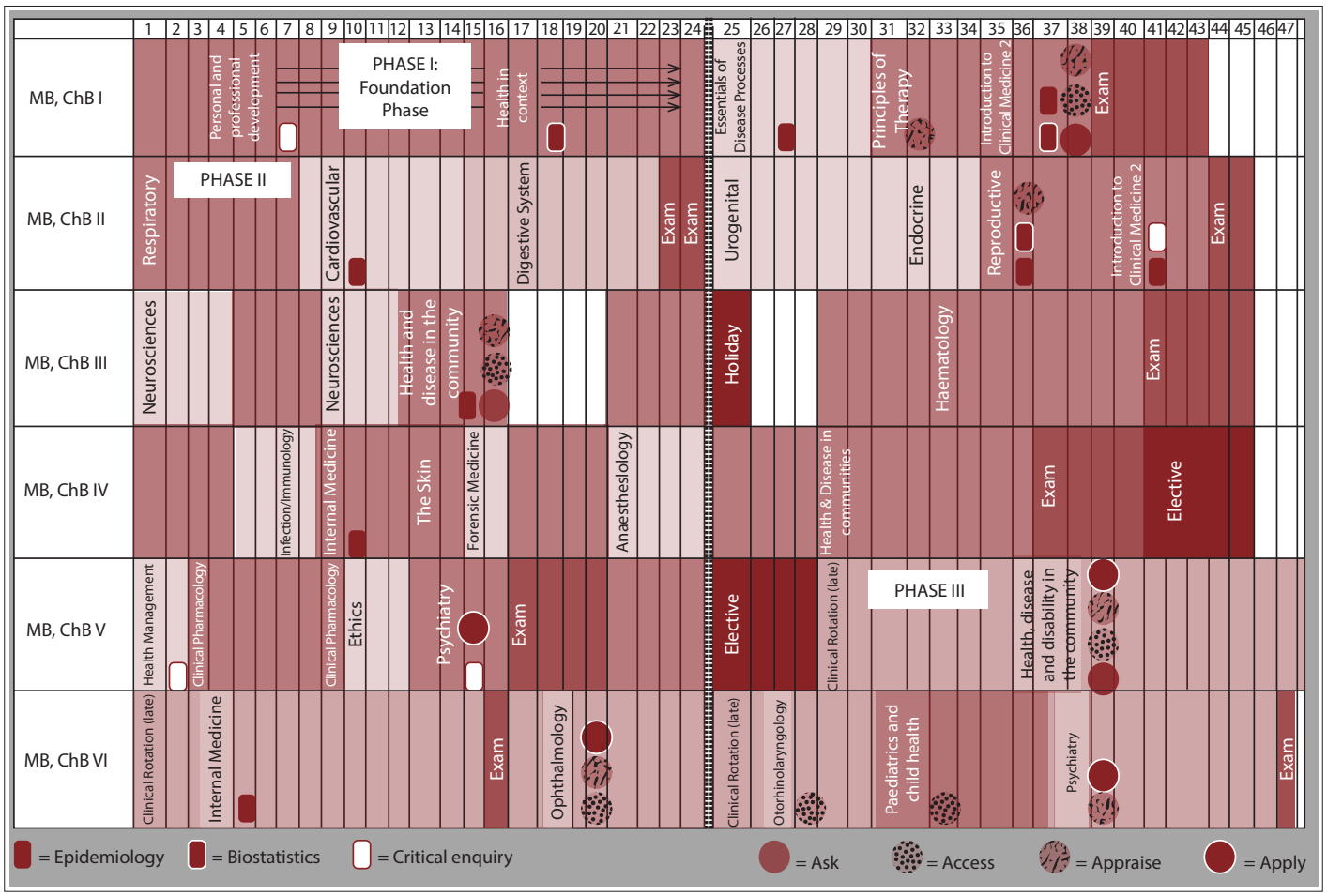

Fig. 2. Summary of EBHC competencies throughout the MB,ChB curriculum at SU.

practising EBHC in the SA health system. Only 27/222 (12.2%) disagreed on this question and 3/222 (1.4%) disagreed quite strongly. Regarding the various EBHC competencies, most stated that EBHC competencies were covered to a basic or adequate extent and few indicated they were covered comprehensively.

When analysing the qualitative data, it emerged that there was a need for increased teaching of certain EBHC competencies, especially related to searching databases, critically appraising studies and interpreting results; this appeared to contradict the findings of the quantitative data. Survey participants also felt that EBHC teaching in the medical curriculum was confined to the Family Medicine rotation and that this was inadequate. They highlighted the need for repeated teaching of EBHC by making use of relevant examples in different disciplines, therefore integrating EBHC teaching across the curriculum. Recent graduates recommended that there should be more emphasis on EBHC in undergraduate medical training, but that it should also be made more interesting and relevant. Applying the principles of EBHC in a hands-on manner (e.g. searching-the-literature workshops), as well as using interactive teaching methods, online learning platforms and social media, was recommended. Table 4 presents a summary of EBHC teaching within the MB,ChB curriculum, based on the combined results of the document review and the survey.

Challenges in practising EBHC in the clinical field

Recent graduates identified many challenges when practising EBHC. What stood out above all other challenges was the limited access to literature once students graduate and no longer have access to SU library's databases. This considerably limits accessibility of journal articles, making it very difficult to practise EBHC.

'No free access to IT technology in work environment. Financial constraints. Subscriptions to internet resources for medical professionals who are not affiliated with a university is extremely expensive.'

Another recurring challenge was time constraints and work overload.

'There is an enormous amount of data and studies on the internet – it's a challenge to choose only relevant studies and to interpret the results. This is time consuming and frustrating.'

'Too few hours in a day to work full time, CPD, a balanced life and to do literature searches for all the changing fields in medicine on top of that.'

Other challenges were related to the lack of EBHC skills, lack of self-motivation, application of evidence in practice (dealing with conflicting evidence; lack of relevant evidence; half-life of evidence; information overload), and the work environment (lack of exposure to EBHC and role models; costs of treatment; rigid hospital protocols and administration; resource constraints).

'We often do not have the resources to treat patients according to EBHC.'

'There is so much conflicting evidence out there, that's why I often find I practise according to my supervisors' advice, rather than EBHC.'

'Senior colleagues sometimes lack EBHC decision making and resort to that

Table 4. Summary of EBHC competencies covered in MB,ChB curriculum

EBHC competencies		Enabling competencies	Ask	Access	Appraise	Apply
Learning outcomes present in module outlines of the 6-year MB,ChB curriculum (document review)	Phase I (6 modules)	**3 modules:** Personal and Professional Development, Health in Context, Essentials of Disease Processes			**1 module:** Principles of therapy	
	Phase II (35 modules)	**8 modules**: Introduction to Clinical Medicine (1), Reproductive System, Introduction to Clinical Medicine (2), Cardiovascular System, Health and Disease in the Community, Internal Medicine, Psychiatry, Health Management	**2 modules:** Introduction to Clinical Medicine (1), Health and Disease in the Community	**2 modules:** Introduction to Clinical Medicine (1), Health and Disease in the Community	**3 modules:** Introduction to Clinical Medicine (1), Reproductive System, Health and Disease in the community	**1 module:** Psychiatry
	Phase III (11 modules)	**1 module:** Internal Medicine	**1 module:** Health, Disease and Disability in the Community	**4 modules**: Health, Disease and Disability in the Community, Ophthalmology, Otorhinolaryngology, Paediatrics and Child Health	**3 modules:** Health, Disease and Disability in the Community, Ophthalmology, Psychiatry	**3 modules:** Health, Disease and Disability in the Community, Ophthalmology, Psychiatry
	Highest level of cognitive functioning	Application	Application	Application	Evaluation	Application
Students' perception of coverage of EBHC competencies	Not at all, *n* (%)	Not addressed in survey	16 (7.2)	3 (1.4)	1 (0.5)	2 (0.9)
	Inadequate, *n* (%)	Not addressed in survey	40 (18.1)	35 (15.8)	36 (16.3)	28 (12.7)
	Basic, *n* (%)	Not addressed in survey	87 (39.4)	67 (30.3)	76 (34.4)	76 (34.4)
	Adequate, *n* (%)	Not addressed in survey	68 (30.8)	91 (41.2)	90 (40.7)	96 (43.4)
	Comprehensive, *n* (%)	Not addressed in survey	10 (4.5)	25 (11.3)	18 (8.1)	19 (8.6)
Students' responses to open-ended questions regarding EBHC teaching (selected quotations)	What other EBHC competencies would have helped you in improving patient care? What competencies would you omit or add to the medical curriculum at SU?	EBHC skills	• 'Better basic and practical knowledge about statistics and study types, and the implication thereof' • 'Better teaching on making use of available databases for evidence' • 'Evaluating a study, was maybe too basic – it was a difficult topic to understand – maybe more time should be spent on it'			
		Approach to teaching EBHC	• 'The EBHC should, instead of being only separate teaching modules, be incorporated into the general curriculum • 'I would move EBHC to early in the curriculum as it would be formative in our thinking about the critical appraisal of all information during the rest of our studies' • 'This part of the SU programme failed because it was confined to one discipline: Family Medicine. Its relevance and importance with regard to other disciplines were not emphasised' • 'EBHC should be part of every block of teaching'			

which is known to them and what they feel comfortable with, which is often outdated. They expect you to do things in the same way, or if you do it differently (but according to EBHC guidelines) they believe you're wrong.'

Discussion

The situational analysis of EBHC teaching at SU aimed to evaluate current EBHC teaching and to identify gaps and opportunities to enhance teaching. We used triangulation of methods as a means of comparing data from different sources on the same topic. By means of cross-checking different sources it is possible to increase validity of the findings.[17] While the document review gave us a good overview of the structure of the medical curriculum and provided us with baseline information on the current approach to EBHC teaching, the online survey of recent graduates gave us an opportunity to gain insight into graduates' perspectives of EBHC teaching, their experiences thereof and challenges they face in clinical practice. A combination of quantitative and qualitative data enhanced the richness of data collected. We present the results of the document review and the graduate survey in this article. The interviews with lecturers are currently being analysed.

The document review, based on the 2011 module guides, shows that there was fragmented teaching of enabling and key EBHC competencies in the curriculum. Although these competencies were not always clearly formulated in the learning outcomes, we found that enabling competencies were mostly addressed in phase I and key competencies in phases II and III (Fig. 2). Based on the module guides, there was no evidence of EBHC teaching in most theoretical and clinical modules of phase II, which runs over more than half of the curriculum. Only two EBHC tasks required students to go through the whole EBHC process. Both these tasks were within the Family Medicine, Community Health and Rehabilitation clinical rotations, one in the early clinical phase and one in the late clinical phase, and focused on questions about treatment. There seemed to be progression from lower to higher level cognitive functioning according to Bloom's taxonomy from the first to the sixth year of the MB,ChB programme.

Survey respondents emphasised the lack of knowledge of biostatistics, epidemiology and critical appraisal as well as the lack of effective searching skills. SU graduates recommended that EBHC teaching should become an essential part of the curriculum, starting with an introduction to concepts in the early phase and reinforcing concepts throughout the curriculum by integrating EBHC teaching into all disciplines and not confining it to Family Medicine within the Health and Disease in Communities modules. Ideally, there should be integrated teaching of EBHC throughout the theoretical and clinical modules so that the MB,ChB graduates are proficient in incorporating best evidence in the decision-making process including questions related to risk factors, diagnosis, prevention, treatment and prognosis. They also recommended that EBHC teaching should become more interactive and that online learning platforms and social media could be used more effectively to facilitate learning. This resonates with international literature regarding teaching of EBHC. Kahn and Coomarasamy[18] have proposed a hierarchy of effective teaching of EBHC, where interactive and integrated teaching of EBHC is seen as the most effective way of teaching and learning EBHC. A recent overview of systematic reviews[19] that included 16 systematic reviews examining the effects of educational activities on EBHC, found that when comparing single interventions (a workshop, journal club, lecture or e-learning) with multifaceted interventions (a combination of different strategies, e.g. lectures, tutorials, e-learning, journal clubs, etc.), multifaceted clinically integrated educational activities were more likely to increase EBHC knowledge, skills, attitude and behaviour.

Recent graduates also reported on the challenges of practising EBHC. Inadequate access to the medical literature was one of the biggest barriers to practising EBHC. Under- and postgraduate medical students have free access to certain electronic databases (e.g. The Cochrane Library) and journals through SU's institutional subscription. After graduation, they no longer have free access to important articles. Private subscriptions are expensive and individual articles can cost up to USD30 per article – prices that no young doctor is willing to pay. In recent years, there has been an increase in the number of scientific articles that are freely available on the internet. But the proportion of these open-access articles is still quite low and was estimated to be 20.4% by Björk *et al*. in 2009.[20]

Even though time constraints, workload and access to electronic databases were predominantly mentioned, other relevant challenges included lack of EBHC skills to find and interpret relevant articles. More effective teaching of EBHC at undergraduate level can address the lack of EBHC knowledge and skills. If medical students are competent in EBHC once they graduate, they will not only have more knowledge and skills, but will also be able to overcome some of the other barriers encountered by respondents. As an example, searching online databases for relevant articles is less time-consuming if one has adequate skills and practice.

Reported challenges that are more difficult to address include: the resistance to change of senior colleagues; the lack of role models in clinical practice; lack of resources; and the hierarchical structure, as well as the policies in healthcare institutions. It is very hard to influence these external factors that impact on practising EBHC and this goes well beyond the medical training of undergraduate students. A recent systematic review looking at the barriers to the use of evidence-based medicine by general practitioners, reported similar challenges to what we found in the survey.[21] They also argue that practising EBHC in the clinical field is subject to a multitude of factors, much of which goes beyond education and training of EBHC. Nonetheless, sound training of EBHC at an undergraduate level would lay the foundation for successful implementation thereof and would ideally automatically become a part of the healthcare decision-making process.

One of the limitations of the document review is that assessment of EBHC competencies, as well as the alignment of the assessment to the learning outcomes could not be evaluated comprehensively. This is an important part of EBHC learning and was addressed in the interviews with the lecturers, currently being analysed. Furthermore, we did not address effective communication as a competency. This is an important part of evidence-based decision-making, since the patient preferences and values should also be taken into account when making informed decisions about healthcare interventions.[22]

When considering the survey respondents, one could argue that recent graduates feeling either exceptionally positive or negative about the way EBHC was taught were more likely to participate in the survey. The response rate could have been higher, but compares well with other studies of a similar type. In addition, we received a balanced response proportion from doctors who completed their degrees in the years included in the study, and from various job positions, representing recently graduated doctors in South Africa.

Conclusion

Recent graduates felt that they needed more EBHC learning opportunities within the undergraduate medical curriculum. The results of our situational analysis show that existing EBHC teaching and learning for undergraduate medical students needs to be enhanced. This can be done by integrating EBHC

into a variety of disciplines, and scaffolding it throughout the curriculum thereby equipping graduates with the necessary EBHC knowledge, attitude and skills to make well-informed healthcare decisions in their daily practice.

Authors' contributions. Anke Rohwer (AR) and Taryn Young (TY) developed the methodology for the document review of the medical curriculum, with input from the SURMEPI curriculum review working group for the medical curriculum: Ms Anke Rohwer, Dr Taryn Young, Prof Lilian Dudley, Dr Fidele Mukinda, Dr Neil Cameron, Dr Bart Willems, Prof Shaheen Mehtar, Dr Frederick Marais, Dr Angela Dramowski, Prof Ben van Heerden. AR and TY analysed data and interpreted the findings. Bart Willems (BW) developed the methodology for the survey of recent graduates, with input from the SURMEPI curriculum review group as listed above. BW analysed the quantitative data; AR and TY analysed the qualitative data and interpreted the findings. AR drafted the manuscript. TY and BW critically engaged with the content and provided input. All authors have approved of the final version of this manuscript.

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4.2: Perspectives of module coordinators of the FMHS, SU, on undergraduate MB,ChB training in EBHC: Interviews with key Faculty

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Involvement of PhD candidate: The PhD candidate developed the protocol, submitted the protocol for ethics approval, facilitated the conduct of the interviews, checked, coded and managed the data, conducted the data analysis and interpretation, and wrote the manuscript.

Involvement of co-authors: Anke Rohwer contributed to protocol development, checked the data coding and interpretation of data and contributed to the manuscript. Jimmy Volmink and Mike Clarke approved the protocol, contributed to data interpretation and the manuscript development. All authors approved the final version of the manuscript.

The ethics approval is included as Appendix 4.2.1 and the COREQ reporting checklist as Appendix 4.2.2.

Erratum: On page 2 of article, paragraph 1, the following sentence should read ‘These recent graduates felt that EBHC was important to cover in the undergraduate curriculum and about 15% of respondents felt that medical school training did not prepare them for practising EBHC in the South African healthcare system’ instead of ‘These recent graduates felt that EBHC was important to cover in the undergraduate curriculum and about a third of respondents felt that medical school training did not prepare them for practising EBHC in the South African healthcare system’.

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RESEARCH

Perspectives of undergraduate module convenors at a South African academic institution on medical student training in evidence-based health care: a qualitative study

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Background: The increasing disease burden in Africa requires medical graduates to have problem-solving abilities. Interviews were conducted to assess module convenors' perspectives on evidence-based health care (EBHC) teaching and learning.
Methods: Qualitative research methods were used. Faculty convening medical undergraduate teaching modules were purposively sampled. Data collection was done using focus-group or individual interviews. Trained interviewers conducted interviews. Investigators conducted data analysis and interpretation.
Results: Five focus groups and 10 individual interviews were conducted with convenors responsible for theory and clinical modules across various disciplines. Interviewees felt that EBHC teaching and learning were not optimal and indicated varying support for enhancing this. They identified various factors to be considered: contextual factors within the faculty (e.g. recognition for teaching), health sector issues (e.g. clinical workload), access to research, lecturer factors (e.g. competing priorities) and learners (e.g. motivation). They emphasised the key roles of lecturers as role models. Planning together to identify opportunities to integrate teaching and assessment, while ensuring coherence, clear explicit outcomes and promoting faculty development, was regarded as central to strengthening EBHC teaching and learning.
Conclusions: The perspectives of module convenors are key to informing strategies to enhance EBHC teaching and learning.

Keywords: evidence-based health care, medical students, teaching, undergraduate

Introduction

Medical practitioners need the necessary knowledge, skills and attitudes to function as independent healthcare providers. Furthermore, as part of an interdisciplinary team, they should respond to the unique health needs of the communities they work in. The increasing burden of HIV/AIDS, tuberculosis and chronic diseases, in addition to the major problems of maternal and child health, and injuries, particularly in rural and underserved areas of South Africa, requires increasingly broader problem-solving abilities by new medical graduates. In South Africa, the national accreditation body, the Health Professions Council of South Africa, has adopted a modified CanMEDS framework[1] as a guide to the key competencies medical doctors should acquire to optimise patient outcomes. It defines the attributes of the graduates according to seven interdependent roles: Medical expert, Scholar, Professional, Communicator, Collaborator, Manager and Health Advocate. This has initiated various curriculum review activities at academic institutions that train medical students.

Embedded in the Scholar attribute is the ability to practise evidence-based health care (EBHC). EBHC has its roots in the field of clinical epidemiology[2] and was first defined by Gordon Guyatt as 'an ability to assess the validity and importance of evidence before applying it to day-to-day clinical problems'.[3] David Sackett (1996) furthered this definition as 'the conscientious, explicit and judicious use of the current best evidence in making decisions about the care of individual patients', thereby combining clinical expertise and experience with current best evidence obtained from clinically relevant research and patient values. EBHC requires critical thinking, decision-making and an ethos of lifelong learning[4] and it is recommended that EBHC should be an integral part of learning in the curriculum of all healthcare professionals.[5] Learning EBHC is best achieved using clinically integrated teaching and learning with assessment.[6] Basic concepts successfully introduced in the first year of study[7] can be reinforced in subsequent years to form a 'golden thread' throughout the medical curriculum. Bedside student learning is particularly useful for learning how EBHC can be applied in practice, but needs point-of-care access to literature, requiring adequate information technology support. The conceptual framework for integrated teaching and learning of EBHC, developed following semi-structured interviews with 24 EBHC programme coordinators from around the world, centres on the engagement between the learner and the teacher within the institutional context.[8]

To inform enhancement of the EBHC curriculum at the Faculty of Medicine and Health Sciences (FMHS), Stellenbosch University, South Africa, we completed a document review of the medical curriculum to assess the learning opportunities and outcomes related to EBHC.[9] The review captured data on the content, teaching and learning methods, and classified the learning outcomes as knowledge, skills or attitudes. We found that EBHC was covered to varying degrees with teaching confined to specific modules with no evidence of progression of learning. However, this review was based purely on the written information contained in the curriculum module guides, and did not

necessarily reflect the learning that took place in the classroom, at the bedside and in other settings. For this reason, a subsequent survey of recent medical graduates (students who graduated between 2004 and 2010) explored their perceptions of the relevance and utility of EBHC teaching and learning in the undergraduate medical curriculum.[9] These recent graduates felt that EBHC was important to cover in the undergraduate curriculum and about a third of respondents felt that medical school training did not prepare them for practising EBHC in the South African healthcare system. They highlighted the need for integration of teaching, especially in the clinical rotations, and suggested that unnecessary duplication of basic concepts should be avoided and attention given to the progression of knowledge and skills gained over the curriculum.[9]

To supplement and enrich the data from the aforementioned studies we carried out an assessment of the perspectives of faculty involved in convening teaching modules on the extent to which the current curriculum includes teaching in EBHC. We aimed to identify best practices and weaknesses in teaching EBHC in the current curriculum, and to identify opportunities for and barriers to strengthening teaching and learning of EBHC.

Methods

We used qualitative research methods and purposively selected and invited module convenors involved with the coordination of teaching to undergraduate medical students. As the programme runs over six calendar years and includes three phases, we aimed to cover a spectrum of module convenors across various years of study, theoretical and clinical modules, and discipline. The foundation phase covers the first year. The second phase covers the second year to the first semester of the fifth year and includes all theory modules, as well as the early and middle clinical rotations. Student internship is the last phase. We interviewed module convenors from both theory and clinical modules and from a variety of disciplines including family medicine, forensic medicine, haematology, infections and clinical immunology, internal medicine, obstetrics and gynaecology, paediatrics, pharmacology, psychiatry, public health, and surgery. They were all senior academics who were responsible for planning and coordinating teaching and learning within the respective theoretical and/or clinical modules and, with support of other lecturers, also facilitated teaching sessions.

Data were collected in 2013 using five focus-group discussions (FGD). Focus groups were organised according to content areas covered in the curriculum. Three focus groups included five participants each, one focus group included four participants and another included three participants. Where invited participants were not available for FGDs they could opt for an individual interview and if they felt that they were not the appropriate person they could nominate another faculty member within their area of work to participate. We conducted 10 individual interviews. In all instances, participants were informed about the purpose of the interviews and asked to provide written informed consent for participation in the study, for digital recording of the interviews, and for using and disseminating the information gathered.

Trained qualitative researchers conducted the interviews using an interview guide.

Interview Guide:

- What is your understanding of evidence-based healthcare (EBHC)
- What is your opinion about the relevance or applicability of EBHC to the subject area of your module/s? And how does this relate to the current outcomes of your modules?
- How is the teaching and learning of EBHC covered during your module/s?
- What is your opinion about integrating competencies of EBHC into your modules?
  - (a) How do you see it being included?
  - (b) What are the opportunities for including these?
  - (c) Which teaching methods do you suggest?
  - (d) Do you envisage any barriers to the incorporation of linked teaching/concepts in EBHC?
  - (e) Are there facilitators for incorporating it into the module(s)?

Data were captured using a digital voice recorder and additional field notes were taken to ensure full and accurate data capturing. Data were transcribed for analysis purposes. The audiotapes were transcribed verbatim and all transcripts were audited for accuracy by the interviewer who conducted the interview. Names of participants did not appear on the transcriptions. Once the code list was agreed, it guided the subsequent coding process.[10] Data were imported into Atlas.ti (Atlas.ti GmbH, Berlin, Germany), a software package that facilitates the process of coding qualitative data. The formal coding of all transcripts was completed by one investigator and checked by another investigator. The researchers then carried out the data analysis and interpretation using thematic content analysis to identify key emerging themes, ultimately relating these to each study objective. This iterative process of aggregation and interpretation was undertaken by the lead researcher and discussed with the rest of the research team. During the discussions, these themes and their relevance to the study objectives were highlighted.

This study received ethics approval by the FMHS ethics review committee (N12/11/081). The consolidated criteria for reporting qualitative research (COREQ)[11] and the standards for reporting qualitative research[12] guided the reporting of the study.

Findings

Current level of EBHC teaching and learning within departments

In general, participants had good levels of knowledge and understanding of EBHC concepts and its application. Some had misconceptions of EBHC, referring to it for instance as 'citation counting' and that it 'only revolves around the chilly, cold science of evaluation and research' [P1]. Overall, however, participants saw EBHC as a way to enhance and build sound clinical reasoning and critical thinking, and playing an important part in equipping new graduates for the future — to be able to function effectively within any healthcare setting. Opinions varied on the level of current teaching of EBHC, and whether it was adequate or not. Some thought it was unnecessary, and were not really interested in adding EBHC competencies. Others thought that EBHC was being taught but mostly in an implicit, 'intuitive' or 'instinctive' way. This group seemed to feel that students get enough input on

EBHC in theoretical as well as clinical rotations, even though there are no explicit learning outcomes. Another group acknowledged that the principles of EBHC were being taught, but that these were not carried through effectively to the clinical rotations and to the bedside. They did not think that anything happens intuitively and emphasised the lack of EBHC in clinical practice and ward rounds. They called for a need to link EBHC teaching and learning to appropriate parts of the curriculum and for formalising this input not just in teaching but also in assessments. The role of learning at the bedside in the clinical setting as well as the opportunity to apply the principles was emphasised. They highlighted the value of clinical experience and the importance of assessing applicability of research findings, and also felt that it was not just about facilitating learning about what to do when there was available research but also about what to do in resource constraint settings and in the absence of research evidence. Illustrative quotes are provided in Table 1.

Issues to consider in planning and implementing the teaching and learning of EBHC to undergraduate medical students

Module convenors raised a number of issues (Table 2) to be considered in planning and implementing EBHC teaching and learning in the undergraduate medical curriculum. These relate to issues within the context/environment of the faculty and the health sector, availability of research evidence, and issues related to the lecturers and the learners. Illustrative quotes are provided in Table 3.

The six-year medical programme is perceived as being full. The view was that each discipline or topic area felt that what they are covering is the most important in the curriculum resulting in a constant 'battle' or competition for space and a resistance to change, irrespective of what the change is. Interviewees felt that teaching staff were overwhelmed with many competing priorities: teaching, research, and heavy clinical workloads. Participants felts that within the context of the faculty's drive for research outputs and the teaching staff's commitment to patient care, teaching often gets marginalised. Change in the curriculum is therefore often seen as additional work, even though it could actually be about working more effectively and efficiently. They mentioned that this resistance to change may also relate to being set in one's ways and not willing to change the way things are done, and to lack of knowledge and skills.

Participants felt that there was lack of continuity within and between modules. This might be as a consequence of having too many lecturers involved where each one comes in and gives a short input on his/her specific topic, often without awareness of what else is covered and thus not linking or connecting to other topics in the same module. The sense was that most people are working in 'silos' and that, to avoid this, there needs to be time for interaction and engagement.

The undergraduate class includes on average 200 students. Within the first six months, this number is doubled as medical and other undergraduate health science students are combined in Phase 1 of the curriculum. Participants highlighted that students' attitudes and perceptions influence learning, and that it is therefore important for students to see the relevance of what they learn as the 'softer' subjects often receive less attention. They mentioned that students want to learn clinical skills and approaches to managing patients and they often do not see the importance of so-called softer skills. From the start, students' perception of what a medical practitioner is, and what the expectations of the programmes are, should be clarified.

Specific to teaching and learning in the clinical setting, participants highlighted that there were too few staff to handle the large student groups. Lecturers found it difficult to give individual attention to students and balance clinical care provision and teaching. They felt that the size of student groups on ward rounds, which typically include undergraduate medical students, student interns, medical specialists in training and

Table 1: Interviewees' perspectives on EBHC relevance and current level of EBHC teaching

Importance and relevance of EBHC
'To me, this is such an essential skill that our doctors must have, they must have healthy reasoning skills' [FGD2]
'I think that it's very relevant. Perhaps we're not recognising it, for what it is' [P2]
'It's not so much the analysis of the content and the detail but it's actually creating a culture of critical reflection and thinking and asking the right questions.' [FGD4]
'… evidence based healthcare is very, very important no doubt for all the disciplines because you get research in all the different fields and there's good evidence coming out constantly with regards to information that is appropriate to each discipline' [P3]
'… teach them — what is the right way of doing it but I think the better they are equipped in terms of evidence based health, the better, the bigger expert they are, the more they will be able to cope. Rather than to tell them listen we just want you to be average because you are going to work in an average system' [FGD3]
Current teaching and assessment
'… although this is part of the curriculum from the beginning there's no continuity and no scaffolding of these concepts…. The students put it in a box and there's a box in the first year and there's a box in the third year and a box in the fifth year. It's not a golden thread' [FGD1]
'So I think it's evidence based healthcare is actually something that we have been teaching students all along but with the programme that … is developing we just trying to formalise it a bit more…' [FGD5]
'… the principles of EBHC are not carried through effectively to the clinical rotation years. I feel that this generation of students does not value EBHC so much and the emphasis lies mainly to gain clinical skills to get to the diagnosis. In [clinical module], students focus so much on getting to the diagnosis, they forget about the developing clinical reasoning and processes necessary to get a valid diagnosis.' [FGD2]
'I think it's probably being done, but once again, it's not specifically being said, "These are the competencies we are trying to teach you here". So, in essence, it's almost taught on a subconscious or intuitive manner. The best word to use is an intuitive manner, in which competencies are carried over, in a reading, or a discussion' [P2]
'… we teaching the students tools to think about things which is much more important than the facts … which gonna change in two or three years' [FGD3]
'In the final exam there is an effort to assess EBHC through critical evaluation of articles around a scenario and assessing the student on how well they incorporate the elements of EBHC into their answers.' [FGD2]
'… evidence based practise is not featuring at the moment…' [P5]

Table 2: Key issues to consider in planning and implementing EBHC teaching and learning

Environment/context	Learners	Lecturers/clinicians
Faculty	Size of class	Knowledge, attitude and practices
Drive for research outputs	Attitude	Teaching approach
Lack of recognition for teaching	Learning style	Not enough lecturers
'Full' curriculum and competition for space		Competing priorities
Health sector		
Heavy clinical workload		Resistance to change
Limited internet access		Lack of engagement
Limited resources		
Research evidence		
Availability		

consultants, impact on clinical care and on teaching at the bedside.

Participants felt that, within the faculty, lack of recognition of teaching impedes involvement in teaching. The sense was that the faculty was research friendly and that teaching was not recognised at the same level as research. They also felt that the focus of performance assessment was linked to publication output without taking into consideration teaching commitments. There were varying perspectives on leadership support. Some felt that this was adequate while others felt there was a lack of leadership support.

Participants said that environmental constraints to implementing EBHC, e.g. access to the internet, access to electronic databases as well as available resources in the healthcare setting, should be taken into account. They also felt that students should be exposed to various levels of healthcare and pointed out that the realities of the healthcare system in South Africa — busy overloaded public healthcare clinics, huge demand for time and to see many patients — necessitate the availability of experienced teachers in the clinical setting.

EBHC knowledge and attitudes of lecturers were regarded as important considerations in the planning process. Participants highlighted the need for staff development in general and the need to assign suitably qualified lecturers to cover specialised topics, e.g. biostatistics. Both general teaching and learning, as well as EBHC,

Table 3: Issues to consider in planning and implementing EBHC teaching and learning

Environment
'… trying to integrate to try and get as much of all of it in a short time that they have because their modules are very tight and they have so little time and we are trying to cram so much in a short space of time' [P10]
'I also think that we are faced with the notion that research is rewarded and teaching not. So you would find that sometimes people neglect the softer skills of medicine because there are no rewards in it and spend their attention mainly on research' [FGD2]
'… bedside teaching perspective it is impossible. I mean you've got students standing at the back chatting with each other or being on their cell phones or whatever because nobody can see them they can't hear so they lose interest. You can't shout in a ward you know so that everybody can hear you and so people in the front seven that are standing around the bed and the rest the other seven around them are lost' [FGD3]
'So we have to recognise the constraints and resources and they put pressures on the health system but our training you know for medical students and in fact all in the health professions needs to take into consideration the reality of the ground of the various pressures and it needs to be real, real, real world' [FGD4]
'… practical problems of actual implementation of evidence based healthcare is on a practical level, the assess to resources and you need information technology, computers, access to internet etc. so that is a limitation that we experience on the ground' [FGD4]
Lecturers
'… they [clinicians] will see as extra work and a burden. You know and how to convince them that it actually is not extra work nor a burden and that they can actually also benefit from that' [P5]
'… a barrier is the three, the roles that the university expect you to play. It's the researcher, the clinician and the teacher and just the university pushes research so much the clinician, you have your job that you have to do daily so that teaching is always left …' [FGD4] 'it comes back to living in the real life, there's teaching and there's work where I actually have to be, you know patient care and so on' [P4]
'I regard it as golden threads that should be going through all the departments and all the disciplines but it doesn't always happen. Not because there is no will for it to happen but because there is simply no staff' [FGD4]
'… you know some of you don't seem to be speaking to each other, if we're not speaking to each other as divisions you know, what do the students gain at the end of the day' [FGD4]
'… role models that they see in actual daily life in the hospital is sometimes not up to the standard that you would expect' [P9]
'That knowledge of the lecturers themselves is probably the only barrier because students are very receptive you know if you teach them stuff you know and they do very well in small group teaching' [P7]
Learners
'… students are making these noises about their lack of interest in what they perceive as softer' [FGD1]
'huge gap between the matric students, the learning methods and what we expect when they come to university and some of the A average students don't know the correct learning methods. They struggle when they come …' [FGD4]

Table 4: Advice on how to strengthen teaching and learning of EBHC

Plan together to integrate
'… I mean if it's intuitive, it's not necessarily planned and it needs to be planned. And it cannot be planned in isolation, it must be planned in terms of what has happened before and what is going to happen further on …' [P6]
'Perhaps there are certain modules, which lends itself more to that. To integrate that, and probably, it's better to integrate that, throughout the entire course, and not just, as a free-standing module or block. We have to look where all of this fits in, and where we can integrate this into existing modules. To get an extra week for something separate, I know, is virtually impossible, or very difficult' [P2]
'… needs to be discussed so that you can review how are you actually teaching it and can you, you know, change your ways to put more emphasis to bring it up in ward rounds' [FGD9]
Ensure coherence
'A little here and a little there but then eventually there's no coherence, and it's about ensuring that it is visible and it is relevant and it is not seen as there comes the crazy whatever again you know…. So that's it not standard loading little bits but it's actually puzzle pieces of the same picture' [P5]
'I don't want to call it a block it needs to be a house. So you'll need to start with a foundation and have that foundation assessed in the first year then you build the walls and then you put on the roof and so it's not, it's not a once-off big block in the third year or wherever you want to place it. You need to start with foundational skills and have those assessed … then it should be continuously be built upon in the second year, in the third year, in the fourth and as you go along and then those concepts must be integrated … infused into the rest of the modules' [FGD1]
Aligning teaching, learning and assessment methods with outcomes
'But once you've decided okay what should be covered then you should also decide how it should be covered because certain things are maybe best sorted by lecture, other things students will learn better by experience or by case studies or by doing assignments or whatever, there are so many different ways of engaging students in learning. But you have to identify the best and most appropriate way to do that for a specific topic or specific concept and then also to assess it appropriately. I mean a classic example if some, if you want to know whether somebody can put up a drip. You should ask them to put up a drip, not to write an essay on how to put up a drip you know' [P5]
Assessment drives learning
'I think at the moment the students are anyway doing an end of task assignment. Where they do have to identify cases or problems that they've picked up while they were rotating in the unit and they already have some questions and we will likely just try and integrate the question' [FGD5]
'You see some of them actually do but we don't see evaluation of it, you see like students are not being assessed in those things, as a component of those modules, and then they were not taken seriously' [FGD1]
Need role models
'At the end of the day, the role-model speaks much louder than whatever lessons they have learned' [FGD2]
'So it's really good, you know, that you have a prominent, you know, physician who is actually modelling good behaviour to students and teaching that and which is being supported by our faculty' [FGD4]

practices influence the learning process. Current lecturers may not have received training in EBHC, may not be sensitised to EBHC, and most of all may not be practising in an evidence-informed way, resulting in negative role modelling in the clinical setting.

Advice on how to strengthen teaching and learning of EBHC

Key advice on how to strengthen EBHC teaching and learning drew attention to the need to plan together, integration of EBHC teaching and learning, ensuring coherence, aligning teaching and learning methods with outcomes, being aware that assessment drives learning and the importance of faculty development (Table 4).

Participants highlighted the need for integration in the curriculum but also with patient care. In working towards integration in the curriculum, it is important to work with convenors to identify opportunities to integrate the learning of EBHC. As graduate attributes (including proficiency in EBHC) had been agreed by the medical programme curriculum committee this provided an opportunity for review of the curriculum and created a window to propose changes. Drawing on principles of change management, participants highlighted the importance of involving, and sensitising, consultants and registrars in the various disciplines and convincing them that teaching EBHC is not necessarily extra work.

Participants emphasised the need for clear explicit learning outcomes and for determining the core content to be covered. Teaching and learning need to build on what has been covered before and need active reinforcement. In order to do this, it is important to engage and work together with module convenors to determine what is covered when, and how one can build on what has been covered, how EBHC can link with current content (thus ensuring relevance), how the theoretical principles can be translated and used in the clinical setting through practical application, and how EBHC can be included in existing assessments within the respective module. In planning assessments, it should not just be about assessing knowledge but also about assessing skills and attitudes. Most importantly, there needs to be alignment between teaching and assessment methods and the learning outcomes.

Successful implementation requires a critical mass of lecturers, from various disciplines, who are familiar with the rest of the module and with what is covered in other modules. Positive role modelling by lecturers and clinicians in the clinical setting is very important. This calls for dedicated faculty development initiatives and also training of future trainers through incorporating EBHC teaching and learning in postgraduate medical specialist training. Most importantly, convenors highlighted the need for a common practice, a common language, and a common way of doing things in an evidence-informed way — 'creating a culture of critical reflection and thinking and asking the right questions' [FGD4].

Discussion

Curriculum change and renewal are ongoing processes, and the implementation of the graduate attributes is a key driver in this current renewal process globally. Curriculum assessment provides information on the current status of teaching and learning, and includes obtaining perspectives from various stakeholders. This study, which focused on the perspectives of module convenors involved with undergraduate medical

students on EBHC teaching and learning, adds value to the findings of the document review and the survey of recent graduates conducted at FMHS, Stellenbosch University. The three components together provide a clear map of what is covered in the curriculum, when it is covered and what the gaps are.[13]

The document review and survey of recent graduates[9] found that EBHC teaching was fragmented and recent graduates called for increased teaching of EBHC competencies. In this study, senior academics interviewed also felt that EBHC teaching and learning were not optimal and indicated varying support for the enhancement of EBHC learning in the undergraduate curriculum. In planning and implementing EBHC teaching and learning, they emphasised that key contextual and environmental factors within both the faculty (e.g. faculty support and recognition) and the health sector (e.g. clinical workload, access to internet and computers) must be considered. These link some of the local realities to that of the conceptual framework developed as part of interviews with international programme coordinators.[8] In addition, the availability of research evidence, and attributes of the lecturers (e.g. EBHC knowledge, skills and practices) and the learners must be considered. The interviewees emphasised the key role of the lecturer, in both theory and clinical modules, as a facilitator and a role model. Planning together, to identify opportunities to integrate teaching and assessment, while ensuring coherence, clear and explicit outcomes and faculty development were central to the advice on strengthening EBHC teaching and learning. In the current era characterised by major advances in the use of information communication technology it was surprising that the views expressed were so silent on the use of technology and how this can be used to facilitate learning, especially once the foundation knowledge has been laid.

The teaching and learning approach of laying the foundation in the early years of the curriculum and building on this through application within clinical modules resonates with best strategies for teaching EBHC.[6,14,15] In a similar local study among academic healthcare practitioners in South Africa, McInerney et al.[16], using quantitative methods, also identified a need to incorporate EBHC into teaching, perceived 'implicit' teaching of EBHC and found that perceived barriers to the use of EBHC included workload, competing priorities and lack of EBHC knowledge. A study among nurse educators in the United States[17] also highlighted the need for faculty development to have competent lecturers facilitating the teaching and learning of EBHC. Importantly, various contextual factors — at both faculty and health system level — must be considered in the planning, implementation and evaluation of teaching and learning strategies.[8,18]

Our qualitative study aimed to obtain the perspectives of module convenors and does not reflect the views of all lecturers. Not all invited participants participated in interviews as some indicated that they were 'too busy'. It could be that these module convenors have different perspectives from those who agreed to be interviewed. As the lead author (and principal investigator for this study) is very active in promoting EBHC teaching and learning at the faculty where the study was done, we were concerned that her presence in the interviews might overly influence what the participants were willing to say. Therefore, to minimise this potential for bias, the interviews were conducted by trained qualitative researchers. However, because they were not experts in EBHC, potential areas for further probing may have been missed.

Conclusions

The perspectives of module convenors are key to informing strategies to enhance EBHC teaching and learning — in identifying opportunities for as well as barriers to strengthening teaching and learning of EBHC.

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Author contributions – Taryn Young (TY) developed the protocol, facilitated the conduct of the interviews, coded the data, conducted the analysis and interpretation, and wrote the manuscript. Anke Rohwer (AR) contributed to protocol development, checked the data coding, interpreted the data and contributed to the manuscript. Jimmy Volmink (JV) and Mike Clarke (MC) approved the protocol, contributed to data interpretation and the manuscript development. All authors approved the final version of the manuscript.

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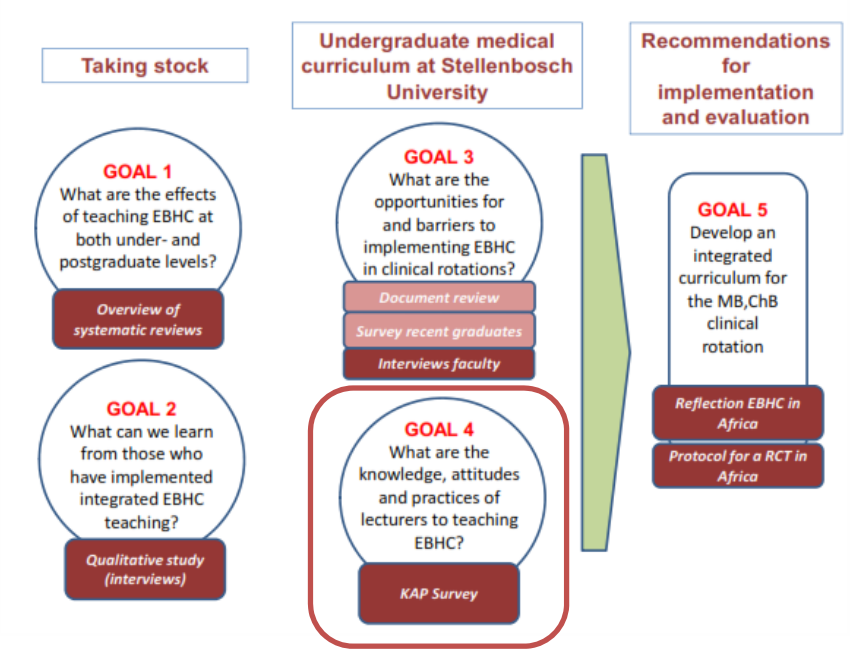
Chapter 5: Attitude and confidence of medical programme lecturers to practice and teach EBHC



Summary: This cross sectional survey assessed medical student educators' confidence to practice and teach EBHC, their attitude to EBHC and barriers to practicing and teaching EBHC. Respondents highlighted various perceived challenges. Key recommendations to advance EBHC learning were reliable internet access with easy point-of-care access to databases and resources, increased awareness of EBHC together with faculty development and a supportive community of practice.

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Involvement of PhD candidate: The PhD candidate developed the protocol, submitted it for ethics approval, facilitated the data collection and management, data analysis, and interpretation, and wrote the manuscript.

Involvement of co-authors: Tonya Esterhuizen contributed to protocol development, data analysis, and manuscript writing. Jimmy Volmink and Mike Clarke approved the protocol, contributed to data interpretation and the manuscript development. All authors approved the final version of the manuscript.

The ethics approval and data collection tool are in Appendices 5.1-5.2

OPEN

Attitude and confidence of undergraduate medical programme educators to practice and teach evidence-based healthcare: a cross-sectional survey

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ABSTRACT

Aim: Medical student educators play critical roles in evidence-based healthcare (EBHC) teaching and learning and as role models practicing EBHC. This study assessed their confidence to practice and teach EBHC, their attitude to EBHC and barriers to practicing and teaching EBHC.

Methods: We conducted a cross-sectional online survey of educators of undergraduate medical students at a South African academic institution. STATA 12 was used for quantitative data analysis. Responses to open-ended questions were coded, and further interpretation done using thematic content analysis.

Results: Forty two (19%) educators from various departments responded to the invitation sent to everyone formally involved in teaching undergraduate medical students. They had high levels of knowledge and understanding of EBHC. Many had received training in teaching and learning approaches, although EBHC training received was mainly on enabling competencies. Limitations to practicing EBHC included lack of time, clinical workload, limited access to Internet and resources, knowledge and skills. One quarter of the respondents indicated that they teach EBHC. Perceived barriers to teaching EBHC reported related to students (e.g. lack of interest), context (e.g. access to databases) and educators (e.g. competing priorities). Respondents' suggestions for support included reliable Internet access, easy point-of-care access to databases and resources, increasing awareness of EBHC, building capacity to practice and facilitate learning of EBHC and a supportive community of practice.

Conclusion: Educators play a critical role in facilitating EBHC learning not just in the classroom, but also in practice. Without adequate support, training and development, they are ill equipped to be the role models future healthcare professionals need.

Key words: confidence, educators, evidence-based healthcare, practice, teaching

Int J Evid Based Healthc 2015; 13:000–000.

Background

Using best evidence to inform healthcare decisions is widely recognized as a key competency for all healthcare professionals.[1] Academic institutions are implementing evidence-based healthcare (EBHC) as part of learning in the curriculum of healthcare professionals. These curricula usually cover critical enquiry and formulating clear questions when faced with a scenario of uncertainty, finding best research evidence applicable to the problem, critically appraising the evidence for validity, clinical relevance and applicability, interpreting and applying the findings in the clinical setting and evaluating the performance. Specific EBHC competencies and assessment approaches link to each of these steps.[1,2]

Clinically integrated teaching and learning, with a focus on learning linked to real-world problems in the

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clinical setting and learning by doing, as modelled by Sackett[3] are considered to be the more effective approaches for improving EBHC knowledge, skills and attitudes.[4] Successful teaching and learning depends on factors related to the learner, the educator/lecturer, and on having a supportive environment with teaching and learning opportunities. Educators play a critical role in the delivery and facilitation of EBHC teaching and learning, in encouraging critical enquiry, in fostering reflective practices and in being role models for the practice of EBHC in the clinical setting.[5]

Within the clinical setting, clinician lecturers/educators who have received EBHC training are more likely to teach the application of EBHC.[6] A study in New Zealand among clinical teachers found that those who received training in EBHC are more likely to teach its application in the clinical setting and are more comfortable to engage students on topics and issues related to EBHC,[7] and this was more often seen among general practitioners than specialists. Among nurse educators, Melnyk *et al*.[8] found significant relationships between educators' knowledge of EBHC and their beliefs about the value of EBHC, the ability to practice EBHC and the relationship between teaching EBHC and advancing the profession and their comfort in teaching EBHC. The CREATE framework,[2] which provides an international consensus statement on EBHC assessment tools, defines self-efficacy as the individual's judgments regarding their ability to perform a certain activity and notes that educators' confidence in their ability may increase their likelihood to engage in practicing the various EBHC steps. Internationally, training initiatives thus focus on training trainers in EBHC to enhance their capacity to integrate EBHC teaching and learning in the clinical setting.[9] Also on the increase are initiatives to build confidence in teaching and learning principles and theories.[10]

In South Africa, the Colleges of Medicine of South Africa includes critical appraisal skills in curricula for medical specialist training while the Medical and Dental Professions Board of the Health Professions Council of South Africa states in its regulations for Registration of Students, Undergraduate Curricula and Professional Examinations in Medicine and Dentistry that:

> The emphasis in teaching should be on fundamental principles and methods that promote understanding and problem-solving skills and not only on the purely factual knowledge which, in any event, becomes outdated. . .. They should be taught at all times to be critical of old and new knowledge and to evaluate data, statistics, thinking and methods objectively.

The Health Professions Council of South Africa used the CanMEDS framework[11] to define the desired graduate attributes of a newly qualified healthcare professional. This now serves as a guide to the essential abilities of a newly qualified health professional to optimize patient outcomes and defines the attributes of the graduate according to seven interdependent roles: Medical Expert, Scholar (which includes EBHC), Professional, Communicator, Collaborator, Manager and Health Advocate.

At Stellenbosch University an ongoing project aims to develop and implement undergraduate EBHC teaching and learning to medical undergraduates in an integrated manner. To inform curriculum development, an assessment of the medical curriculum was conducted, including a document review of the 2011 curriculum, a survey of recent graduates[12] and interviews with faculty. This found that EBHC is covered to varying degrees with teaching in specific modules, which it was not explicitly integrated in a stepwise fashion and did not progress from foundational knowledge to the acquisition of skills and practical competencies throughout the curriculum. Recent graduates felt that they lacked EBHC skills and proposed that EBHC teaching and learning be integrated into clinical rotations, making use of relevant examples in different disciplines.

As educators play a key role in facilitating the teaching and learning of EBHC, especially within the clinical setting, the study reported here assessed educators' confidence in practicing, and their attitude, to EBHC, as well as their confidence in teaching EBHC and the barriers they had experienced, or perceived, to practicing and teaching EBHC.

Methods

A cross-sectional survey was conducted in 2014. The study population included all faculty members involved in teaching on the undergraduate medical curriculum across the 10 departments at the Stellenbosch University Faculty of Medicine and Health Sciences. All those employed by the university, and those on joint appointments, whose role included teaching of undergraduate medical students were invited to participate by e-mail, and provided with a link to the online questionnaire. A reminder was sent after 2 weeks.

The structured questionnaire sought information regarding demographics and training received, experience in teaching and learning, and previous exposure to EBHC (training received, research conducted, etc.). We used validated tools for assessing confidence in practicing, and attitude to, EBHC.[2] Confidence in practicing EBHC was assessed using the Evidence-based

Practice Confidence[13] scale and questions were included to assess attitude.[14] Visual analogue scales measured attitudes to, and confidence in, teaching EBHC[7] and open-ended questions explored barriers to practicing and teaching EBHC. The questionnaire was available in English and Afrikaans. It was first developed in English and then translated to Afrikaans. The Afrikaans version was back translated by a person independent of the research team, and the original English and the back-translated version compared to ensure that the meaning of the questions was not lost.

STATA 12 (StataCorp LP, College Station, Texas, USA) was used for quantitative data analysis. Data were first checked for completeness. Continuous variables were summarized using descriptive summary measures and related measures of dispersion. Categorical data were summarized using proportions. For questions on knowledge we assessed consistency and found high Cronbach's alphas (95%) and therefore combined all 16 items into one knowledge score. The highest score was allocated to the best level of knowledge, giving a knowledge score with a maximum 80. For questions on attitude to practicing EBHC we reversed the scores of the negatively phrased items, for example 'I rarely formulate questions about patients' and then added all the items together to get an overall score between 10 and 50 (Cronbach's alpha 57%). For confidence in practicing EBHC[14] we grouped the scores into five categories aligned with the five steps in practicing EBHC namely ask clear questions, search for research evidence, appraise and interpret the evidence, apply the evidence and audit practices. Scores for self-perceived confidence in teaching EBHC were also combined into an overall score (maximum 55). Bivariate analysis of associations between factors such as demographics, education and exposure to EBHC, and outcomes such as attitude and confidence to practice and teach EBHC were assessed using correlation analysis, analysis of variance testing, Pearson's χ^2 analysis and t tests as appropriate. Responses to open-ended questions on barriers, and proposed strategies to overcome these, to practicing and teaching EBHC were coded and analysis and interpretation were done by the investigators, using thematic content analysis to identify key emerging themes. We linked these to the conceptual framework for integrated teaching and learning of EBHC, developed following semistructured interviews with 24 EBHC programme coordinators from around the world, which revolves around the engagement between the learner and the educator within the institutional context.[15]

Participants were asked to provide informed consent for participation in the online survey. Participation was voluntary. The study proposal was approved by the Stellenbosch University Health Research Ethics Committee (S12/10/262(C)). To enhance response rate, we had a lottery for respondents, with a sponsored conference registration, for a conference of their choice, to the value of R5000 as the prize. Participants who wanted to enter the lottery had to provide their cell phone numbers, which were only be used to notify the winner. Thirty-six respondents entered the lucky draw.

Results

Forty two (19%) of 227 faculty members involved in teaching undergraduate medical students responded. They worked across various departments, were mainly senior lecturers and offered teaching to all years of medical students (Table 1). About 75% had attended training on research methodology (mainly epidemiology, research proposal writing, biostatistics, systematic reviews and qualitative research methods), and to a lesser extent training on knowledge translation and change management. Most participants had conducted primary research, with only a few conducting systematic reviews. More than half (57%) indicated that they had done some training in EBHC in the past 5 years by attending short courses, workshops/seminars, online courses, journal clubs or by reading articles on EBHC. These activities mainly addressed enabling competencies such as epidemiology, biostatistics, research methodology and the basic principles of EBHC. Most (85%) had attended teaching and learning training events that had content such as teaching and learning strategies, assessment, curriculum planning, teaching EBHC, supervision and promoting active learning. Participants described EBHC as:

> Supporting clinical decision-making by combining best available evidence with own experience, patient preference and local factors' and 'Healthcare practices (of any nature – e.g. prevention, diagnosis, treatment, prognosis etc.) that are informed by evidence as far as possible; and recognising where there is inadequate/insufficient evidence to inform these practices. It implies ongoing changes to healthcare practice when new evidence becomes available.

Some emphasised use of research evidence and did not include reference to combining this with clinical experience and patient preferences. Participants' self-reported understanding of EBHC-related terms is described in Table 2. Using the overall knowledge score

Table 1. Profile of survey responders

Total survey population	227	
Overall response rate	42 (19%)	
Age	Mean 45.4 years (SD 9.5)	
Sex (M/F)	21/21	
Highest qualification	*n*	%
MB,ChB	3	7
MSc	4	10
MMED/other specialist	18	43
PhD	8	19
Other	9	21
Response rate per department (N)		
Anaesthesiology and critical care (6)	0	0
Biomedical sciences (21)	4	19
Interdisciplinary health sciences (20)	7	35
Medical imaging and clinical oncology (4)	0	0
Medicine (55)	8	15
Obstetrics and gynaecology (11)	3	27
Paediatrics and child health (22)	5	23
Pathology (29)	9	31
Psychiatry (19)	1	5
Surgical sciences (31)	3	10
Centres (9)	2	22
Current position		
Lecturer	9	21
Senior lecturer	16	38
Professor	9	21
Registrar (specialist in training)	1	2
Other	7	17
Teaching medical students (year of study)		
MB,ChB 1	18	43
MB,ChB 2	23	55
MB,ChB 3	30	71
MB,ChB 4	27	64
MB,ChB 5	27	64
MB,ChB 6	23	55
How long working at University	8 years (median) (IQR 5–15)	

How long teaching UG medical students	9.5 years (median) (IQR 6–18)
Training in EBHC	24 (57%)
Training in research methodology	31 (74%)
Research experience	
Led the conduct of a primary research project	36 (86%)
Contributed to the conduct of a primary research project	39 (93%)
Led conduct of a systematic review	4 (10%)
Contributed to conduct of a systematic review	8 (19%)
Training in teaching and learning	35 (85%)

EBHC, evidence-based healthcare; IQR, interquartile range.

for the 16 items, maximum score 80, the median score was 72 (interquartile range 62–77). The knowledge scores were not significantly associated with training, highest qualification, years since qualifying, position, academic department or age.

Attitude to evidence-based healthcare

Figure 1 graphically depicts responses to the questions on attitude to practicing EBHC. The items were framed both positively, for example 'EBHC is useful on a daily basis' and negatively, for example 'I rarely formulate questions about patients'. Most felt that EBHC is a realistic option in their practice and that lifelong learning is important. However, more than 50% felt that literature searches are too time-consuming to undertake in the clinic and that questions can be answered faster by referring to a textbook or a consultant. The overall mean score was 38 (SD 5) (maximum score 50). Data were normally distributed, so we compared the independent variables to attitude score using *t* tests and analysis of variance. Training in EBHC and research methods, qualification, time since qualification, faculty position, age, conducting systematic reviews and years of teaching were not significantly associated with attitude.

Table 2. Self-reported understanding of evidence-based healthcare-related terms often used in research articles

	Yes, understand and I could explain to others		Some understanding		Do not understand, but would like to understand		Do not understand, it would not be helpful to me to understand		No idea about this	
	n	%	n	%	n	%	n	%	n	%
Absolute risk difference	12	29	5	12	10	24	7	17	8	19
Allocation concealment	18	43	3	7	7	17	7	17	7	17
Case control study	31	74	6	14	4	10	0	0	1	2
Case series	28	67	7	17	4	10	2	5	1	2
Cohort study	32	76	6	14	3	7	0	0	1	2
Confidence interval	26	62	7	17	7	17	1	2	1	2
Selection bias	29	69	7	17	3	7	0	0	3	7
Intention to treat analysis	17	41	8	19	9	21	4	10	4	10
Lost to follow-up	28	67	7	17	5	12	0	0	2	5
N.N.T. (number needed to treat)	20	48	6	14	6	14	9	21	1	2
Sample size	31	74	4	10	6	14	0	0	1	2
Systematic review	25	60	8	19	6	14	2	5	1	2
Meta-analysis	23	55	9	21	8	19	1	2	1	2
Odds ratio	17	41	13	31	6	14	4	10	2	5
Confounding	22	52	10	24	7	17	1	2	2	5
Sensitivity	30	71	7	17	4	10	0	0	1	2

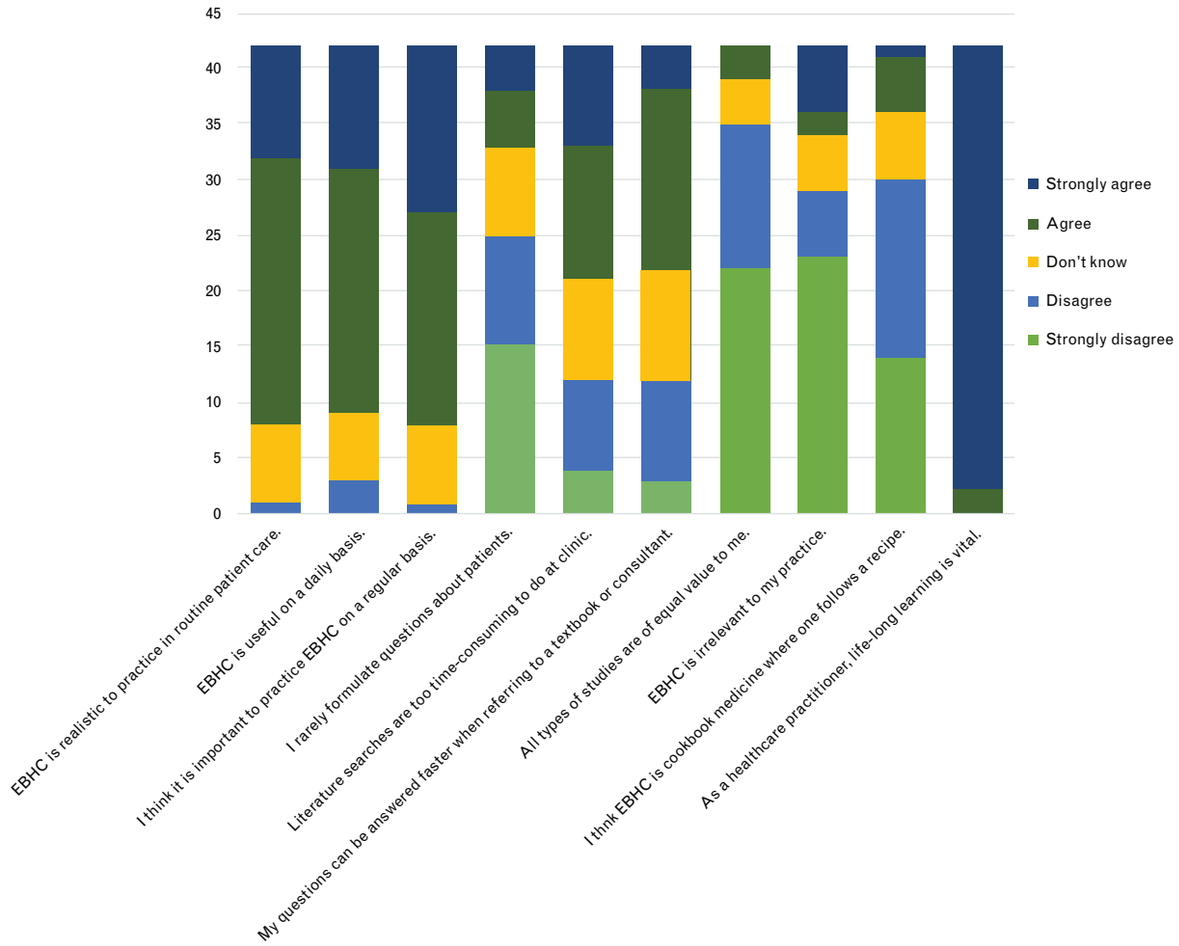

Figure 1. Educators' attitudes to evidence-based healthcare (EBHC)[14].

Practicing evidence-based healthcare

Lecturers' confidence in practicing EBHC is summarized in Table 3, highlighting levels of confidence that are high overall but with lower levels for interpreting statistics. They raised various barriers, relating to the individual or the context, to practicing EBHC. By far the most common were lack of time, clinical workload, limited access to Internet and resources, knowledge and skills.

> No simple solution to increase time - clinicians' responsibilities in the hospital, including patient and student load will only be addressed if more posts are made available.

They made suggestions on how this could be addressed, calling for more staff and dedicated time for research and for faculty development. They proposed capacity development opportunities to especially enhance their capacity to interpret and understand biostatistics, searching skills, how to read papers and on time management. They also suggested a 'support group' to assist each other. To create an enabling environment, they suggested widely available and reliable Internet access and WIFI, access to relevant literature and having evidence informed clinical guidelines available at the point of care. Furthermore, they suggested using auditing and feedback to enhance practices.

Teaching evidence-based healthcare

Ten participants (24% of respondents) indicated that they teach EBHC. This was done through lectures, small group tutorials, teaching at the bedside, online learning and including EBHC concepts in assessments. The content covered in these sessions focused on the enabling competencies (epidemiology, biostatistics),

Table 3. Educators' self-perceived confidence in practicing evidence-based healthcare ($n = 42$)[14]

Confidence in current ability to	0% No confidence	10%	20%	30%	40%	50%	60%	70%	80%	90%	100% completely confident
identify a gap in your knowledge related to a patient or client situation (e.g. history, assessment, treatment)?	1	3		1	1	1	2	5	10	9	9
formulate a question to guide a literature search based on a gap in your knowledge?				3		1	4	9	7	8	10
effectively conduct an online literature search to address the question?			1	0	1	1	1	10	7	11	10
critically appraise the strengths and weaknesses of study methods (e.g. appropriateness of study design, recruitment, data collection and analysis)?			1	2	3	5	5	8	8	8	2
critically appraise the measurement properties (e.g. reliability and validity, sensitivity and specificity) of standardized tests or assessment tools you are considering using in your practice?			1	2	2	8	8	7	6	5	3
interpret study results obtained using statistical tests such as t-tests or chi-square tests?	1	4	3	1	5	3	6	4	8	4	3
interpret study results obtained using statistical procedures such as linear or logistic regression?	1	5	4	2	6	0	6	9	4	4	1
determine whether evidence from the research literature applies to your patient's or client's situation?	2		1	1	1	3	4	10	6	9	5
ask your patient or client about his/her needs, values and treatment preferences?	2			1	3	2	1	5	9	9	10
decide on an appropriate course of action based on integrating the research evidence, clinical judgment and patient or client preferences?	2			1	2	4	1	6	11	9	6
continually evaluate the effect of your course of action on your patient's or client's outcomes?	2			2	1	4	2	9	6	11	5

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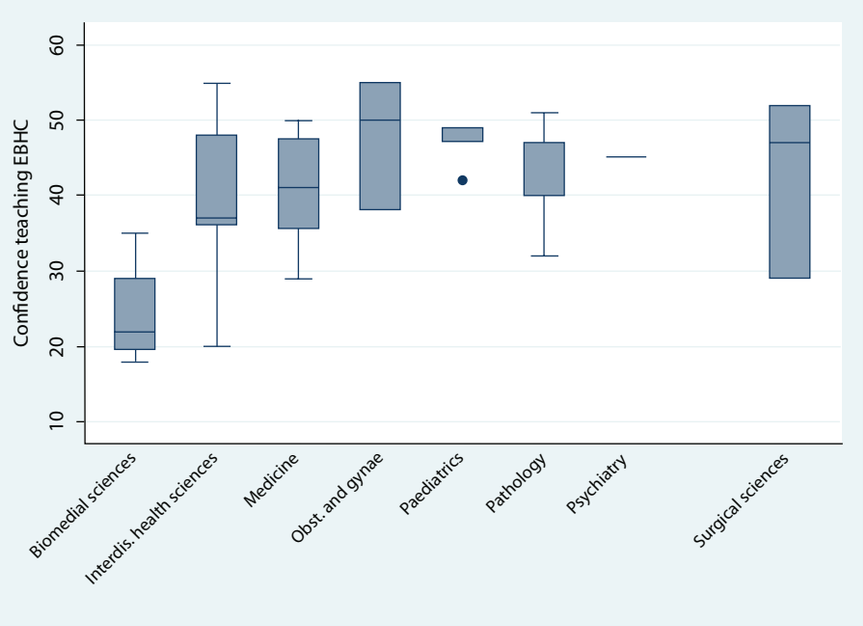

Figure 2. Confidence in teaching evidence-based healthcare (EBHC) per department*. *Using total score (maximum = 55).

basic EBHC principles and searching skills. The overall mean score for self-perceived confidence in teaching EBHC was 40 (SD 11) of a maximum of 55 ($n = 42$).

Most (38) of the 42 respondents indicated that they were confident to help medical students find relevant articles in MEDLINE (or other bibliographic databases), and to guide critical review of articles (60% or higher on the visual analogue scale). Fewer (30) indicated that they were confident to assist students phrase a clear question following a clinical encounter with a patient, and to guide students in considering the application of the results of their critique of articles to the patient's care. Twenty seven selected 60% or higher on the visual analogue scale for confidence in evaluating students' EBHC knowledge. Total scores for the respondents from each department are shown in Fig. 2.

Educators raised a number of perceived barriers to teaching EBHC, which relate to the students, the context and the educators. They felt that the curriculum is full, that students are subjected to information overload, that there is no scaffolding of EBHC learning over the course of the degree and that EBHC is not integrated in practice. Lack of Internet access, especially at point-of-care, was commonly listed. With respect to students the size of student groups, immaturity and lack of interest of students were seen as barriers to EBHC learning while competing priorities and lack of time ('am involved with too many other activities'), as well as limited EBHC knowledge and skills ('I need to upgrade and maintain my knowledge of EBHC') and the tendency to stick to habits influence how educators facilitate EBHC learning.

Suggestions for addressing these challenges included improving departmental Internet access, exploring WIFI access for the whole faculty, and easy point-of-care access to databases and resources. Respondents stressed the importance of increasing awareness of the value and utility of EBHC ('demonstrate to them the value of EBHC') and thus the need for EBHC teaching. They also emphasized building capacity to both practice and facilitate learning of EBHC, and expressed the need for more time to devote to teaching students ('Get somebody to take over my postgraduate activities. Less meetings'). Furthermore, they called for promotion of critical thinking among students, incorporating the teaching and learning of EBHC from the start of the curriculum, and making 'EBHC applicable and relevant to students'. Respondents felt that there needs to be dedicated time to apply EBHC principles especially within the clinical setting, and that it should be integrated in assessments. To support each other, educators requested help from others who are particularly proficient, for example 'a working group supporting educators', and highlighted the need for evaluation

and ongoing refinement of teaching approaches and material.

Discussion

This is one of only a few studies conducted in South Africa to assess one or more of the following: undergraduate educators' confidence in practicing and teaching EBHC, attitudes to EBHC and to practicing and teaching EBHC. This study links to ongoing work at Stellenbosch University supporting the implementation of graduate attributes, specifically linked to developing and implementing clinically integrated EBHC teaching and learning for medical undergraduates, a process within which educators play a critical role.[5,15] Despite respondents having a high self-reported level of knowledge and understanding of EBHC concepts attitudes towards EBHC varied (Fig. 1). Their confidence in both teaching and practicing EBHC were generally high. Those who were teaching EBHC focused the curricula content on enabling competencies of EBHC, basic EBHC principles and searching skills, rather than on reading, interpreting and considering the application of different types of articles. As educators are faced with various competing priorities the need was expressed for dedicated faculty development and a community of practice to provide support in the implementation of EBHC teaching and learning.

Similar studies among South African psychiatrists and general practitioners with a special interest in mental health,[16] general practitioner and specialist educators in New Zealand[7] and nurse educators in the United States[8] found that those who had attended EBHC courses were more likely to teach EBHC. Barriers to teaching EBHC, resonating with our survey, were centred around lack of time, lack of support, lack of evidence in some clinical areas and the need for more training in teaching EBHC. Findings of this survey also resonate with a curriculum assessment,[12] which found that there is no scaffolding of EBHC learning over the course of the degree and that EBHC is not integrated in practice.

A supportive enabling institutional, and health sector, environment is important for advancing EBHC learning. Educators need to be confident and competent to facilitate the learning and, to this end, require opportunities to enhance their capacity in EBHC and in how to facilitate learning.[10,15] Furthermore, through working together, building on each other's strengths, sharing best practices and lessons learnt, in a supportive community of practice can build the critical mass of educators needed to facilitate learning across the various disciplines.

Respondents worked across various departments. Our survey had limited the power to assess associations between confidence to practice and teach EBHC and variables such as attitude and training. The low response rate might also mean that those who took part are not representative of the target population. The nonresponders may have different levels of confidence to practice and teach EBHC, their attitude may vary and they could be experiencing different challenges. To assess this we conducted brief follow-up survey of nonresponders, to which 14 educators responded. They described EBHC in a similar way to responders and listed lack of time, length of the survey, limited involvement with undergraduate teaching and that EBHC is irrelevant to their practice as reasons for not participating.

Conclusion

Educators play a critical role in facilitating learning not just in the classroom, but also in practice. This survey, despite low response rate, shows that even for those with high levels of self-reported knowledge and understanding of EBHC; adequate support, training and development and an enabling environment are important for educators to be the role models future healthcare professionals need.

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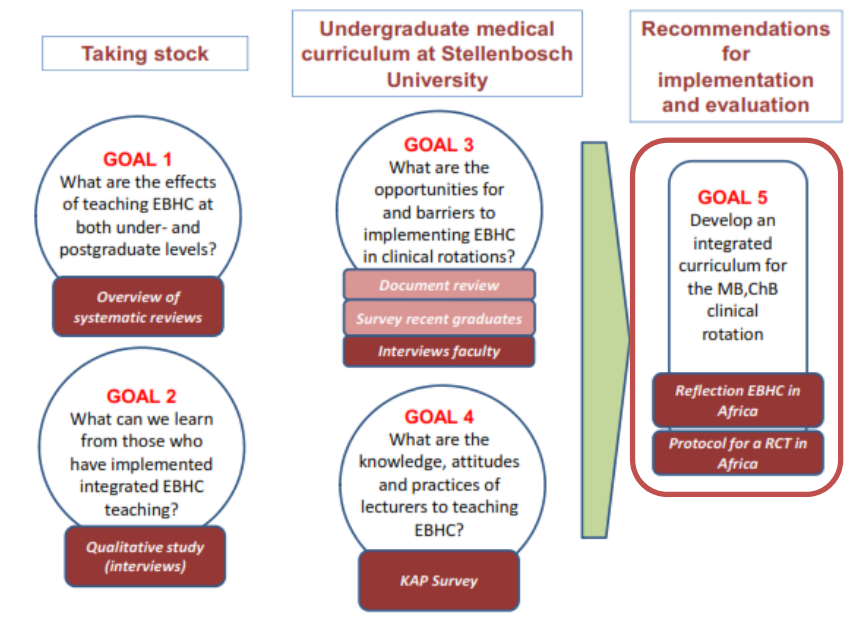
Chapter 6: Clinically integrated teaching and learning of EBHC at SU – Next steps



Summary: The context of EBHC within the African region influences the implementation of clinically integrated teaching and learning of EBHC. This chapter firstly provide a reflection on EBHC in the African region and then, drawing on chapters 2 to 5 presents a strategy for the implementation and evaluation of clinically integrated EBHC teaching and learning to medical students.

6.1 The history and the future role of EBHC in Africa: a reflection

Summary: This paper provides a reflection on EBHC activities in the African region over the past two decades and considers a future role for EBHC in Africa. Initiatives to promote EBHC in the African region have expanded considerably in recent years. Increased collaboration will help advance EBHC in the region. Potential collaborative activities span capacity building initiatives to conduct and use research, mainstreaming EBHC teaching and learning in health professional training, and partnering with policy makers and clinicians to enhance understanding and the use of reliable evidence in policy and practice.

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Involvement of PhD candidate: The PhD candidate developed the outline for this paper, conducted the literature review and search for information on various initiatives in Africa, drafted the first version of this paper and sought input from co-authors. She led its revision and finalisation.

Involvement of co-authors: Paul Garner, Mike Clarke and Jimmy Volmink reviewed and commented on the draft manuscript. All authors approved the final paper.

Appendix 6.1 includes the journal correspondence.

Evidence-based Health Care and Policy in Africa: past, present and future

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Key points

- Initiatives to promote evidence-based health care and policy in the African region are increasingly common.
- Health services and clinical researchers have some responsibilities to work in partnership with policy makers and clinicians to enhance understanding and the use of reliable evidence in policy and practice.
- Tailored, responsive capacity building initiatives are required to build capacity to conduct and use research.
- Teaching and learning to increase evidence-based health care knowledge, skills, attitude and behaviour should be mainstreamed into health professional training curricula, including undergraduate curriculae.
- Experience suggests that equitable partnerships and collaboration help advance evidence informed healthcare practices in the African region.

Abstract

Objective, study design and setting
Africa has high disease burden and health system challenges but is making progress in recognising, accepting and adopting evidence-based health care (EBHC). In this paper, we reflect on the developments of the past two decades and consider further steps that will help with the translation of reliable research results into the decision making process.

Results
There has been a rapid growth in various initiatives to promote EBHC in the African region. These include the conduct and reporting of primary and secondary research, research capacity development and supportive initiatives, access to information, and work with decision makers in getting research into clinical guidelines and health policies. Much however still needs to be done to improve the impact on health in the region. A multipronged approach consisting of regionally relevant well conducted research addressing priority health problems, increased uptake of research in healthcare policy and practice, dedicated capacity development initiatives to support the conduct as well as use of research, facilitated by wider collaboration and equitable partnerships will be important.

Conclusion
Working together in mutually supporting partnerships is key to advancing both evidence informed healthcare practices and better health.

Key words: evidence-based health care; Africa; reflection

Running title: Evidence-based health care in Africa

Relevance of evidence-based health care and policy in Africa

The disease burden in countries of Africa remains high: with increases in chronic non-infectious diseases adding to the already existing large burden of infectious diseases, injuries, and maternal and child health conditions [1]. Government health care is poorly resourced in general, with too few trained staff (including doctors, nurses, emergency medicine practitioners and allied health professionals) and poor health system infrastructure and limited resources. In the public sector, global initiatives and foreign funds from donors can put pressure on existing services by funding particular initiatives, such as targeted disease control programme. These place further strain on service loads and can distort national priorities and human resource allocations. In addition, the formal private sector is not well developed, although increasingly becoming so in both middle and low income African countries, and the public healthcare system is perceived to offer 'poor services for the poor.' Under these conditions individuals and communities increasingly turn to private health care (formal or informal) and self-treatment for care. This may result in their exploitation by predatory companies making false claims about their products and services, particularly in environments where the levels of income and education are low and government regulations do not exist or are not enforced. Having ready access to reliable information on what healthcare interventions work will help decision makers including the public, clinicians and governments to make the right choices [2].

Evidence-based clinical care, the integration of current best available research evidence with clinical expertise and patient values and preferences, is gaining momentum in the African region. Whilst initially arising from clinical medicine to guide clinical decisions, increasingly these decisions impact on national and global policies; and the methods of research synthesis are being applied to public health problems. In the context of this broadened agenda, evidence–based health care and policy is a better way of describing the current status of shifting from research into public health policy and clinical practice, and is the scope taken in this article.

Important strides have been taken to get evidence-based health care (EBHC) onto the agenda at regional, national and local levels in some countries of Africa. In this paper we reflect on the developments of the past two decades and, consider further steps required to ensure that the results of reliable research continue to inform decision-making on the continent.

EBHC in Africa: the past 2 decades

Globally there has been an explosion of efforts aimed at developing research synthesis methods, conducting systematic reviews and designing structured ways of getting evidence into healthcare policies. People in Africa have played a key role in this process, mainly through The Cochrane Collaboration (www.cochrane.org). Since its inception in 1997, Cochrane South Africa (www.mrc.ac.za/cochrane) has formed part of this global network, and worked with various stakeholders inside and outside of Africa to raise awareness of the value and importance of EBHC, in addition to spearheading the conduct and support of regionally relevant Cochrane Reviews. Data from Cochrane's contact database in September 2014 show that the number of Cochrane contributors from the Cochrane South Africa reference region (comprising a total of 25 countries in Sub-Saharan Africa) has increased considerably, with the majority located in South Africa and Nigeria (Figure 1). Working with the Cochrane Review Groups for HIV/AIDS and Infectious Diseases, Cochrane South Africa has trained, mentored and supported a large number of African authors of Cochrane Reviews. An average of 44 full Cochrane Reviews and 26

protocols were published each year by authors from Africa during 2009-2013. These authors frequently act as change agents who continue to promote EBHC and advocate the use of systematic reviews within their home institutions and countries [3]. And, on an international scale, they have challenged global policy e.g. on the use of directly observed treatment strategy for tuberculosis [4] and continue to contribute to clinical guideline development, as seen in the recent WHO Malaria guidelines where more than three quarters of the 11 Cochrane Reviews informing guideline development were authored by Africans [5].

In addition to identifying what works and what does not, systematic reviews help to identify gaps in the research base and can therefore guide decisions about what new studies are needed. There has been an increase in research productivity in the African region since 1991 which has been shown to be associated with the number of epidemiology training programmes, especially at a Masters level [6], and national gross domestic product [7]. The conduct of randomised trials, specifically, is being strengthened through funding from the US National Institutes of Health (NIH), Wellcome Trust and the EDCTP among others, the development of research ethics committees, the availability of the Pan African Clinical Trials Registry which allows prospective registration of trials [8,9], and dedicated capacity development initiatives primarily through Masters and PhD programmes. While the growth in research productivity is a welcome development it remains unclear to what extent research is being informed by findings from systematic reviews. Furthermore, there is still a huge discrepancy between research capacity in Africa compared to that of Europe and North America [10]. This links with various factors, such as the lack of sustained investment in research and research capacity building and a lack of alignment between available research funding and national and regional priorities [11].

The availability of research evidence is, of course, only one of the inputs into the complex process of health care decision-making [12]. Healthcare decisions made by policymakers, healthcare professionals, managers, researchers, media, professional associations, and the public-at-large are influenced by many factors including cost, feasibility, and availability of products and services [13]. The priority given to best evidence in decisions can be influenced by these, as well many other factors, particularly competing interests, which may be commercial, academic or political [14].

Over the past two decades we have witnessed a positive change in attitudes towards the use of evidence in healthcare planning. For example, at the start of the 21st century, when high rates of mother to child transmission of HIV was an important health problem, a Cochrane Review was undertaken in response to a direct request from the South African Department of Health for evidence on the effects of antiretroviral treatment for the prevention of mother to child transmission of HIV. On presenting the evidence to key decision makers, the door was literally closed in the face of the researchers because the evidence did not speak to what the decision makers wanted to hear. This was an all too typical case of evidence based policy [15] versus policy based evidence (finding evidence to confirm instead of inform policy decisions). Today, with the caveat that one needs to be clear on what the phrase means, it is unusual to see any policy without the words ‘evidence based’ in it.

It needs to be kept in mind that for evidence informed policymaking to succeed proactive engagement of researchers with policymakers and other decision makers is required. Here, initiatives such as the Effective Health Care Research Consortium (EHCRC) www.evidence4health.org, an international consortium working closely with African partners, in Cameroon, Kenya, Nigeria and South Africa, can be identified as an example

of a group which has had considerable impact [3]. Since 2006, the work of this consortium has gone beyond conducting relevant high quality reviews which inform policy and practice. It uses an explicit theory of change where the production of systematic reviews or their derivative products are considered outputs while outcomes of interest include these outputs being accessed and used by decision makers (short term), being used to inform new or amended policies or guidelines (medium term). Long-term outcomes comprise EHCRC evidence being used to influence major funding decisions by bi-lateral or multi-lateral agencies and an increased number of evidence-informed decisions being made by intermediary organisations and networks (e.g. WHO, bilateral) and national decision makers. Further examples of dedicated initiatives to promote evidence use in policymaking include the SUPPORT Collaboration which developed tools for policymakers [16], the SURE Collaboration [17] which engages decision makers through deliberate dialogues to develop evidence-informed policy briefs, and by preparing rapid responses to policymakers in need of research evidence, and Evidence Aid which is seeking to improve access to systematic reviews relevant to disasters and other humanitarian emergencies, such as the Ebola outbreak in West Africa in 2014 [18].

There have also been promising developments in clinical guideline development and evaluation in the African region [13,19,20]. For example, Kredo et al [19], assessed 30 regional guidelines from 13 countries linked to five priority diseases and found quality gaps in relation to the AGREE II tool and variable concordance with current best evidence. An assessment of South African primary healthcare guidelines had similar findings [21] illustrating the need for dedicated initiatives to advance and promote guideline development, reporting and implementation. Sinclair et al [13], have similarly described a project in which researchers worked with the Ghana National Drugs Programme to review the evidence base for five priority areas in paediatric medicine. They considered both the international evidence base and the local applicability of the evidence and presented these as structured summaries to be used by guideline development teams.

Indeed the Paediatric Association of Kenya in using explicit, transparent guideline development procedures on three important topics in the country. They made clear recommendations about stopping bolus fluids in shocked children based on the totality of the evidence (including the large trial in Africa evaluating this, known as FEAST) [22], something that the WHO has not yet implemented. This has benefited children by improving clinical care, reducing bolus treatments and saving lives, and shown an African country can take on board evidence well in front of any guidelines from the World Health Organization.

It is clear that existing international evidence-informed clinical guidelines are not always taken into account by African guideline development groups. This may be due to the peculiarities of local health systems, such as specific clinical care pathways and resource limitations; knowledge of evidence, and a reliance on clinical experience. To accelerate the availability and implementation of high quality local guidelines, a shift from new guideline development to guideline adaptation [23], application and evaluation would be helpful.

In recent years there has been a growing recognition of the need for EBHC as demonstrated by multiple initiatives to promote the use of evidence in policymaking and practice (Table 1), the increased number of systematic reviews being commissioned and funded, and an increase in institutional initiatives to support the conduct of research. There has also been improved access to evidence through the HINARI initiative [24], and free one-click access to the Cochrane Library for people in many African countries. Furthermore, postgraduate and continuing professional development courses in EBHC are

increasing whether measured in the number of programmes or the number of students enrolling [25,26]. In 2012, the signing of the Kigali declaration on EBHC [27] by representatives from universities, health colleges, hospitals, NGOs and research institutions from nine African countries, forming part of the Collaboration for Evidence based Health in Africa, signalled a key milestone in the recognition of EBHC and the momentum for moving towards the implementation of evidence based practices (Table 2).

Future role of EBHC in Africa

How can we ensure that all these developments in EBHC have the greatest impact on reducing the continent's disease burden and improving the lives of Africans? A multipronged approach consisting of regionally relevant and robust research addressing priority health problems, increased uptake of research in healthcare policy and practice, dedicated capacity development initiatives to support the conduct as well as use of research, facilitated by wider collaboration will be important. Avoiding research waste and unnecessary duplication will help ensure that initiatives remain sustainable.

Conducting regionally relevant robust new research

New research needs to be informed by the existing body of research [28,29] and such primary studies and systematic reviews must seek to answer relevant research questions linked to the burden of disease and to health system needs [30]. They should not be driven solely by the agendas of funders or researchers. In striving for global excellence and local relevance, African researchers need to stay abreast of methodological developments and remain cognisant of research integrity principles. Various postgraduate programmes play a significant role in building relevant capacity [6,31]. However, these will need to be complemented by efforts to improve science literacy in schools, broad-based initiatives to empower a critical mass of local researchers to conduct and deliver internationally competitive research, support senior researchers to become role models and leaders, create enabling institutional environments for research, and build closer relationships between researchers on the one hand and health decision makers, funders and the public on the other [11]. Dedicated specialised institutional and regional initiatives (centres of excellence) can also make an important contribution. For example, regional biostatisticians are joining together to strengthen capacity in biostatistics in Sub-Saharan Africa by increasing the number, and standards of, postgraduate programmes in biostatistics [32,33] in order to facilitate collaborative research initiatives and build biostatistics literacy.

Promoting the use of research to inform policy and practice

The availability of robust research evidence on its own is not enough to impact on health care [34,35]. Sensitisation of undergraduates – the next generation of healthcare practitioners, healthcare managers, policy makers, and researchers – to the importance of research in decision making is important. Internationally, there is recognition and acceptance of the need to include teaching and learning of EBHC in the training of all healthcare professionals [36,37]. Despite this recognition, there is a still a general lack of coordinated country and regional efforts to support integration of EBHC at both undergraduate and postgraduate levels. Evidence informed strategies should be used to inform how EBHC learning can be mainstreamed into health professions education [38]. As part of the momentum towards transformative health professions education [39], the process of curriculum review presents useful opportunities to include and enhance EBHC learning. For instance, the Committee for Undergraduate Education and Training of the Health Professions Council of South Africa has adopted a modified version of the

CanMEDS framework for establishing graduate attributes of a newly qualified healthcare professional [40]. It provides a guide to the essential competencies health professionals must have to optimise patient outcomes. The framework defines the attributes of the graduate according to seven interdependent roles: Medical Expert, Scholar (which includes most of the aspects of EBHC), Professional, Communicator, Collaborator, Manager and Health Advocate.

Undergraduate training programmes in South Africa are being reviewed to better reflect these attributes and this period of change to the curriculum provides a window of opportunity to introduce, strengthen and integrate multifaceted EBHC teaching and learning with assessment [38,41]. The process starts by assessing the current curriculum [42,43], and moves on to working with lecturers and programme convenors to plan how EBHC learning can be integrated with a view to laying the foundation in pre-clinical years and building on this in the clinical years, getting institutional buy in, and enhancing the competencies of the trainers to facilitate learning and, most importantly, acting as role models [44,45]. In the course of these activities, academic institutions can benefit through working together, sharing best practices and using robust evaluations alongside implementation, to learn from their experiences.

In working towards evidence informed policy making [15], we need to keep in mind that the research outputs may not be well aligned to the information needs of policymakers. What can be done about this? As a start, researchers need to understand how the policy process and health system work, and engage with policy-makers to understand their priorities. This will guide efforts to access and interpret existing research, especially systematic reviews, conduct new research (where necessary) and complete and communicate research timeously and in appropriately tailored formats [46], in order to inform decision making at both policy development and implementation level. Clinical guideline development can be enhanced by following standardised approaches, followed by dedicated initiatives to support guideline implementation and evaluation. National and regional initiatives in this regard are in the pipeline. The recently launched G-I-N Africa [47] is '*a regional community of clinical practice guideline developers, users and other stakeholders from the African continent who are interested in improving the effectiveness, rigor and efficiency of guideline development, adaptation, dissemination, implementation and performance measurement.'* Initiatives such as these, need support and engagement from guideline development teams and ministries of health to avoid unnecessary duplication and ensure sustainability and impact.

Partnership and collaboration are key guiding principles as we move forward to advance EBHC in the African region.

Collaboration between researchers and decision makers, between academic institutions, between academic and research institutions, and between cadres of specialist staff, is key to moving towards the common goal of evidence informed healthcare practices in the African region. By sharing best practices, collaborating and partnering on research and capacity development initiatives, avoiding unnecessary duplication and building equitable [48] long term relationships, African efforts to promote EBHC will go further [49,50].

Conclusion

There has been a rapid growth in various initiatives to promote EBHC in the African region. Much still needs to be done to improve impact on health in the region. Working together in

mutually supporting partnerships is key to advancing both evidence informed healthcare practices and better health.

Contribution of authors

Taryn Young developed the draft manuscript. Mike Clarke, Paul Garner and Jimmy Volmink provided input, reviewed and commented on the draft manuscript. All authors approved the final version.

Conflicts of interest

All authors are identified with Cochrane. All receive grant money from public bodies based on activities related to producing systematic reviews and promoting their uptake.

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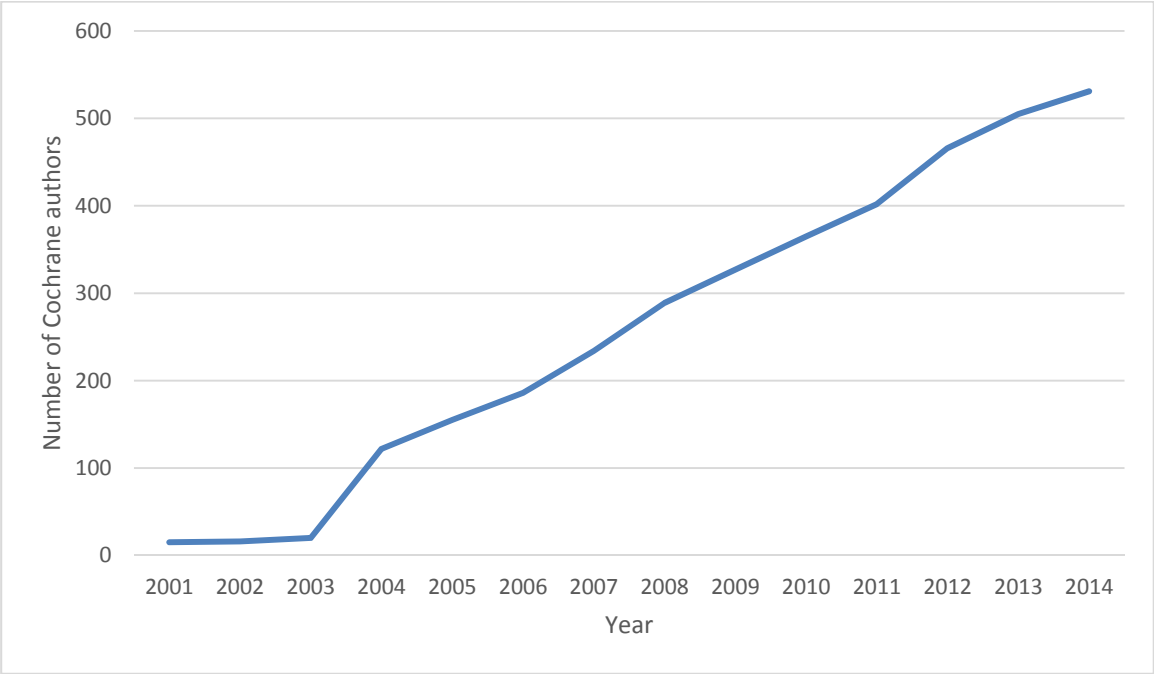
Figure 1: The growth in the number of Cochrane authors in Cochrane South Africa reference region* (2001-2014)



*Reference region: Benin, Botswana, Cameroon, Comoros, Eritrea, Ethiopia, Gambia, Ghana, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Nigeria, Sierra Leone, Somalia, South Africa, Swaziland, Tanzania, Uganda, Zambia and Zimbabwe.

Table 1. Examples of EBHC initiatives in Africa – rapid growth in initiatives to promote EBHC

Initiative	**Short description**	**Website**
Alliance for Health Policy and Systematic reviews (AHPSR)	An international collaboration hosted by the World Health Organization which goal is to promote the generation and use of health policy and systems research as a means to improve the health systems of low and middle income countries (LMICs).	http://www.who.int/alliance-hpsr/
Collaboration for Evidence Based Healthcare in Africa (CEBHA)	A network of institutions in Africa engaging in promoting EBHC in Africa.	http://www.cebha.org/
Development Research Uptake in Sub-Saharan Africa (DRUSSA)	Provides direct support to universities at individual, institutional and systems levels to improve participation in and impact on policy and practice.	http://www.drussa.net/
Effective Health Care Research Consortium (EHCRC)	International consortium focusing on preparing and updating Cochrane Reviews about the effects of health care relevant to LMICs; and identifying approaches to ensure dissemination and use of the results of systematic reviews in decision making.	http://www.evidence4health.org/
Evidence-Informed Policy Network (EVIPNet)	Promotes the systematic use of health research evidence in policy-making focusing on LMICs, partnerships at the country level between policy-makers, researchers and civil society in order to facilitate both policy development and policy implementation through the use of the best scientific evidence available.	http://global.evipnet.org/
Knowledge translation Network (KNET)	A network of eight research coalitions with membership of a coalition of researchers from 9 countries with the overall aim to promote and support the uptake and use of research evidence generated by their coalition partners who are funded by the Global Health Policy and Health Systems research programme.	http://www.ktnetafrica.net/
Policy BUDDIES - **BU**ilding **D**emand for evidence in **D**ecision making through **I**nteraction and **E**nhancing **S**kills	A collaborative project promoting researcher and policymaker engagement to promote evidence informed policymaking.	http://www.cebhc.co.za/policy-buddies/
SUPPORT	An international Collaboration Network that involves a partnership between LMICs and European scientists and LMICs' policymakers to provide training and support to encourage researchers and policymakers in collaborative policy-relevant research.	http://www.support-collaboration.org/
Supporting the Use of Research Evidence (SURE)	A collaborative project that builds on and supports EVIPNet in Africa and the Region of East Africa Community Health (REACH) Policy Initiative.	http://www.who.int/evidence/sure/en/

Table 2: Recommendations from the Kigali declaration [27]

- A sustainable collaboration to foster evidence based healthcare in Africa is developed
- Health workers, policy makers and researchers are trained and infrastructure is provided to support evidence based healthcare
- Evidence based healthcare is integrated into health education curricula
- All health workers have access to relevant electronic health information resources
- Systematic reviews and guidelines relevant to African healthcare needs and disease burden are developed
- Health care practitioners, policy makers and consumers of health care are supported to identify and use reliable evidence in making healthcare decisions
- Effective dissemination and implementation strategies are established
- Research to further strengthen the knowledge base for the implementation of evidence based healthcare in the African context is encouraged and supported
- Centres and satellite offices for evidence based healthcare are established in countries.

6.2: Implementation and evaluation of clinically integrated teaching and learning of EBHC for medical students in Africa – outline protocol for a cluster randomised controlled trial

Summary: This protocol outlines a proposed approach for coordinated implementation of clinically integrated teaching and learning with robust evaluation, as part of an expansion of EBHC learning among medical students. The effects of three alternative strategies for clinically integrated interactive teaching and learning of EBHC on EBHC knowledge, skills and attitude of undergraduate medical students in the student intern year, will be evaluated in a cluster randomised controlled trial. The trial will be conducted in Sub-Saharan African academic institutions offering medical undergraduate programmes. The unit of randomisation (clusters) will be the institution, and within each cluster the intervention will be implemented during students' clinical rotations in their final year of medical training (student intern year).

Involvement of PhD candidate: The PhD candidate developed the protocol.

Involvement of co-authors: Mike Clarke and Jimmy Volmink provided comments and methodological guidance.

Abstract

Background

Clinically integrated multifaceted teaching and learning of EBHC with assessment is effective in increasing EBHC knowledge, skills and attitude. There is however no clear guidance on what the minimum components are for multifaceted interventions and how best to implement these interventions. This randomised controlled trial will evaluate the effects of alternative strategies for clinically integrated teaching and learning of EBHC on EBHC knowledge, skills and attitude of final year medical students.

Methods

The trial will be conducted in Sub-Saharan Africa in academic institutions offering medical undergraduate training programmes. The unit of randomisation will be the academic institution and within each institution (cluster), the intervention will be implemented during the final year of medical training (student intern year) during their clinical rotations. Three strategies for clinically integrated interactive teaching and learning of EBHC will be evaluated with each having the same objectives, minimum core intervention package, and learning outcomes. The differences in the strategies will relate to the educators and the delivery strategies used. Strategy A will include team teaching with small group tutorial sessions, strategy B will include clinician led teaching and explicit bedside learning, and strategy C will include EBHC staff led teaching with online discussions. Baseline data and pre-assessment of EBHC knowledge, skills and attitude will be done using an online data collection tool before randomisation, and post assessment data collection will take place at the end of the clinical rotation and 3 months later. Responses to the baseline and post-intervention assessments will be scored, and comparisons between the 3 intervention groups made.

Discussion

Various academic institutions are grappling with the implementation of EBHC learning to undergraduate students. This study provides an opportunity for a coordinated implementation of clinically integrated teaching and learning with robust evaluation which will inform the roll out and expansion of EBHC learning of medical students in the African region.

Background

Evidence-based health care (EBHC) is accepted by many as an approach for improving healthcare globally and in the African region [1]. Supporting this view, the Kigali declaration on EBHC [2], signed by representatives from universities, health colleges, hospitals, NGOs and research institutions from nine African countries, forming part of the Collaboration for Evidence-based Health in Africa, specifically recommended that EBHC be integrated into health professions education curricula.

The overview reported as part of this thesis, which draws together evidence from multiple systematic reviews, shows that clinically integrated multifaceted teaching and learning of EBHC with assessment is effective in improving EBHC knowledge, skills and attitude [3]. Nine randomised controlled trials (RCTs) conducted amongst undergraduate students (sample sizes ranging from 77 to 238) indicated that various combinations of strategies such as lectures, computer lab sessions, small-group discussions, journal clubs, use of real clinical examples, portfolios and assignments, presented over a few weeks, were more likely to improve knowledge, skills and attitudes compared to single strategies offered over a short duration or no interventions. However, it is unclear what the minimum number of components is for multifaceted interventions to be successful and how best to implement these.

Programme convenors, who have successfully implemented this approach, have recommended laying the foundation in pre-clinical years with further application in the clinical years. They point to a number of critical success factors for clinically integrated teaching and learning [4]. These include having an enabling environment with faculty buy-in and endorsement by institutional leaders, adopting a pragmatic approach and being ready to use opportunities for engagement and for incorporating EBHC learning into the curriculum, role modelling in the clinical setting, a critical mass of the right teachers who have EBHC knowledge, attitudes and skills and are confident in facilitating learning, together with a supportive community of practice.

In the African region, various academic institutions are starting to plan implementation of undergraduate EBHC learning. However there is a need for a more coordinated approach and robust evaluation of implementation programmes [5]. Educational interventions are complex and context dependent, and few robust evaluations have been conducted on teaching EBHC in the African region. As with the evaluation of healthcare interventions, rigorous methods can be used to evaluate educational interventions [5,6]. In this cluster trial, we aim to evaluate the effects of strategies for clinically integrated teaching and learning of EBHC on EBHC knowledge, skills and attitude of undergraduate medical students in the student intern year.

Methods

This section was informed by the SPIRIT (Standard Protocol Items: Recommendations for Interventional Trials) statement (http://www.spirit-statement.org/) which defines a key set of items to address in a trial protocol. Figure 1 illustrates the overarching trial procedures.

Setting and participants

The trial will be conducted in Sub-Saharan African academic institutions offering medical undergraduate programmes. The region has more than 150 medical schools [7]. The Sub-Saharan African Medical Schools Study (SAMSS) [7] in which 105 out of 146 medical schools participated, showed that schools generally required 5 to 7 years for students to graduate. The curricula are typically divided into pre-clinical and clinical phases. In the

SAMSS, most medical schools reported use of community-based learning, multi-disciplinary team-based learning, and problem-based learning, and more than half used e-learning to augment teaching. Most schools also require students to complete a research project.

Inclusion criteria: leadership buy-in for the implementation of EBHC teaching and learning, reliable internet access and access to relevant electronic databases such as MEDLINE and the Cochrane Library, and student and educator access to computer equipment to conduct literature searches.

Exclusion criteria: curricula offered in languages other than English; limited access to internet, computer equipment and relevant databases, no leadership buy-in, less than 50 medical students in student intern year.

Recruitment and enrolment

The lead investigators will approach heads of potentially eligible academic institutions such as those involved with Collaboration for Evidence based Health for Africa (www.cebha.org/) and the Medical Education Partnership Initiative (www.mepinetwork.org/). These include academic institutions in Sub-Saharan Africa. Eligibility will be assessed by the lead investigators through engagement with each institution's medical curricula coordinator and permission will be sought from the head of the institution for the institution to participate in the study.

Allocation / randomisation

The unit of randomisation will be the academic institution (cluster). The allocation sequence will be generated by the Biostatistics Unit at Stellenbosch University using computer generated random numbers. Pre-assessments on EBHC knowledge, skills, attitude and reported behavior will be completed using an online tool before randomisation. The outcome of the pre-assessments will be used to stratify academic institutions so that those with similar performance are grouped together, ensuring a balance of academic institutions related to how well they are doing with EBHC before implementation of the intervention. Randomisation, using block allocation, will take place within each stratum.

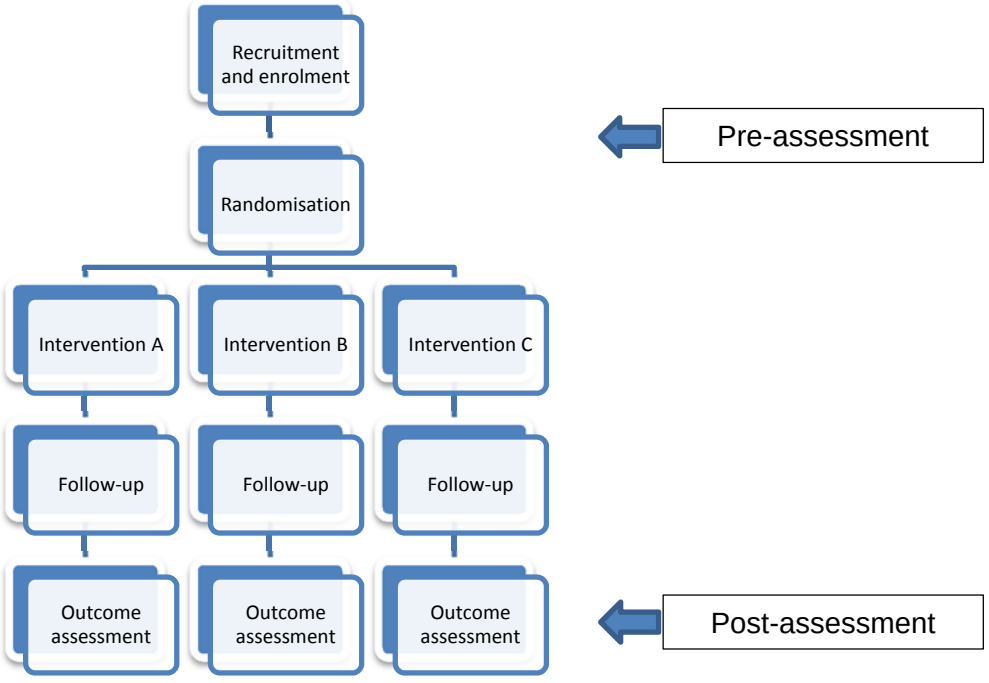


Figure 1. Diagram illustrating trial procedures

Intervention

Within each institution, the intervention will be implemented within the final year of medical training (student intern year) in a specific clinical rotation. The same clinical rotation will be used at all sites. The choice of the clinical rotation will be informed by discussion and consultation with sites before the trial.

As academic institutions are starting to implement EBHC learning, the 'standard of practice' is evolving across Africa. For this reason, three strategies A, B and C for clinically integrated interactive teaching and learning of EBHC (Table 1) will be evaluated. Each will have the same minimum core package with the same objectives and learning outcomes. The focus will be on phrasing treatment questions and then finding, appraising, interpreting and considering the findings from a systematic review. The strategies have been informed by the critical success factors identified by programme convenors, who have successfully implemented multifaceted integrated EBHC teaching and learning strategies [4], while being mindful of challenges raised by local educators – especially the lack of time and clinical workload. Strategy A will include team teaching with small group tutorial sessions, strategy B will include clinician led teaching and explicit bedside learning, and strategy C will include EBHC staff led teaching with online discussions.

Table 1: Summary of interventions

Intervention	A	B	C
Faculty development on EBHC and how to facilitate clinically integrated EBHC learning	Yes	Yes	Yes
Enabling competencies	Yes	Yes	Yes
Core competencies	Yes	Yes	Yes
Educators	Team teaching	Clinician	EBHC facilitator
Clinical integration	Yes	Yes	Yes
e-resources	Yes	Yes	Yes
Small group tutorial sessions	Yes	No	No
Explicit bedside learning	No	Yes	No
Synchronous online discussion	No	No	Yes
Assessment / task	Yes	Yes	Yes

The differences in the strategies being evaluated will be related to the educators and the delivery strategies used (Table 1). In Young 2015 [4], we categorized staff involved in facilitating EBHC learning into the core EBHC team, clinical lecturers and clinicians working in the clinical setting. Clinical lecturers are typically academics with postgraduate qualifications in clinical epidemiology or epidemiology and an interest in EBHC. Clinicians are those working on the wards and the core EBHC team are typically trained in EBHC, experienced in conducting systematic reviews and other research, and drive the EBHC implementation process.

- In *strategy A* students will have a small group tutorial session at the start of the 5 week period facilitated by a team consisting of a clinician lecturer and a facilitator with EBHC experience from the core EBHC team. This session will introduce the learning outcomes for the 5 weeks and will recap key approaches to be used. The team of educators will be available both online and face: face during the 5 week period to answer queries students may have. In week 5, students submit the assessment online to the team for evaluation.

- In *strategy B* students receive introduction to the learning outcomes in an email. Clinicians working in the clinical environment explicitly link EBHC learning to teaching at the bedside and are available to answer queries students may have. In week 5, students submit the assessment online to the clinician for evaluation.

- In *strategy C* students receive introduction to the learning outcomes in an email. They have access to an EBHC facilitator from the core EBHC team using the online platform or by email. At the end of week 3 there is an online synchronous discussion session with students and the EBHC facilitator touching base on their progress and answering any queries they may have. In week 5, students submit their assessment online to the EBHC facilitator for evaluation.

The core package will include faculty development, coverage of enabling competencies and similar core competencies with access to dedicated online resources and an assessment.

- Faculty development: If integrated teaching of EBHC is to be successful, educators need a sound understanding of EBHC, knowledge and skills to practice EBHC themselves; as well as to be familiar with different approaches to teaching EBHC. Educators involved with teaching students will therefore be offered specific faculty development on both EBHC and teaching and learning strategies. This will be done in a series of workshops and EBHC content will be the same as that to be covered by the students.

- Enabling competencies: All students will receive teaching to build their foundational knowledge on the relevance of EBHC and its approaches, basic epidemiology and biostatistics, searching skills and the approach to critical appraisal. This will be done over a 2 week period by a core team. They will use lectures, small group tutorials and practical interactive sessions on how to search. Formative assessments will include multiple choice and short questions. Table 2 details the enabling competencies.

- Core competencies: The core competencies will be the same for all strategies – the ability to identify an area of uncertainty in the clinical setting related to treatment and phrase a clear question, search for a systematic review, appraise and interpret its findings, and consider the application of the findings to the patient (Table 3). Teaching and learning will take place over a 5 week period when the students are doing a clinical rotation. All students will have access to a package of online resources to support their learning. This will include approaches to help them phrase questions and develop a search strategy, readings on systematic reviews and appraisal and interpretation, and guidance on what to consider when applying evidence. All students will complete an individual written assessment (a critically appraised topic) which will detail the clinical problem they identified, their question and approach to searching, the appraisal and interpretation of the systematic review, and a summary of their application considerations. This will be submitted at the end of the 5 week period.

Table 2. Enabling EBHC competencies

EPIDEMIOLOGY

- Knows the value of research to clinical practice
- Knows the benefits and weaknesses of different quantitative study designs to address different clinical questions - cross-sectional (questions on burden of disease and diagnostic accuracy); cohort studies (questions on prognosis and risk factors); case-control (questions on risk factors and harm); randomised controlled trials (questions on effects of interventions) and systematic reviews
- Describes what is meant by: Systematic error (selection and measurement bias); Random error (chance); confounding; Internal validity and external validity
- Describes sources of bias and strategies to overcome them
- Describes different approaches to sampling
- Describes strategies to reduce the risk of confounding
- Describes methods of randomization

BIOSTATISTICS

- Recognises different types of data: Categorical (ordinal, nominal, dichotomous); Continuous
- Interprets descriptive statistics
- Interprets simple tabular presentations: 2x2 table, frequency table, frequency distribution
- Interprets graphical presentations: bar chart, histogram, pie chart, scatter plot, box plot
- For studies evaluating diagnostic accuracy, estimates the characteristics of a test and sample: sensitivity, specificity, likelihood ratios (positive and negative), prevalence, positive predictive value, negative predictive value
- Describes what is meant by: prevalence, cumulative incidence, incidence rates
- Interprets measures of treatment impact: odds ratios, risk ratios, rate ratios; absolute risk reduction; absolute benefit increase; relative risk reduction; relative benefit increase; number-needed to treat; number needed to harm
- Knows when to use and able to interpret (but not calculate) specific hypothesis tests
- Interprets and explains confidence intervals
- Knows what is meant by: Type I error; Type II error; power; sample size

PRINCIPLES OF SEARCHING ELECTRONIC DATABASES

- Knows which databases to search
- Identify appropriate search terms
- Use appropriate limits (e.g. age, gender, publication type)
- Use Boolean operators correctly
- Combine search concepts in final search strategy
- To access and find electronic journals and full text articles

Table 3. Core EBHC competencies – effects of interventions

1. ASK
    a. Identifies knowledge gaps
    b. Translates clinical uncertainty into an answerable question
    c. Formulates focused answerable questions using the PICO(t) format (Patient, exposure/intervention, comparison, outcome, time) when faced with an uncertain situation
    d. Recognises and formulates different types of clinical questions: therapy; harm; aetiology; prognosis; diagnosis
    e. Identifies the best study design for each type of question

2. ACCESS
    a. Identifies and understands the best sources of evidence for each type of question
    b. Describes the "hierarchy of evidence" as it applies to different types of questions
    c. Designs a search strategy relevant to the question
    d. Identifies appropriate databases
    e. Searches effectively and efficiently in MEDLINE, the Cochrane Library, and other relevant databases

3. APPRAISE
    a. Appraises systematic reviews for validity
    b. Interprets the research findings
    c. Translates outcomes into meaningful summary statistics

4. APPLY
    a. Knows the approach to assess applicability and generalizability of research findings in clinical practice

Follow-up

Before randomisation, each participant will complete the pre-assessment of EBHC knowledge, skills, attitude and reported behaviour (baseline) using an online data collection tool. The intervention will be implemented for an academic year because small groups of students usually rotate through the clinical rotations over a period of a year. Post-assessments will take place immediately after completion of the clinical rotation, and 3 months later. We will keep track of number lost to follow-up and reasons, as well as the number who discontinued the intervention and why. Figure 2 illustrates the follow-up per study arm. Details on the data collection procedures are detailed below in the section on data collection, management and analysis.

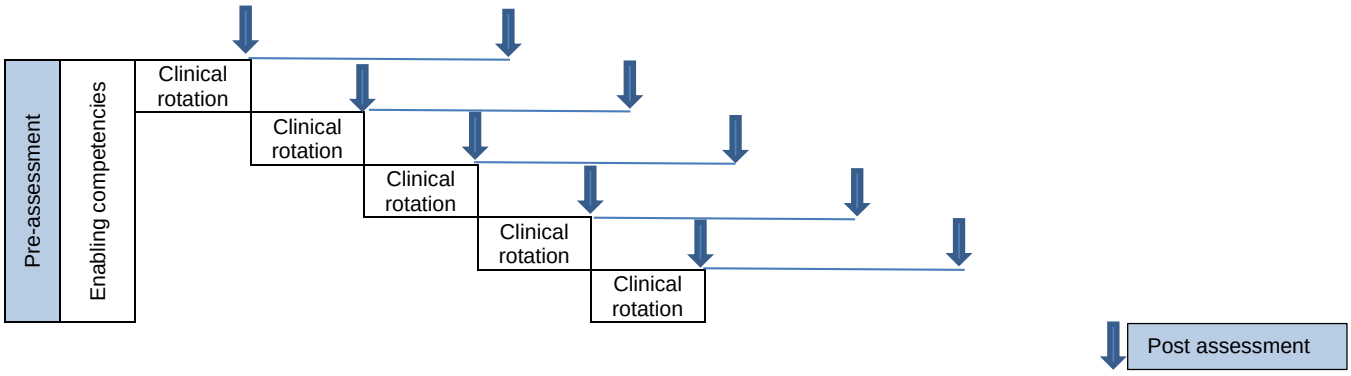


Figure 2. Diagram illustrating follow-up per study arm

The clinical rotations are typically 5 or 6 weeks long. Adherence to the interventions will be assessed through monitoring of attendance of small group turorial session (strategy A), rollcall while in the clinical setting (strategy B) and participation in the online discussion (strategy C). Furthermore, usage of the online resources and participation in assessments will be tracked as each student has a unique student number and log in code for the online platform.

Outcomes

Primary outcomes will be EBHC knowledge, skills and attitude. Secondary outcomes will include EBHC behaviour, process outcomes such as satisfaction of students and educators, learner assessment performance and learner experience.

Blinding

With the nature of an educational intervention it is not possible to blind the participants or the educators. Outcome assessors will be blinded to the group that participants were allocated to, to ensure objective evaluation of the pre- and post-intervention assessments. Outcome assessors will be asked to indicate if they believe that they became aware of the intervention implemented at sites, because by the nature of a cluster trial, if a single participant at a site is unblinded to the assessor, this reveals the allocation for all the participants at that site.

Sample size

The approximate class size varies across medical schools in Sub-Saharan Africa (Table 4). A sample size of 6 clusters per intervention group with 50 individuals per cluster achieves 80% power to detect a difference of 10 points in the Fresno score between the group means [8] [9] at 0.05 significance level, assuming the standard deviation of the outcome is 12 and the intracluster correlation is 0.2.

Table 4. Examples of number and average class size of Public Medical Schools in Sub-Saharan Africa http://www.samss.org/schools.aspx?medschools (accessed 3 October 2015)

Country	Number of medical schools	Average approximate class size
Cameroon	3	119
Botswana	1	36
Ethiopia	10	80
Ghana	2	101
Kenya	3	75
Malawi	1	55
Mozambique	0	-
Namibia	1	10
Nigeria	21	117*
Rwanda	1	90
South Africa	8	136
Tanzania	1	201
Uganda	3	72
Zambia	1	50
Zimbabwe	1	103

*Based on school with information on class size

Data collection, management and analysis

Baseline data and pre-assessment will be done using an online data collection tool before the intervention is implemented, and post assessment data collection will take place at the end of the clinical rotation and 3 months later using the same tool.

The data collection tool for pre- and post assessment will include questions to assess EBHC knowledge, skills, attitude and behaviour. EBHC knowledge and skills will be assessed using the validated Fresno test [9] which includes 12 questions. EBHC attitude will be assessed using Likert-scale questions (Table 5) [10]. EBHC behaviour will be measured by self-reported behaviour changes e.g. amount of questions formulated, amount of searches done (Table 5). Satisfaction of students and educators, and learner experience, will be measured with Likert-scale questions post-training, and open-ended questions yielding qualitative data.

Table 5. Examples of questions which will be used to assess EBHC attitude and behaviour

EBHC attitude

Read the following statements and rate each on a scale of 1 to 5:
1: strongly disagree; 2: disagree; 3: don't know; 4: agree; 5: strongly agree

a. EBHC is realistic to practice in routine patient care.
b. Literature searches are too time-consuming to do in a clinic.
c. My questions can be answered faster when referring to a textbook or a consultant, than performing the steps of EBHC.
d. All types of studies are of equal value to me.

EBHC behaviour

Answer the following questions by choosing the most appropriate option from 1 to 5:
1: never; 2: rarely; 3: most days; 4: daily

a. In the past 2 weeks, how often did you conduct searches in response to a patient in clinical practice?
b. In the past 2 weeks, how often did you critically appraise evidence in relation to patient care?

The online data collection tool will be available in English. Once completed and submitted, the data are exported into an Excel spreadsheet. All data will be checked for completeness. Each participant will have a unique identification number and data will be stored in a password protected file and backed up on an external hard drive which will be kept in a locked cupboard. The cluster approach was chosen to reduce the risk of contamination (i.e. the unintended delivery of one intervention to the participants in a different group), which often limits individual randomisation in educational research.

Data analysis will be conducted with STATA using pre-planned analysis of multiple comparisons comparing strategy A versus B, A versus C, and B versus C. Data for the various outcome measures will be presented as means with 95% confidence intervals. Responses to the baseline and post- assessments will be scored for each outcome, and comparisons between the 3 intervention groups made. A two-sided significance level of 0.05 will be used. For continuous, normally distributed outcomes, repeated measures ANOVA testing will be used to compare the rate of change in scores over time between

groups. A significant time*group interaction effect according to the Wilk's lambda statistic will indicate differential rate of change over time between the groups, i.e. treatment effect. Profile plots will be generated to assess the direction of the effect and trends shown in the data.

Piloting

The data collection tool will be piloted and refined based on feedback, before it is used in the trial. This will be done by administering the tool to individuals similar to the target participants.

Ethics and dissemination

Each participating academic institution must provide approval for the study. Participants will be informed about the purpose of the study and will be asked to provide written informed consent for participation in the study, and for using and disseminating the anonymous information provided by them. The proposed study will be submitted for Ethics approval and prospectively registered with the Pan African Clinical Trials Registry (www.pactr.org).

Should individual students not provide consent, they will still receive the allocated intervention as part of their rotation, including the assessment, but will not be asked to provide initial or follow-up data.

The findings of this study will be presented to the participating academic institutions, and results will be published in peer-reviewed journals and will follow the CONSORT reporting guideline. The findings will also be presented in platforms where EBHC teaching and learning is of relevance.

Discussion

With the progress in evaluation of EBHC educational strategies, and considering the current body of evidence [3], the question is no longer about comparing one strategy to no intervention, but about comparing active, alternative educational interventions through comparative effectiveness studies. These are vital to advancing knowledge and understanding of what works, for whom and under which circumstances.

Various academic institutions are grappling with the implementation of EBHC teaching and learning to medical professionals in training. Of all strategies, multifaceted clinically integrated strategies with assessment are the most effective in increasing EBHC knowledge, skills and attitudes. It is however unclear what the core components of these strategies are. Therefore, this cluster randomised controlled trial will evaluate three strategies for multifaceted clinically integrated teaching and learning. Key aspects to consider in clinically integrated teaching and learning of EBHC relate to the educator, the learner, their engagement and the educational and healthcare context within which they are based. The focus in this study is on different educator roles and their involvement, and the teaching and learning methods used.

Having the 'right' educators and positive role modelling emerged as critical success factors for clinically integrated teaching and learning of EBHC [4]. Educators' role are influenced by factors such as competing priorities, limited time, and their own confidence in practicing and facilitating learning of EBHC. In this study different educator roles will therefore be assessed. Explicit teaching facilitated at the bed side by clinicians in the clinical setting is regarded by many as the 'gold standard' for EBHC learning [11]. This is dependent on the

clinicians' confidence in practicing and teaching EBHC, and also the health sector context. Team teaching presents an alternative. Through combining clinical lecturers and core EBHC staff, teaching is strengthened through the combination of complementary backgrounds and roles which can facilitate linkage between EBHC and clinical expertise. Often however, the reality in many academic institutions is that clinicians and clinician lecturers are too busy (with clinical loads and competing priorities), have limited capacity to teach EBHC and the teaching is done by the core EBHC staff. As EBHC staff do not usually have access to students in the clinical setting, e-learning strategies can be used to augment engagement.

Various approaches ranging from experimental to observational to qualitative studies can be used to evaluate educational interventions [12]. The best approach for evaluating educational strategies depends on the question to be answered. For questions on the effects of health professional education strategies, despite the complexity of educational environments, robust RCTs are the best approach to use [6]. Randomisation minimises the risks of selection bias and confounding, and the risk of contamination can be minimised through the use of clusters instead of individuals as the randomisation unit. However, care needs to be taken to ensure that small sample sizes, and thus underpowered studies with a higher likelihood of type II error (failing to find a statistically significant difference when in fact a difference does exist) do not undermine the research.

There are some potential limitations of the study outlined here. As small groups of students usually rotate through the clinical rotations over a period of a year, the intervention will be implemented over an academic year. There may thus be variation, linked to educator and learner practices, between rotations within a particular cluster. Implementation of the interventions may be hampered by instability of the online learning management systems related to internet disruptions, clinical workloads and competing priorities on the part of educators, educators changing employment, and situations such as political or student protests which may disrupt academic programmes.

The findings of this study have the potential to inform the implementation of multifaceted clinically integrated EBHC learning within medical curricula, especially considering the various roles of educators. This foundation could then be built on further to support EBHC learning throughout the curriculum.

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Chapter 7: Discussion

EBHC is recognized as key to the implementation of sound healthcare practice [1, 2]. Initiatives to promote EBHC internationally, and in the African region, are increasingly common and there is general acceptance of the need to facilitate learning of EBHC among healthcare professionals in training. In doing so, it is important to keep in mind that EBHC is about informing patient care with the best available research evidence [3, 4]. This is captured aptly by Glasziou and Haynes [5] in the term 'bedside' EBHC.

Research in this area up to now has generally focused on whether to teach EBHC or not, and this PhD moves beyond that. The research evidence generated as part of this PhD (Box) examines how the teaching and learning of EBHC can best be integrated in training of medical students to enhance student EBHC knowledge, attitude and skills; leading to a proposed study to compare different teaching and learning strategies.

Box: The PhD research contributed to the current knowledge in a number of ways

The overview brought together a critical summary of multiple systematic reviews in one place and showed that teaching and learning strategies to enhance these competencies need to focus on implementing multifaceted clinically integrated approaches with assessment. It included innovative mapping of primary studies against systematic reviews to identify potential overlap between reviews and thus avoid double counting.

Implementation of clinically integrated EBHC teaching and learning was further explored through interviews with programme coordinators from around the world who shared approaches used, barriers and facilitators encountered with programmes aimed at teaching and learning EBHC in an integrated manner. Through this original study critical success factors for programme implementation were identified.

The comprehensive curriculum assessment at SU using document reviews, survey of recent graduates and interviews with key faculty, allowed for a clear assessment of the current opportunities for, and potential barriers to, teaching EBHC. This original assessment provided a clear map of what is covered in the curriculum, when it is covered and what the gaps are. Novel approaches, drawing on methods for doing systematic reviews, were used to conduct the document reviews of the curriculum.

To further explore the key role of educators a cross sectional survey was conducted to assess SU educators' knowledge, attitude and practices related to both practicing and teaching EBHC. Despite the low response rate this survey showed that even for those with high levels of self-reported knowledge and understanding of EBHC, adequate support, training and development, and an enabling environment, are important for educators to be the role models future healthcare professionals need.

Drawing on the findings of both the quantitative and qualitative studies, which captured perspectives of various role players, while considering the context of EBHC initiatives in the African region, the thesis concludes with an outline proposal for implementation of clinically integrated EBHC and a rigorous evaluation using a cluster randomised controlled trial.

Summary of thesis findings

The research conducted as part of the PhD set out to provide answers to how the teaching and learning of EBHC can best be integrated in undergraduate medical training at SU to enhance student EBHC knowledge, attitude and skills. In addressing this, various sub-questions were considered.

What are the effects of teaching EBHC to health professions at under- and postgraduate levels? The overview of systematic reviews on the effects of teaching EBHC to health professionals and students in training found that clinically integrated multifaceted teaching and learning with assessment were most effective to enhance knowledge, attitude and skills. Multifaceted interventions, with combinations of methods including lectures, computer lab sessions, small-group discussions, journal clubs, use of real clinical issues, and portfolios and assignments, were more likely to improve knowledge, skills and attitude than single interventions or no interventions. The focus of the included systematic reviews was on EBHC knowledge, skills, attitudes and behaviour as outcomes, especially in the short term, rather than assessing practice outcomes. These outcomes were in line with three of the four recommended Kirkpatrick's levels (reaction, learning and behaviour), which are widely accepted for assessing training programme outcomes. It was however unclear what the minimum components for multifaceted interventions were, what their impact was in the medium to long term, and how best to implement these interventions.

What are the approaches used to clinically integrate EBHC teaching and learning in medicine and health science programmes, nationally and internationally, and what are the barriers and facilitators in teaching and learning EBHC in an integrated manner? To further understand the implementation of clinically integrated EBHC teaching and learning, interviews with programme coordinators, both internationally and nationally who have successfully implemented, or who have attempted and failed to implement, clinically integrated EBHC teaching and learning, gathered data on the approaches used to clinically integrate EBHC teaching and learning, and the barriers and facilitators encountered in teaching and learning EBHC in an integrated manner. Programme coordinators reported that the implementation of clinically integrated teaching and learning of EBHC takes a lot of time. Many programmes did not have full integration of EBHC learning in all clinical rotations. Typically, learning started in pre-clinical years through the use of real clinical scenarios and subsequently was consolidated through application to real patient settings and assessment within the clinical years. Participants highlighted that the EBHC curriculum content should cover the full spectrum of EBHC and not be focused on critical appraisal only. On-going curriculum revision and renewal occurred before integration became 'business as usual'. Medical curricula are however typically organised around disciplines and this is often a barrier to integrating cross-cutting issues such as EBHC. Participants therefore proposed a holistic approach to curriculum renewal, recognising that this might require a change management process. Critical success factors were adopting a pragmatic approach and being ready to use opportunities for engagement and for fitting EBHC learning within the curriculum, patience, and a critical mass of the right teachers who have EBHC knowledge, attitudes and skills and are confident in facilitating the learning. Role modelling within the clinical setting emerged as a critical facilitator. The institutional context has an important influence on what is possible. Faculty buy-in, endorsement by institutional leaders and having an EBHC culture, together with a community of practice, create an enabling environment. By far the most common challenges were lack of space in the clinical setting, EBHC misconceptions, resistance of staff and lack of confidence of tutors, time, and negative role modelling.

What are the opportunities for, and barriers to implementing EBHC in the MB,ChB clinical rotations at SU? A set of quantitative and qualitative studies of EBHC teaching and learning at Stellenbosch University's Faculty of Medicine and Health Sciences were conducted to determine the opportunities for, and barriers to, implementing EBHC teaching and learning. The approach included a document review of the curriculum, a survey with recent graduates and interviews with faculty. EBHC teaching was found to be fragmented and concentrated in the first and last phase of the six year medical curriculum. Recent graduates, despite 86% indicating in responses to Likert questions that EBHC teaching was adequate, repeatedly raised lack of EBHC knowledge and skills in open ended questions, leading us to believe that EBHC teaching at SU is actually less than adequate. This discrepancy in results shows the richness and informativeness of qualitative data when compared to the quantitative data, and the limitations of Likert-scale questions. Respondents emphasised the lack of knowledge of biostatistics, epidemiology and critical appraisal as well as the lack of effective searching skills. They identified lack of access to literature as the main challenge when practicing EBHC. Other challenges included time constraints, work-overload, lack of EBHC skills, lack of self-motivation, application of evidence and the work environment. Focus groups and individual interviews with module convenors responsible for theory and clinical modules, and from various disciplines, found that interviewees felt that EBHC teaching and learning were not optimal and indicated varying support for enhancing this. They identified a number of factors that need to be addressed such as contextual factors within the faculty (e.g. recognition for teaching), health sector issues (e.g. clinical workload), access to research evidence, and issues related to educators (e.g. competing priorities) and learners (e.g. motivation). The interviewees emphasised the key roles of educators as facilitators and role models. Planning together to identify opportunities to integrate teaching and assessment, while ensuring coherence, having clear and explicit outcomes and promoting faculty development were regarded as central to strengthening EBHC teaching and learning.

What are SU educators' confidence in practicing and teaching EBHC, their attitude to EBHC, and the perceived barriers to practicing and teaching EBHC? A cross-sectional survey at the FMHS evaluated the roles of educators as facilitators of learning and role modelling, especially in the clinical setting and the perceived barriers to practicing and teaching EBHC. Forty two (19%) educators from various departments responded. They had high levels of knowledge and understanding of EBHC. Many had received training in teaching and learning approaches, but EBHC training received had mainly been on enabling competencies such as epidemiology and biostatistics. Limitations to practicing EBHC included lack of time, clinical workload, limited access to internet and resources, knowledge and skills. One quarter of the respondents indicated that they teach EBHC. Respondents' suggestions for support for EBHC teaching included reliable internet access, easy point-of-care access to databases and resources, increasing awareness of EBHC, building capacity to practice and facilitate learning of EBHC, and a supportive community of practice.

Can these findings be used to inform clinically integrated EBHC teaching and learning in the African region? With increasing regional EBHC initiatives, and commitment from various institutions that 'Evidence based healthcare is integrated into health education curricula' (Kigali declaration) [6], academic institutions can benefit through working together, sharing best practices and using robust evaluations alongside implementation, to learn from their experiences. The overview of systematic reviews found that multifaceted, clinically integrated teaching and learning strategies with assessment is the best approach to use. Results from the mixed methods studies show various barriers to be mindful of and success factors to draw on. Of these, the key role of competent and confident educators in

facilitating learning, a supportive community of practice, the need for working pragmatically within the context of the health and academic sector, faculty buy-in and endorsement by institutional leaders were key areas. A regional randomised controlled trial is thus proposed which will evaluate the effects of strategies for implementing clinically integrated teaching and learning of EBHC on EBHC knowledge, skills and attitude of undergraduate medical students at academic institutions that offer medical training. Institutions will be randomised to receive one of three different strategies defined by type of educator and delivery method, in a multifaceted approach to achieve integrated interactive teaching and learning of EBHC. The findings of this study will contribute to the evidence-base to inform implementation of EBHC learning within medical curricula in the African region.

Comparison with findings of previous research

The issues related to integrated EBHC teaching and learning are not unique but are similar to those identified in the integration of cross cutting themes such as ethics [7] and inter professional education [8]. The educational approach of laying the foundation in the early years of the curriculum and building on this through application, learning by doing, within clinical modules, offers the best strategy for teaching EBHC [2, 9]. The conceptual framework for integrated teaching and learning of EBHC, developed following semi-structured interviews with EBHC programme coordinators from around the world, centres around the engagement between the learner and the teacher within the institutional and healthcare context. Importantly, in designing and evaluating EBHC learning activities, being clear on who the learners are, and what their needs, background, prior knowledge and learning styles are, guide relevant teaching and learning strategies to use as well as assessment [10] and evaluation techniques [11, 12]. Within the educational and healthcare context, the critical success factors institutional buy in, faculty development and retention, joint planning, and having a supportive community of practice, resonate with the broader transformative approaches to build a competent needs based healthcare workforce in low and middle-income countries [13-15].

The barriers and facilitators to EBHC teaching and learning to medical students (pre-service level) identified in this thesis, correspond with those found by others in different settings. Oude Rengerink and colleagues [16] examined teaching EBM in clinical practice (as part of continuing education) in various European countries and found lack of teaching time and lack of EBHC requirements in curricula as key barriers, and train the trainer initiatives and access to relevant databases as the key facilitators. Dans [17] and Del Mar [18] highlight the lack of role models in the clinical setting as an important limitation which could be overcome over time through postgraduate EBHC programmes and train the trainer initiatives. Through interviews with undergraduate medical students, Ilic [19, 20] found that demonstrating applicability to clinical disciplines and mentorship are key facilitators while lack of application by senior clinicians was a main barrier. In a South African study at another academic institution, McInerney et al [21], using quantitative methods, also found that perceived barriers to the use of EBHC included workload, competing priorities and lack of EBHC knowledge. A study among nurse educators in the United States [22] likewise highlighted the need for faculty development to have competent lecturers facilitating the teaching and learning of EBHC. The importance of contextual factors – both at faculty and health system level - in the planning, implementation and evaluation of teaching and learning strategies is borne out by previous work [23]. It is recognised that integrating a curriculum is a complex process [24].

Faculty development initiatives are known to enhance EBHC knowledge, attitude and skills of educators [25], confidence in facilitating the learning in the classroom and at the bedside

[26, 22], and ability to be positive role models [27]. Key features of effective faculty development [28] correspond with those identified for effective EBHC teaching and learning [29] – using multiple instructional methods, experiential learning and reflective practice, individual and group projects, supportive communities of practice, mentorship, and institutional and leadership support. Change management, in itself a complex issue, is imbedded in faculty development and in curriculum renewal.

Practicing EBHC is limited by, amongst other factors, the availability of relevant robust research into the effectiveness of different strategies [4]. This may be due to lack of relevant studies, poor methodological standards, lack of publication or poor reporting of research [30]. This is not just a local or regional phenomenon [31] but is especially prominent in the African region. Although there has been an increase in research productivity in Africa [32], in 2014 only 1.3% of worldwide health research publications were co-authored by researchers resident in African countries. There are several reasons for this at the moment - the lack of sustained investment in research and research capacity building, lack of priority setting, and a lack of alignment between available research funding and national and regional priorities [33]. Therefore to enhance EBHC in the region, the focus cannot only be on teaching and learning of EBHC (thus increasing the use of research evidence), but also on promoting and advancing the conduct and dissemination of regionally relevant research in general [34].

Various other factors influence evidence based practice – a lot of which goes beyond teaching and learning of EBHC, and availability of relevant robust research. In the mixed methods studies, in addition to limited EBHC knowledge and skills, factors such as access to resources, hierarchical structures, resistance to change, heavy clinical workloads, and limited time were raised. These barriers to evidence based practice can be classified into individual and institutional level factors. Enhancing teaching and learning of EBHC, which focuses on the individual level, will build competence and confidence to practice in an evidence-informed way which is just one piece of the complex web of factors contributing to good clinical practice.

Strengths of this PhD project

The research evidence generated as part of this PhD project contributes to the knowledge base regarding the integration of EBHC as a core competency in undergraduate medical education. Most of the research in this area to date has focused on whether to teach EBHC or not, rather than on how best to teach and learn EBHC, and has been concentrated in high income settings [35, 36]. There is a lack of research from low and middle income countries which face challenges with high burden of disease, overloaded healthcare systems, lack of resources, challenges with healthcare staff and academic faculty retention, lack of alignment of research and needs, and high student numbers [13].

Aligned with the pragmatic paradigm [37], this PhD project used mixed methods combining both quantitative and qualitative research methods. This had the advantage of being able to answer different types of research questions and using qualitative methods to augment what was learnt from quantitative studies. All sub-studies had pre-specified protocols, were submitted for ethics approval, were implemented following the protocol and then reported in accordance with research reporting guidelines.

The foundation for the work was laid by an overview which employed robust methods to examine the effects of strategies to teach EBHC. The overview brought together a critical summary of multiple systematic reviews in one place and used this to guide new research

[38]. The methods followed aimed to reduce selection, language, publication and indexing biases [39, 40]. A comprehensive search, without language limitations, was conducted in various electronic databases, and efforts were made to identify both on-going and unpublished systematic reviews. Additional searches were conducted to resolve discrepancies related to the studies included in the systematic reviews. Two reviewers independently applied pre-defined eligibility criteria to select systematic reviews for inclusion, extracted data and evaluated the methodological quality of each included systematic review. To avoid double counting of primary studies included in the systematic reviews the overview included a matrix mapping primary studies to systematic reviews. This clearly showed the current overlap of primary studies and also provided a description of the participants, interventions and location of the primary studies highlighting the absence of such studies from low and middle income countries. The overview identified strategies which work and provided direction for further studies on how to implement EBHC teaching and learning. Subsequently, we identified three new systematic reviews [41-43] in an updated search covering the period 2013-2015. The new systematic reviews were mapped to the matrix of the overview of systematic reviews to include both the new systematic reviews and the studies included within these reviews. It was useful to examine whether these reviews have added to the evidence or merely duplicated the previous work. Ahmadi 2015 [41] included 27 studies of which only one study was new to what the overview already included, Ilic 2014 [42] included 9 studies of which 4 RCTs on single interventions were new to the matrix and Rohwer [43] included 22 RCTs of which 13 were new to the matrix.

To further inform the implementation of clinically integrated teaching and learning of EBHC a qualitative study, using semi-structured interviews, was conducted with international programme coordinators. This allowed for deeper enquiry into the successes and challenges, as well as critical success factors, in implementing clinically integrated EBHC teaching and learning. Strengths include the international scope of the participants who are linked to institutions in various regions, and the trans-disciplinary nature of the research team with postgraduate academic backgrounds in medicine, nursing, evidence-based health care, public health and higher education. The lead researcher, with a background in public health and EBHC, conducted all the interviews and led the coding after the lead researcher and two other researchers, with different backgrounds, discussed and finalised the code book. Even though contextual factors, such as the culture of EBHC, change over time and barriers from 15 years ago might have reduced over time, this qualitative study sheds further light on both potential barriers and facilitators to the implementation of clinically integrated teaching and learning of EBHC. It adds to the knowledge base by sharing experiences and lessons learnt in how to implement clinically integrated EBHC teaching and learning.

At Stellenbosch University, an in depth curriculum assessment combining data from a document review and graduate survey with interviews using focus group discussions and individual interviews with module convenors and key staff at the FHMS, allowed for a clear assessment of the current opportunities for, and potential barriers to, teaching EBHC. The three components together provide a clear map of what is covered in the curriculum, when it is covered and what the gaps are [44]. As the role of educators emerged as a critical factor, a cross sectional survey was conducted to assess SU educators' knowledge, attitude and practices related to both practicing and teaching EBHC. This was one of only a few of such studies conducted in South Africa. Respondents worked across various departments, and despite low response rate, the survey showed that even for those with high levels of self-reported knowledge and understanding of EBHC, adequate support,

training and development, and an enabling environment, are important for educators to be the role models future healthcare professionals need.

Drawing on the findings of both the quantitative and qualitative studies, which captured perspectives of various role players, while considering the context of EBHC initiatives in the African region, the thesis concludes with an outline proposal for implementation of clinically integrated EBHC and a rigorous evaluation using a cluster randomised controlled trial.

Limitations of this PhD project

In seeking perspectives from those who have implemented, or have tried to implement clinically integrated EBHC teaching and learning [45], most participants were involved with medical programmes and very few were involved in other programmes. Even though the experiences and lessons learnt from medical settings seemed to resonate with those reported within other programmes, it would add to the comprehensiveness of the assessment to have perspectives from more non-medical programmes. However, given that the focus of this PhD project is on medical student training, this was adequate for addressing the candidate's research questions. There also might have been differences between countries but we were limited by what was covered in the interviews and a deeper understanding of this would require a more detailed study at institutional and national level.

The other elements in the PhD project focused on studies at one institution in South Africa. The qualitative study at SU which aimed to obtain the perspectives of module convenors did not reflect the views of all lecturers as some invited participants were 'too busy' to participate. It could be that these module convenors have different perspectives from those who agreed to be interviewed. As the PhD candidate is very active in promoting EBHC teaching and learning at the Faculty where the study was done, and the concern that her presence in the interviews might overly influence what the participants were willing to say, the interviews were conducted by trained qualitative researchers. However, because they were not experts in EBHC, potential areas for further probing may have been missed. If this study could be repeated, trained interviewers with experience in EBHC would be used.

The survey of educators at SU had limited the power because of the low response rate, leading to lack of precision. It was not possible to assess associations between confidence to practice and teach EBHC and variables such as attitude and training as with the limited power Type II errors are more likely and all these will have wide confidence intervals. It might also be that those who took part in the survey were not representative of the target population and might be more engaged in EBHC practice and teaching. The non-responders may have different levels of confidence to practice and teach EBHC, their attitude might vary and they could be experiencing different challenges. To assess this we conducted a brief follow-up survey of non-responders, obtaining input from 14 educators. They described EBHC in a similar way to responders and listed lack of time, length of the survey, limited involvement with undergraduate teaching and that EBHC is irrelevant to their practice as reasons for not participating. The survey tried to collect data on multiple aspects – attitude to EBHC, EBHC knowledge, confidence in practicing EBHC, attitude to teaching EBHC, confidence in teaching EBHC, barriers and facilitators to practicing and teaching EBHC – and as a result the data collection tool took long to complete. Considering the various competing priorities of participants, if this survey should be repeated, it would be shorter, and focused on a specific component.

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Chapter 8: Conclusion and recommendations

Research conducted as part of this PhD project adds to the knowledge base on how to teach EBHC. This is an important issue many academic institutions are, and should be, grappling with. Clinically integrated multifaceted teaching and learning strategies with assessment are most effective to enhance EBHC knowledge, attitude and skills compared to single interventions or no interventions. Implementing such curricula requires institutional support, a critical mass of the right teachers and role models in the clinical setting, and most of all patience, persistence and pragmatism. In enhancing EBHC teaching and learning, contextual factors within the academic institution (e.g. recognition for teaching), health sector issues (e.g. clinical workload), access to research evidence, and issues related to educators (e.g. competing priorities, limited knowledge and skills) and learners (e.g. motivation) must be considered.

Implications for practice

Teaching and learning strategies to enhance EBHC competencies should focus on implementing multifaceted clinically integrated approaches with assessment. Learning should start in the pre-clinical years through the use of real clinical scenarios and be consolidated with application to real patient settings and assessment within the clinical years. The EBHC curriculum content should cover the full spectrum of EBHC. Working together, adopting a pragmatic approach and being ready to use opportunities for engagement and for fitting EBHC learning within the curriculum, patience, a critical mass of the right teachers with role modelling within the clinical setting and a supportive enabling environment are critical success factors.

Implications for further research

It is important that future research, primary or secondary, carefully considers the questions to be addressed and refines these, based on existing evidence to avoid unnecessary duplication.

Future studies and systematic reviews should focus on minimum components for multifaceted interventions, assessment of EBHC knowledge, attitude, skills and behaviour in the medium to long term, using validated assessment tools, and how best to implement these interventions. One such study is outlined in chapter 6 (section 6.2).

Existing studies provide no consensus on what the minimum curriculum requirement and standards are for health professionals in training compared to postgraduate studies. There is therefore a need for research to define and outline this and to standardise formative and summative assessments.

Further evaluation should consider the effectiveness of e-learning and the influence of various teaching and learning settings and the context within which teaching takes place.

Adherence to rigorous methodological approaches and good reporting practices are important to ensure a contribution to evidence informed decisions on the teaching and learning of EBHC.

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Appendix 1: Graduate attributes, Stellenbosch University

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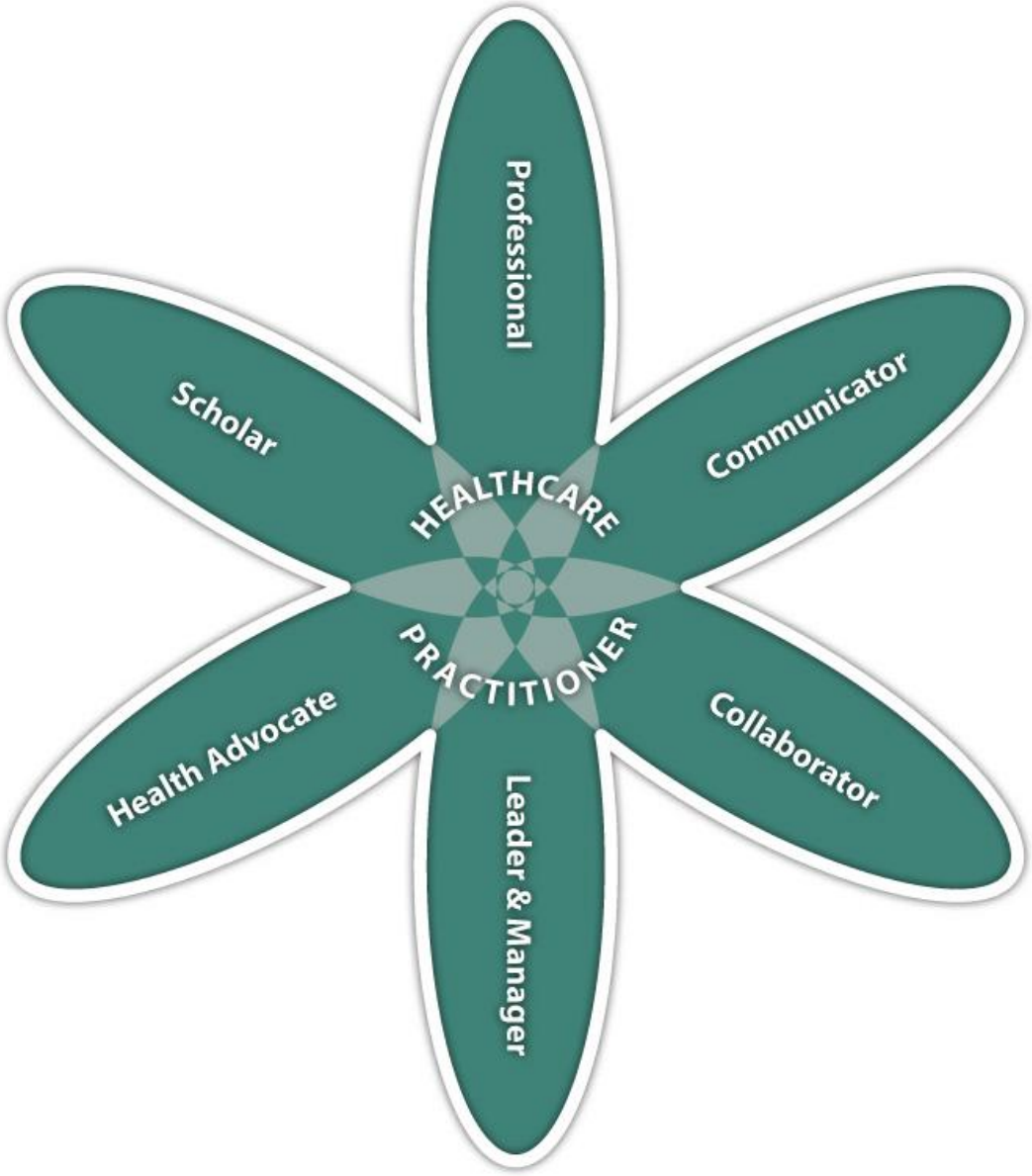
Graduate attributes*
for undergraduate students in teaching and learning programmes at the Faculty of Medicine and Health Sciences



Version: July 2013

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1 ROLE: HEALTHCARE PRACTITIONER

As *healthcare practitioners*, healthcare professionals integrate all of the graduate attribute roles, applying profession-specific knowledge, clinical skills and professional attitudes in their provision of patient/client-centred care. The *healthcare practitioner* is the central role in the framework of graduate attributes.

1.1 KEY COMPETENCY

Function effectively as entry-level healthcare professionals, integrating all graduate attribute roles to provide optimal, ethical, comprehensive and patient/client-centred care in a plurality of health and social contexts.

1.1.1 ENABLING COMPETENCIES

a) Perform a consultation or facilitate a structured clinical encounter effectively, including thorough documentation of assessments and recommendations.

b) Identify and respond appropriately to relevant ethical issues arising in patient/client care and clinical decision-making.

c) Prioritise professional duties effectively and appropriately when caring for multiple patients/clients and being challenged to address their healthcare needs holistically.

d) Provide compassionate, empathetic and patient/client-centred care.

e) Demonstrate a commitment to work in primary healthcare settings (urban and rural), and find professional and personal satisfaction in it.

1.2 KEY COMPETENCY

Acquire and maintain knowledge, skills, attitudes and character appropriate to their practice.

1.2.1 ENABLING COMPETENCIES

a) Reflect on, integrate, apply and evaluate core knowledge, skills, attitudes and character acquired during undergraduate training in:

i. the application of appropriate writing, numeracy and information technology skills;

ii. natural sciences;

iii. normal human structure;

iv. normal biological, psychological, social and spiritual development and functioning of the individual in the context of family and community;

v. the pattern, aetiology and history of common human disease processes and mechanisms;

vi. physical, psychological, social and spiritual determinants of health and disease;

vii. the principles of drug action and use;

viii. the efficacy of various therapies;

ix. the holistic management of functional and structural impairment, activity limitations and participation restrictions, all with reference to personal and environmental factors;

x. the interdependence between health and education systems; and

xi. the ethical, human rights and legal principles embedded in healthcare.

b) Apply life-long learning skills to keep up to date and to enhance professional competence.

1.3 KEY COMPETENCY

Perform comprehensive assessments of patients/clients.

1.3.1 ENABLING COMPETENCIES

a) Effectively identify and explore issues to be addressed in a patient/client encounter, including the patient/client's context and preferences.

b) Elicit a history of the patient/client that is relevant, concise and accurate to context, for the purposes of disease prevention, health promotion, diagnosis and/or management.

c) Perform a holistic and focused examination that is relevant and accurate, for the purposes of disease prevention, health promotion, diagnosis and/or management.

d) Select appropriate investigative methods in a resource-effective and ethical manner.

e) Demonstrate effective problem-solving and judgement to address patient/client problems, including interpreting data and integrating information to make differential diagnoses and propose holistic management plans.

f) Demonstrate increasing proficiency in clinical decision-making.

1.4 KEY COMPETENCY

Use preventive, promotive, therapeutic and rehabilitative interventions effectively.

1.4.1 ENABLING COMPETENCIES

a) Demonstrate effective, appropriate and timely application of therapeutic interventions.

b) Include prevention and health promotion in management plans.

c) Consider the range of solutions that have been developed for treatment and prevention of health problems, taking into consideration all ages and diverse communities.

d) Formulate and implement appropriate holistic, cost-appropriate and effective management plans in collaboration with patients/clients and their families, emphasising the importance of healthy behaviour and the patient/client's right to choice.

e) Ensure that appropriate informed consent is obtained for interventions and that patients/clients' needs and rights are respected.

f) Appropriately utilise clinical-care and patient/client care guidelines and protocols, and demonstrate the ability to adapt these to local settings.

g) Develop and deliver appropriate follow-up and ongoing care beyond the immediate consultation and short-term management plan.

h) Recognise acute life-threatening emergencies, and initiate appropriate treatment and referral.

i) Take cognisance of the structure, organisation and functioning of the South African healthcare system in compiling the patient/client care plan.

1.5 KEY COMPETENCY

Demonstrate efficient and appropriate use of procedural skills, both diagnostic and therapeutic.

1.5.1 ENABLING COMPETENCIES

a) Demonstrate effective, appropriate and timely performance of diagnostic, therapeutic and rehabilitative procedures.

b) Appropriately document and disseminate information related to procedures performed and their outcomes.

c) Ensure adequate follow-up care and care continuity for procedures performed.

1.6 KEY COMPETENCY

Seek appropriate consultation from other healthcare professionals, recognising the limits of their own and others' expertise.

1.6.1 ENABLING COMPETENCIES

a) Demonstrate insight into own limitations of expertise.

b) Demonstrate effective, appropriate and timely consultation of other healthcare professionals as needed for optimal patient/client care.

2 ROLE: COMMUNICATOR

As *communicators*, healthcare professionals effectively facilitate the carer-patient/carer-client relationship and the dynamic exchanges that occur before, during and after interventions.

2.1 KEY COMPETENCY

Develop rapport, trust and ethical therapeutic relationships with patients/clients, families and communities from different cultural backgrounds.

2.1.1 ENABLING COMPETENCIES

a) Demonstrate a patient/client-centred and community-centred approach in interactions with patients/clients and their families.

b) Practise good communication as a core clinical skill, recognising that effective communication between the healthcare professional and the patient/client can foster patient/client and professional satisfaction, as well as adherence and improved clinical outcomes.

c) Establish positive therapeutic relationships with patients/clients and their families characterised by understanding, trust, respect, honesty, integrity and empathy.

d) Respect patient/client confidentiality, privacy and autonomy.

e) Motivate patients/clients and their families and communities to take personal responsibility for their health.

f) Demonstrate flexibility in the application of communication skills.

2.2 KEY COMPETENCY

Accurately elicit and synthesise relevant information and perspectives of patients/clients and families, communities, colleagues and other professionals.

2.2.1 ENABLING COMPETENCIES

a) Gather information about health conditions and functioning, as well as about a patient/client's beliefs, concerns, expectations and illness experience.

b) Seek and synthesise appropriate information from relevant sources, such as a patient/client's family, community, caregivers and other professionals.

c) Communicate effectively by listening, clarifying uncertainties, probing sensitively, and being aware of, and responsive to, non-verbal cues.

2.3 KEY COMPETENCY

Convey relevant information and explanations accurately and effectively to patients/clients, families, communities, colleagues and other professionals as well as statutory and professional bodies.

2.3.1 ENABLING COMPETENCIES

a) Retrieve patient/client-specific information from a clinical data system.

b) Deliver information to a patient/client and family, communities, colleagues and other professionals in a humane manner and in such a way that it is understandable, and encourages discussion and participation in decision-making.

c) Present well-documented assessments and recommendations effectively in written and/or verbal form in response to a request from another healthcare professional.

d) Compile accurate reports as needed and required for statutory and professional purposes.

2.4 KEY COMPETENCY

Develop a common understanding of issues, problems and plans with patients/clients, families, communities, colleagues and other professionals, to develop a shared plan of care/action.

2.4.1 ENABLING COMPETENCIES

a) Identify and explore problems to be addressed effectively from a patient/client encounter, including the patient/client's functioning, context, responses, concerns and preferences.

b) Respect diversity and difference and the influence of ethnicity, gender, religion, education and culture on decision-making.

c) Encourage discussion, questions and interaction.

d) Engage patients/clients, families, communities and relevant healthcare professionals in shared decision-making to develop a plan of care/action.

e) Effectively address challenging communication issues, such as obtaining informed consent, delivering bad news, and addressing anger, confusion and misunderstanding.

f) Communicate effectively with patients/clients and their families about costs and risks implicit in clinical interventions and care, in order to minimise potential medico-legal issues.

2.5 KEY COMPETENCY

Convey effective and accurate oral and written information about a clinical encounter.

2.5.1 ENABLING COMPETENCIES

a) Maintain clear, accurate and appropriate records (written or electronic) of all clinical encounters and plans, within systems that allow for the dependable and rapid retrieval of such information.

b) Present effective oral and written reports of clinical encounters and plans, using language, visual, information technology and numeracy skills.

c) Recognise ethical and legal issues in compiling patient/client documentation.

3 ROLE: COLLABORATOR

As *collaborators*, healthcare professionals work effectively within a team to achieve optimal patient/client care.

3.1 KEY COMPETENCY

Participate effectively and appropriately in multicultural, interprofessional and transprofessional teams, as well as teams in other contexts (the community included).

3.1.1 ENABLING COMPETENCIES

a) Describe their own roles and responsibilities to other professionals.

b) Recognise and respect – irrespective of profession, status, age, gender, race, class or beliefs – the diversity of roles, responsibilities and competencies of other team members. Appreciate diversity, and demonstrate the ability to adapt. (Healthcare team members may include other professionals, community workers and practitioners of alternative, complementary and cultural/traditional healthcare practice).

c) Work interdependently and share tasks with others to assess, plan, provide and integrate quality care for individual patients/clients (or groups of patients/clients).

d) Collaborate with others, where appropriate, to assess, plan, provide and review other tasks, such as research problems, educational work, programme review or administrative responsibilities.

e) Participate effectively in interprofessional team meetings, respecting team ethics, including confidentiality, resource allocation and professionalism.

f) Demonstrate appropriate leadership in a healthcare team.

3.2 KEY COMPETENCY

Work effectively with other healthcare professionals to promote positive relationships and prevent, negotiate and resolve interpersonal conflict.

3.2.1 ENABLING COMPETENCIES

a) Demonstrate a respectful attitude towards other team members, and work with other professionals to promote positive relationships and prevent conflict.

b) Employ collaborative negotiation skills to achieve consensus and/or resolve conflict.

c) Recognise differences, misunderstandings and limitations in other professionals, and acknowledge their own differences, misunderstandings and limitations that may contribute to interpersonal tension.

d) Reflect on improving interprofessional and transprofessional team function.

4 ROLE: LEADER AND MANAGER

As *leaders and managers*, healthcare professionals are integral participants in healthcare organisations, organising sustainable practices, making decisions about allocating resources, and contributing to the effectiveness of the healthcare system.

4.1 KEY COMPETENCY

Participate in activities that contribute to the effectiveness of the healthcare organisations and systems in which they work.

4.1.1 ENABLING COMPETENCIES

a) Work with others in their organisations, understanding the structure and functioning of the healthcare systems as these relate to their practice.

b) Demonstrate the competence to work in home and community-based care settings, with insight into the potential contributions of community support groups.

c) Participate in the quality process evaluation and improvement of systems, such as practice audits, mortality and morbidity meetings and patient/client safety initiatives, integrating the available best evidence and practice.

d) Demonstrate problem-solving enterprise and creativity in improving and managing a healthcare system, and by providing advice to relevant authorities, with support from superiors.

4.2 KEY COMPETENCY

Manage their practice and career effectively.

4.2.1 ENABLING COMPETENCIES

a) Set priorities and manage time to balance patient/client care, practice requirements, outside activities and personal life.

b) Manage their professional practice, including finances, human resources and effective record keeping.

c) Implement processes to ensure personal practice improvement.

d) Use information technology effectively in managing healthcare environments.

4.3 KEY COMPETENCY

Utilise finite healthcare resources appropriately.

4.3.1 ENABLING COMPETENCIES

a) Utilise healthcare resources under their control carefully and fairly.

b) Apply evidence and good management to achieve cost-appropriate care.

4.4 KEY COMPETENCY

Serve in administration and leadership roles, as appropriate.

4.4.1 ENABLING COMPETENCIES

a) Participate effectively in committees and meetings, as the need arises.

b) Participate in implementing change, where necessary, in the healthcare organisation in which they are serving.

c) Plan relevant elements of healthcare delivery (e.g. duty rosters).

4.5 KEY COMPETENCY

Provide effective healthcare to geographically defined communities.

4.5.1 ENABLING COMPETENCIES

a) Play a constructive, critical and creative role in the organisation, management and provision of healthcare, in the community, hospital and other facilities where profession-specific services are rendered.

b) Evaluate the burden of disease within the community using local, regional, national and global data.

c) Identify the health determinants of the population, such as genetic, demographic, environmental, socio-economic, psychological, cultural and lifestyle-related determinants.

d) Evaluate existing primary healthcare practice and community health programmes.

e) Evaluate the elements of the local health system, taking into consideration the economic and practical constraints within which the service is delivered and the audit process to monitor its delivery.

f) Collaborate with other professionals, relevant organisations and the community to draw up a plan to manage the identified health priorities and to collectively promote health.

g) During planning, take cognisance of the functional links between primary healthcare and public health, the interface between hospital and home-based care, and the principles of ethics and human rights in community-oriented healthcare.

5 ROLE: HEALTH ADVOCATE

As *health advocates*, healthcare professionals responsibly use their expertise and influence to advance the health and well-being of individuals, communities and populations.

5.1 KEY COMPETENCY

Respond to individual patient/client health needs and related issues as part of holistic care.

5.1.1 ENABLING COMPETENCIES

a) Identify the health needs of an individual patient/client, taking into consideration his/her culture.

b) Identify and use opportunities for health promotion and disease prevention with individuals to whom they provide care, incorporating ethical and human rights principles.

c) Act as advocates for patient/client groups with particular health needs (including the poor and marginalised members of society).

5.2 KEY COMPETENCY

Respond to the health needs of the communities that they serve.

5.2.1 ENABLING COMPETENCIES

a) Familiarise themselves with the communities they serve by obtaining insight into the functioning of the local health system, barriers to access care and resources, local cultures and worldviews as it relates to the understanding of health and disease, and other factors not directly part of healthcare.

b) Identify vulnerable or marginalised populations and respond appropriately, with a commitment to equity through access to care and equal opportunities.

c) Identify opportunities for health promotion and disease prevention within the context of promoting a healthy environment and lifestyle.

d) Communicate effectively with communities, and enable them to identify, prioritise and address healthcare needs specific to them.

e) Recognise and respond to competing interests within the community being served by reporting these to the relevant stakeholders in the community.

f) Apply the ethical and professional principles inherent in health advocacy, including altruism, social justice, autonomy, integrity and idealism, appreciating the possibility of conflict inherent in the role of *health advocate*.

6 ROLE: SCHOLAR

As *scholars*, healthcare professionals demonstrate a lifelong commitment to reflective learning as well as the creation, dissemination, application and translation of knowledge.

6.1 KEY COMPETENCY

Maintain and enhance professional competence through ongoing learning, both as healthcare professionals and as responsible citizens, locally and globally.

6.1.1 ENABLING COMPETENCIES

a) Reflect on and acknowledge the strengths and limitations of their knowledge and skills.

b) Commit to maintaining and enhancing knowledge and skills using a personal development plan.

c) Use appropriate strategies and utilise opportunities for continued professional development and lifelong learning.

d) Be able to maintain comprehensive, complete and accessible records for the purposes of good practice and the facilitation of audits and healthcare research.

e) Reflect on, and learn from, challenges that are experienced in practice by posing appropriate questions, accessing and interpreting relevant evidence, integrating new learning with practice, evaluating the impact of change in practice, and documenting the learning process.

f) Know the requirements of the regulations regarding continuous professional development (CPD), as specified by the Health Professions Council of South Africa.

6.2 KEY COMPETENCY

Ask questions about practice, locate relevant evidence, critically evaluate and interpret information and sources, and consider the application of the information.

6.2.1 ENABLING COMPETENCIES

a) Phrase clear, answerable, relevant questions related to practice.

b) Utilise knowledge gained through the critical evaluation of health-related literature to keep up to date with new developments.

c) Use appropriate techniques to effectively and efficiently access relevant research findings from reliable sources.

d) Critically appraise retrieved evidence for quality and relevance, and interpret the findings.

e) Consider the applicability of research findings to own setting.

f) Understand the basic principles of quantitative and qualitative research design and analysis as well as research ethics.

g) Respect and comply with laws pertaining to plagiarism, confidentiality and ownership of intellectual property when accessing and using information and conducting research.

6.3 KEY COMPETENCY

Facilitate the learning of patients/clients, families, students, other healthcare professionals, the public, staff and others, as appropriate.

6.3.1 ENABLING COMPETENCIES

a) Identify collaboratively the learning needs and desired learning outcomes of others.

b) Select effective teaching strategies and content to facilitate others' learning.

c) Reflect on teaching encounters and seek feedback to guide their development as effective facilitators of learning.

d) Create an enabling and supportive learning environment that is sensitive to issues that can influence learning.

e) Listen and provide feedback.

f) Seek and utilise opportunities to develop their skills as facilitators of learning and as mentors.

7 ROLE: PROFESSIONAL

As *professionals*, healthcare professionals are committed to ensure the health and well-being of individuals and communities through ethical practice, profession-led self-regulation and high personal standards of behaviour.

7.1 KEY COMPETENCY

Demonstrate commitment and accountability to their patients/clients, other healthcare professions and society through ethical practice.

7.1.1 ENABLING COMPETENCIES

a) Exhibit and promote appropriate professional behaviour, including honesty, integrity, commitment, compassion, respect for life, accessibility and altruism.

b) Demonstrate a commitment to delivering the highest quality care and maintenance of professional competence according to the values of the profession.

c) Recognise and appropriately respond to ethical, legal and human rights issues and dilemmas encountered in practice and not be influenced by political pressure.

d) Recognise and appropriately manage conflict of interest in practice.

e) Recognise the principles and limits of patient/client confidentiality as defined by professional practice standards and law.

f) Maintain appropriate professional relations with patients/clients, healthcare professionals and communities.

7.2 KEY COMPETENCY

Demonstrate a commitment to their patients/clients, healthcare professionals and society through participation in profession-led self-regulation.

7.2.1 ENABLING COMPETENCIES

a) Adhere to the appropriate professional, legal and ethical codes of practice of the profession.

b) Recognise and interrogate public health policy in terms of ethics and human rights.

c) Demonstrate accountability and fulfil the regulatory and legal obligations required by the regulatory bodies of the health professions.

d) Recognise, address and report unprofessional behaviour encountered in healthcare training and practice.

e) Maintain professional competence through ongoing self-reflection and peer review.

7.3 KEY COMPETENCY

Demonstrate a commitment to own health and sustainable practice.

7.3.1 ENABLING COMPETENCIES

a) Make informed choices for their own future career development based on an understanding of the nature and scope of various professions.

b) Recognise and balance personal and professional priorities to achieve personal health and a sustainable and effective practice.

c) Demonstrate insight into personal and professional problems, and develop strategies to address them effectively with the aim to maintain own physical, psychological, social and spiritual well-being.

d) Recognise other professionals in need, and respond appropriately.

Appendix 2.1: Overview of systematic reviews - Ethics approval

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Approval Notice
New Application

09-Nov-2012
Young, Taryn TN

Ethics Refernce #: S12/10/262

Title: **Effects of teaching Evidence -based Health Care to under-and postgraduate students in the health professions: Overview of systematic reviews**

Dear Doctor Taryn Young,

The **New Application** received on **17-Oct-2012**, was reviewed by members of **Health Research Ethics Committee 1** via Expedited review procedures on **09-Nov-2012** and was approved.
Please note the following information about your approved research protocol:

Protocol Approval Period: **09-Nov-2012 -09-Nov-2013**

Please remember to use your **protocol number** (**S12/10/262**) on any documents or correspondence with the HREC concerning your research protocol.

Please note that the HREC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

After Ethical Review:
Please note a template of the progress report is obtainable on www.sun.ac.za/rds and should be submitted to the Committee before the year has expired.
The Committee will then consider the continuation of the project for a further year (if necessary). Annually a number of projects may be selected randomly for an external audit.
Translation of the consent document to the language applicable to the study participants should be submitted.

Federal Wide Assurance Number: 00001372
Institutional Review Board (IRB) Number: IRB0005239

The Health Research Ethics Committee complies with the SA National Health Act No.61 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 Part 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health).

Provincial and City of Cape Town Approval

Please note that for research at a primary or secondary healthcare facility permission must still be obtained from the relevant authorities (Western Cape Department of Health and/or City Health) to conduct the research as stated in the protocol. Contact persons are Ms Claudette Abrahams at Western Cape Department of Health (healthres@pgwc.gov.za Tel: +27 21 483 9907) and Dr Helene Visser at City Health (Helene.Visser@capetown.gov.za Tel: +27 21 400 3981). Research that will be conducted at any tertiary academic institution requires approval from the relevant hospital manager. Ethics approval is required BEFORE approval can be obtained from these health authorities.

We wish you the best as you conduct your research.
For standard HREC forms and documents please visit: www.sun.ac.za/rds

If you have any questions or need further assistance, please contact the HREC office at 0219389657.

Included Documents:
Investigators declaration
Cover Page
Protocol
Application Form
Attachments

Sincerely,

Franklin Weber
HREC Coordinator
Health Research Ethics Committee 1

Appendix 2.2: Overview of systematic reviews – Data extraction form

REVIEWER: _____ **DATE:** _____

SUMMARY OF SYSTEMATIC REVIEW		
	What the review authors searched for	What the review authors found
Studies		
Participants		
Interventions		
Controls		
Outcomes		
Date of the most recent search:		
Limitations: First complete the section below and then come back to add a summary here		
Citation:		

ASSESSING METHODOLOGY:

A. Methods used to identify, include and critically appraise studies

A.1 Were the criteria used for deciding which studies to include in the review reported? Did the authors specify: ☐ Types of studies ☐ Participants ☐ Intervention(s) ☐ Outcome(s) *Coding guide - check the answers above* *YES: All four should be yes*	☐ Yes ☐ Can't tell/partially ☐ No
Comments (note important limitations or uncertainty)	
A.2 Was the search for evidence reasonably comprehensive? Were the following done: ☐ Language bias avoided (no restriction of inclusion based on language) ☐ No restriction of inclusion based on publication status ☐ Relevant databases searched (Medline + Cochrane Library) ☐ Reference lists in included articles checked ☐ Authors/experts contacted *Coding guide - check the answers above:* *YES: All five should be yes* *PARTIALLY: Relevant databases and reference lists are both ticked off*	☐ Yes ☐ Can't tell/partially ☐ No
Comments (note important limitations or uncertainty)	
A.3 Is the review reasonably up-to-date? *Were the searches done recently enough that more recent research is unlikely to be found or to change the results of the review?*	☐ Yes ☐ Can't tell/not sure ☐ No
Comments (note important limitations or uncertainty)	

A.4 Was bias in the selection of articles avoided? Did the authors specify: ☐ Explicit selection criteria ☐ Independent screening of full text by at least 2 reviewers ☐ List of included studies provided ☐ List of excluded studies provided *Coding guide - check the above* *YES: All four should be yes*	☐ Yes ☐ Can't tell/partially ☐ No
Comments (note important limitations or uncertainty)	
A.5 Did the authors use appropriate criteria to assess the risk for bias in analysing the studies that are included? ☐ The criteria used for assessing the risk of bias were reported ☐ A table or summary of the assessment of each included study for each criterion was reported ☐ Sensible criteria were used that focus on the risk of bias (and not other qualities of the studies, such as precision or applicability) *Coding guide - check the above* *YES: All four should be yes*	☐ Yes ☐ Can't tell/partially ☐ No
Comments (note important limitations or uncertainty)	
A.6 Overall – how would you rate the methods used to identify, include and critically appraise studies? *Summary assessment score A relates to the 5 questions above.* *If the "No" or "Partial" option is used for any of the questions above, the review is likely to have important limitations.* *Examples of fatal flaws might include not reporting explicit selection criteria, not providing a list of included studies or not assessing the risk of bias in included studies.*	☐ **Fatal flaws** (limitations that are important enough that the results of the review are not reliable and they should not be used in the policy brief) ☐ **Important limitations** (limitations that are important enough that it would be worthwhile to search for another systematic review and to interpret the results of this review cautiously, if a better review cannot be found) ☐ **Reliable** (only minor limitations)
Comments (note any fatal flaws or important limitations).	

B - *Methods used to analyse the findings*

B.1 Were the characteristics and results of the included studies reliably reported? Was there: ☐ Independent data extraction by at least 2 reviewers ☐ A table or summary of the characteristics of the participants, interventions and outcomes for the included studies ☐ A table or summary of the results of the included studies. *Coding guide - check the answers above* *YES: All three should be yes*	☐ Yes ☐ Partially ☐ No ☐ Not applicable (e.g. no included studies)
Comments (note important limitations or uncertainty)	
B.2 Were the methods used by the review authors to analyse the findings of the included studies reported?	☐ Yes ☐ Partially ☐ No ☐ Not applicable (e.g. no studies or no data)

Comments (note important limitations or uncertainty)	
B.3 Did the review describe the extent of heterogeneity? ☐ Did the review ensure that included studies were similar enough that it made sense to combine them, sensibly divide the included studies into homogeneous groups, or sensibly conclude that it did not make sense to combine or group the included studies? ☐ Did the review discuss the extent to which there were important differences in the results of the included studies? ☐ If a meta-analysis was done, was the I^2, chi square test for heterogeneity or other appropriate statistic reported?	☐ Yes ☐ Can't tell/partially ☐ No ☐ Not applicable (e.g. no studies or no data)
Comments (note important limitations or uncertainty)	
B.4 Were the findings of the relevant studies combined (or not combined) appropriately relative to the primary question the review addresses and the available data? How was the data analysis done? ☐ Descriptive only ☐ Vote counting based on direction of effect ☐ Vote counting based on statistical significance ☐ Description of range of effect sizes ☐ Meta-analysis ☐ Meta-regression ☐ Other: specify ☐ Not applicable (e.g. no studies or no data) How were the studies weighted in the analysis? ☐ Equal weights (this is what is done when vote counting is used) ☐ By quality or study design (this is rarely done) ☐ Inverse variance (this is what is typically done in a meta-analysis) ☐ Number of participants ☐ Other, specify: ☐ Not clear ☐ Not applicable (e.g. no studies or no data) Did the review address unit of analysis errors? ☐ Yes - took clustering into account in the analysis (e.g. used intra-cluster correlation coefficient) ☐ No, but acknowledged problem of unit of analysis errors ☐ No mention of issue ☐ Not applicable - no clustered trials or studies included *Coding guide - check the answers above* *If narrative OR vote counting (where quantitative analyses would have been possible) OR inappropriate table, graph or meta-analyses OR unit of analyses errors not addressed (and should have been) the answer is likely NO.* *If appropriate table, graph or meta-analysis AND appropriate weights AND the extent of heterogeneity was taken into account, the answer is likely YES.* *If no studies/no data: NOT APPLICABLE* *If unsure: CAN'T TELL/PARTIALLY*	☐ Yes ☐ Can't tell/partially ☐ No ☐ Not applicable (e.g. no studies or no data)
Comments (note important limitations or uncertainty)	

B.5 Did the review examine the extent to which specific factors might explain differences in the results of the included studies? ☐ Were factors that the review authors considered as likely explanatory factors clearly described? ☐ Was a sensible method used to explore the extent to which key factors explained heterogeneity? ☐ Descriptive/textual ☐ Graphical ☐ Meta-regression ☐ Other	☐ Yes ☐ Can't tell/partially ☐ No ☐ Not applicable (e.g. too few studies, no important differences in the results of the included studies, or the included studies were so dissimilar that it would not make sense to explore heterogeneity of the results)
Comments (note important limitations or uncertainty)	
B.6 Overall - how would you rate the methods used to analyse the findings relative to the primary question addressed in the review? *Summary assessment score B relates to the 5 questions in this section, regarding the analysis.* *If the "No" or "Partial" option is used for any of the 5 preceding questions, the review is likely to have important limitations.* *Examples of fatal flaws might include not reporting critical characteristics of the included studies or not reporting the results of the included studies.*	☐ **Fatal flaws** (limitations that are important enough that the results of the review are not reliable and they should not be used in the policy brief) ☐ **Important limitations** (limitations that are important enough that it would be worthwhile to search for another systematic review and to interpret the results of this review cautiously, if a better review cannot be found) ☐ **Reliable** (only minor limitations)
Use comments to specify if relevant, to flag uncertainty or need for discussion	

C- Overall assessment of the quality of the review

C.1 Are there any other aspects of the review not mentioned before which lead you to question the results?	☐ Additional methodological concerns ☐ Robustness ☐ Interpretation ☐ Conflicts of interest (of the review authors or for included studies) ☐ Other ☐ No other quality issues identified

C.2 **Based on the above assessments of the methods how would you rate the quality of the review?**

☐ **Fatal flaws** (exclude); briefly (and politely) state the reasons for excluding the review by completing the following sentence: *This review was not included in this policy brief for the following reasons:*

Comments (briefly summarise any key messages or useful information that can be drawn from the review for policy makers or managers):

☐ **Important limitations**; briefly (and politely) state the most important limitations by editing the following sentence, if needed, and specifying what the important limitations are: *This review has important limitations.*

☐ **Reliable**; briefly note any comments that should be noted regarding the reliability of this review by editing the following sentence, if needed: *This is a good quality systematic review with only minor limitations.*

AMSTAR

Criteria		How assessed
1	Was an a priori design provided?	
2	Was there duplicate study selection and data extraction?	
3	Was a comprehensive literature search performed?	
4	Was the status of publication (i.e. grey literature) used as an inclusion criterion?	
5	Was a list of studies (included and excluded) provided?	
6	Were the characteristics of the included studies provided?	
7	Was the scientific quality of the included studies assessed and documented?	
8	Was the scientific quality of the included studies used appropriately in formulating conclusions?	
9	Were the methods used to combine the findings of studies appropriate?	
10	Was the likelihood of publication bias assessed?	
11	Was the conflict of interest stated?	

RESULTS

Capture results per outcome

NOTES

Missing information – need to contact author

Any relevant reference to obtain

Appendix 2.3: Overview of systematic reviews – Supplementary tables

Table S1. Characteristics of included systematic review Ahmadi 2012

	What the review authors searched for	What the review authors found
Studies	Systematic review including RCT's, non-randomised comparisons, before-after studies	7 studies: 1 RCT; 3 uncontrolled before and after studies; 3 surveys 8 studies: 1 RCT; 3 uncontrolled before and after studies; 3 surveys and 1 observational studies
Participants	Surgical residents	
Interventions	Two reviews- one on EBM teaching and another on Journal club	
Comparisons		Only reported for RCTs
Outcomes	EBM knowledge, EBM attitude, participants' satisfaction Critical appraisal knowledge, knowledge of EBM, knowledge of statistics and study design, self-assessed skills, research productivity, participants' satisfaction	1.EBM knowledge, EBM attitude, participants' satisfaction 2. Critical appraisal knowledge, knowledge of EBM, knowledge of statistics and study design, self-assessed skills, research productivity, participants' satisfaction
Date of the most recent search: July 2010		
Limitations: Search strategy not comprehensive; English language only; No risk of bias assessment for included studies		
Citation: Ahmadi N, McKenzie ME, MacLean A, Brown C, Mastracci T, McLeod RS. Teaching Evidence-based Medicine to Surgery residents – Is journal club the best format? A Systematic Review of the literature. Journal of Surgical Education 2012:69; 91-100		

Table S2. Characteristics of included systematic review Audet 1993

	What the review authors searched for	What the review authors found
Studies	Did not specify - studies with at least 10 participants per group - controlled before and after studies; some RCT	2 RCT (post-test only); 3 Controlled trials; 3 Controlled before-after studies; 1 Before-after study; 1 Cross-sectional study
Participants	Undergraduate and postgraduate medical students	Residents and Undergraduate medical students
Interventions	Critical appraisal teaching	Journal clubs; Weekly lectures; Once-off sessions; Biostatistics module
Comparisons	Not specified	
Outcomes	Knowledge in clinical epidemiology and biostatistics, reading habits, ability to critically appraise a scientific article	Increased knowledge; Reading habits; Critical appraisal skills
Date of the most recent search: Not clearly reported. Authors included studies published between 1980 and 1990 – The review was only published in 1993.		
Limitations: Search limited to English and French studies; No report of publication status of studies; Only searched MEDLINE and FAMLI databases; Did not contact experts; No report of duplicate screening of abstracts; No list of excluded studies; Results described narratively, no measures of effect or Confidence interval reported; Authors used vote-counting based on direction of effect and statistical significance to summarise results		
Citation: Audet N, Gagnon R, Ladouceur Rm Marcil M. L'enseignement de l'analyse critique des publications scientifiques médicales est-il efficace? Révision des etudes et de leur qualité méthodologique. Can Med Assoc J. 1993; 148(6):945-52		

Table S3. Characteristics of included systematic review Baradaran 2013

	What the review authors searched for	What the review authors found
Studies	Any comparative study – e.g. randomised controlled trials, non-randomised controlled trials, controlled before-after studies	27 studies: 11 CBA'S; 10 RCT'S (2 cross over and 1 cluster); 6 Non-randomised controlled studies
Participants	Undergraduate medical students (defined as medical school students before entering residency programs) Excluded: postgraduate students	Medical students (from 1st to final year); Clinical clerks; Interns
Interventions	At least one educational intervention (def: coordinated educational activity of any medium, duration or format) to teach EBM. Excluded: Where content covered only teaching searching, biostatistics and epidemiology)	EBM lectures; EBM workshops; Integrated teaching of EBM; Online teaching of EBM
Comparisons	Not described	No teaching of EBM or different forms of teaching EBM
Outcomes	Students' knowledge, attitudes, skills, behaviours	EBM knowledge; EBM skills; EBM behaviour; Critical appraisal skills; EBM attitude
Date of the most recent search: May 2011		
Limitations: Did not contact experts; No list of excluded studies provided; No effect sizes and 95% confidence reported. Findings not substantiated by results; Meta-analysis conducted but not appropriate; Heterogeneity not explored; Differences between studies and results not analysed and described sufficiently		
Citation: Baradaran HR, Amadi S-F, Ahmadi E. Teaching evidence-based medicine to undergraduate medical students: A systematic review and meta-analysis 2013 *(personal communication, not yet published, currently under peer review with BEME)*		

Table S4. Characteristics of included systematic review Coomarasamy 2004

	What the review authors searched for	What the review authors found
Studies	Systematic review including RCT's, non-randomised controlled studies, before-after studies	Four RCT's; Seven non-randomised controlled studies; 12 before and after studies
Participants	Postgraduate (health care professionals – not specified) and health care professionals attending continuing medical education activities (excluding undergraduates)	Postgraduate health care practitioners (did not specify in the report)
Interventions	Postgraduate EBM or critical appraisal teaching compared to control or baseline before teaching	Standalone EBM teaching – 18 studies and Integrated EBM teaching – 5 studies. Teaching methods included workshops, seminars, and journal clubs alone or in various combinations. Details of interventions – duration, learning outcomes, setting, etc not clearly reported. Integrated teaching focused on training in EBM components (such as question formulation, literature searching, and critical appraisal) in real time clinical ward rounds or basing the EBM teaching sessions on encounters with patients on the wards and in clinics. Duration of interventions unclear.
Comparisons		Not reported
Outcomes	Participants' learning achievements: knowledge, critical appraisal skills, attitudes, behaviour; Patients' health gains	Knowledge, critical appraisal skills, attitude and behaviour; No patient health outcomes
Date of the most recent search: April 2004		
Limitations: Unclear whether search covered all languages; No methods detailed for independent selection of studies and data extraction; Description of excluded studies incomplete; No assessment of risk of bias of included studies; Results of individual studies not reported.		
Citation: Coomarasamy A, Khan SK. What is the evidence that postgraduate teaching in evidence-based medicine changes anything? A systematic review. BMJ 2004; 329 and Coomarasamy A, Taylor R, Khan KS. A systematic review of postgraduate teaching in evidence-based medicine and critical appraisal. Medical Teacher. 2003; 25:1, 77-81		

Table S5. Characteristics of included systematic review Deenadayalan 2008

	What the review authors searched for	What the review authors found
Studies	Experimental studies which directly and concurrently compared outcomes from journal club activities with outcomes from other forms of education; Quasi-experimental or comparative studies which assessed outcomes pre- and post-journal club inception	3 RCT's; 3 CT's; 2 Cohort studies; 3 Curriculum reports; 5 Reports; 1 un blinded interventional study; 1 review of journal club; 1 feasibility study; 1 personal experience report; 1 pilot study
Participants	Health practitioners of any discipline	Undergraduates, graduates, postgraduates and clinicians from the following health disciplines were included: Obstetrics and Gynaecology; Clinical Epidemiology and Biostatistics; Internal Medicine; Psychiatry; Nursing; Geriatric Medicine
Interventions	Any form of journal club	
Comparisons	Any comparator	
Outcomes	Any outcome measure relating to journal club effectiveness, including knowledge, attitudes, skill acquisition, practice behaviours, satisfaction	Reading habits; Critical appraisal skills; Knowledge of current medical literature; Research methods; Statistics
Date of the most recent search: Not reported		
Limitations: Only included articles in English language and where the full text was available; Authors /experts not contacted; Unclear whether publication status influenced inclusion (but authors only included studies of which the full text was available); Date of search unclear; Authors reported that they used the McMaster; University instrument to critically appraise studies and gave scores according to the 14 criteria. Criteria not reported – only score out of 14 for each included study; Did not report independent data extraction; Did not describe heterogeneity or the process of data synthesis		
Citation: Deenadayalan Y, Grimmer-Somers K, Prior M, Kumar S. How to run an effective journal club: a systematic review. *Journal of Evaluation in Clinical Practice*. 2008;14: 898-911		

Table S6. Characteristics of included systematic review Ebbert 2001

	What the review authors searched for	What the review authors found
Studies	RCT's, cohort studies, before-after studies, cross-sectional studies	7 studies: 1 RCT; 3 Cohort studies; 1 Before and after study; 2 cross-sectional studies
Participants	Postgraduate physicians (interns and residents) training in any speciality or subspecialty	Postgraduate students (internal medicine, Paediatrics, Emergency medicine, Obstetrics and Gynaecology; Physical medicine and rehabilitation)
Interventions	Journal club (small-group meeting to discuss one or more journal articles)	
Comparisons	Not stated	No journal club, before journal club, Standard conference on topics in ambulatory care, traditional, unstructured journal club.
Outcomes	Critical appraisal skills, reading habits, knowledge of clinical epidemiology and biostatistics, use of medical literature in clinical practice, improved patient outcomes	Critical appraisal skills, reading habits, knowledge of clinical epidemiology and biostatistics, use of medical literature in clinical practice
Date of the most recent search: March 2000		
Limitations: Authors did not specify whether they had any language restrictions; Authors did not describe how they analysed results and how the variability between interventions influence results in the methods or results section, but mention in the discussion that “the lack of methodologically rigorous study designs and the apparent heterogeneity in the outcomes measured argued against pooling of the results”		
Citation: Ebbert JO, Montori VM, Schultz HJ. The journal club in postgraduate medical education: a systematic review. Medical Teacher 2001: 23(5); 455-461		

Table S7. Characteristics of included systematic review Flores-mateo 2007

	What the review authors searched for	What the review authors found
Studies	Systematic review including RCT's, non-randomised trials, Before-and-after studies	24 studies: sample size ranging from 12 to 800 - 11 RCT's; 5 non-randomised controlled trials; 8 Before-after studies
Participants	Postgraduate healthcare workers. Excluded - medical students and undergraduates; focused on prescribing practices; specific health problems; Theoretical reviews of different components of EBP; General continuing medical education; Testing the effectiveness of implementing guidelines; Evaluating teaching methods Using IT devices (PDA or computer-based reminder)	Postgraduate healthcare workers: Health care professionals; Medical interns; Physicians; Primary care residents; Medical research, managerial and nursing staff; Family medicine residents; Psychiatry residents; Emergency Medicine residents; Internal medicine residents; Medical residents; Experts in EBM and third year medical students; Public Health physicians; Surgeons; Paediatric residents; Occupational therapists; General practitioners
Interventions	Teaching EBP	Teaching EBP: Workshops; Multifaceted interventions; Internet-based intervention; Journal club (most common); Course and clinical preceptor; Educational presentation; Literature search course; Seminars
Comparisons	Not specified	Controls not described
Outcomes	Improved EBP knowledge, skills, attitudes and behaviour	EBM knowledge; EBM skills; EBM behaviour; EBM attitudes; Therapy supported by evidence
Date of the most recent search: December 2006		
Limitations: Search strategy did not include unpublished literature; authors did not contact experts in the fields for additional studies; No list of excluded studies; Risk of bias assessment not adequate for all included studies (quality assessment); Results reported selectively – only those results where authors were able to calculate an effect size were reported. Results of 14/24 included studies not reported.		
Citation: Flores-Mateo G, Argimon JM. Evidence based practice in postgraduate healthcare education: A systematic review. BMC Health Services Research. 2007, 7:119 doi:10.1186/1472-6963-7-119		

Table S8. Characteristics of included systematic review Green 1999

	What the review authors searched for	What the review authors found
Studies	Not specified	18 reports of EBM curricula (study design not specified) and 7 of these looked at the effectiveness of the curriculum and 5 of these had control group
Participants	Graduate medical education	Residents (7 in internal medicine, 3 in family medicine, 3 in obstetrics and gynaecology, 2 in paediatrics, 1 in surgery, 1 in emergency medicine and 1 inter-programme curriculum)
Interventions	EBM/critical appraisal curricula	Teaching critical appraisal skills: Journal club format in 13 studies; Integrated EBM teaching into clinical rotations: 2 studies; Integration of EBM in morning reports:2 studies; Comprehensive, program-wide curricular change: 1 study
Comparisons	Not specified	Not relevant for most studies, pretest-posttest design for most effectiveness studies
Outcomes	Curriculum development, curriculum objectives, curriculum formats, educational strategies, curriculum evaluation	Curriculum development; Curriculum objectives; Curriculum formats; Educational strategies; Curriculum evaluation (effectiveness) - Residents' knowledge of clinical epidemiology and critical appraisal and Students' self-reported EBM behaviour; Process evaluation; Satisfaction evaluation
Date of the most recent search: 1998		
Limitations: Selection criteria not sufficiently explicit and was very broad; Search strategy: did not contact authors, no mention of unpublished studies, only MEDLINE and ERIC searched; No list of excluded studies; No duplicate, independent selection of studies; Review focuses more on curriculum development and content than effectiveness.		
Citation: Green ML. Graduate medical education training in clinical epidemiology, critical appraisal and evidence-based medicine: A critical review of curricula. Acad Med 1999;74(6):686-94		

Table S9. Characteristics of included systematic review Harris 2011

	What the review authors searched for	What the review authors found
Studies	Systematic review including any quantitative or qualitative study evaluating journal clubs	8 before and after studies; 6 questionnaire surveys; 1 observational study; 1 case control study; 1 controlled trial; 1 randomised controlled trial
Participants	Undergraduates in any type of health care field, or postgraduates practicing in their field. Excluded librarians	Undergraduate and postgraduate (not clearly described)
Interventions	Journal clubs. Excluded studies with video/internet and one-off clubs	Journal clubs in different formats
Controls	Not described	Not clearly described
Outcomes	Learner reaction, attitude, knowledge, skills, behaviour, patient outcomes	Change in reading behaviour; Confidence in ability to critically appraise research; Demonstrated knowledge and critical appraisal skills; Ability to apply findings to clinical practice
Date of the most recent search: Not reported		
Limitations: Date of last search not reported; Unclear which databases were searched; Risk of bias assessment of included studies not adequately reported; Characteristics of included studies not clearly described		
Citation: Harris J, Kearley K, Henegan C, Meats E, Roberts N, Perera R, Kearley-Shiers K. Are journal clubs effective in supporting evidence-based decision making? A systematic review. BEME Guide No.16. Medical Teacher 2011; 33:9-23		

Table S10. Characteristics of included systematic review Horsley 2010

	What the review authors searched for	What the review authors found
Studies	Systematic review of RCTs, CCT, CBA and ITS where there was a clearly defined point in time when the interventions occurred and at least three data points before and after the intervention.	3 RCT's; 1 CCT
Participants	All health care providers involved in direct patient care. No undergraduates and no students.	Residents; Doctors, nurses, allied health professionals, Occupational health physicians
Interventions	Considered interventions designed to increase the frequency and/or quality of healthcare professionals question formulation of any duration and follow-up	Lecture and input from librarian; Live demonstrations, hands on practice sessions; Didactic input, hands-on practice; Questionnaire with written instructions and examples
Comparisons	Comparison group could receive no intervention, continued current usual practices or a less intensive intervention.	
Outcomes	Primary: Frequency of questions generated; Quality of questions generated; Practitioner competency; Patient delivery of care; Patient-related outcomes; Knowledge-seeking practices; Evidence-based practice(s). Secondary outcomes: Objective measures of self-efficacy; Increased success of answering questions generated; Summary data pertaining to the types of questions generated by healthcare professionals.	Quality of questions; Increased success of answering questions; Knowledge-seeking practices; Self-efficacy; Types of questions generated
Date of the most recent search: August 2008		
Limitations: None		
Citation: Horsley T, O'Neill J, McGowan J, Perrier L, Kane G, Campbell C. Interventions to improve question formulation in professional practice and self-directed learning. *Cochrane Database of Systematic Reviews* 2010, Issue 5. Art. No.: CD007335. DOI:10.1002/14651858.CD007335.pub2.		

Table S11. Characteristics of included systematic review Horsley 2011

	What the review authors searched for	What the review authors found
Studies	RCT's, controlled clinical trials, controlled before and after studies, interrupted time series (minimum requirement that there has to be a comparison with no teaching in critical appraisal, either in a separate group or in the same group – before teaching.	3 RCT's (n=272)
Participants	Any qualified healthcare professional (including managers and purchasers) with direct patient care in any given clinical setting. No students	Interns in Internal Medicine, Health care professionals (general practitioners, hospital physicians, professions allied to medicine, and healthcare managers and administrators),Surgeons
Interventions	Educational interventions (def: co-ordinated educational activity, of any medium, duration or format) teaching critical appraisal (def: the process of assessing and interpreting evidence by systematically considering its validity, results and relevance to ones' own work). Single or package of interventions. Teaching of biostatistics and epidemiology excluded	Journal club supported by a half-day workshop (Linzer 1988), critical appraisal materials (package) including papers with methodological reviews, list serve discussions and articles (MacRae 2004) and a half-day workshop based on a Critical Appraisal Skills Programme (CASP) (Taylor 2004).
Comparisons	No teaching in critical appraisal, either in a separate group of before intervention	Standard conference series on ambulatory medicine; Access to journals and articles only; waiting list for workshop
Outcomes	Objectively measured process of care variables; Objectively measured patient outcomes; Objectively measured assessments of the impact of teaching critical appraisal on health professional's knowledge/awareness were considered if assessment of outcome measure was based upon standardised and reliable instruments	Knowledge scores; Critical appraisal skills
Date of the most recent search: January 2010: EMBASE, LISA, ERIC, CDSR, DARE, EPOC specialised register, ISI web of knowledge; June 2011: CENTRAL, MEDLINE		
Limitations: No mention of minimising language bias		
Citation: Horsley T, Hyde C, SantessoN, Parkes J, Milne R, Stewart R. Teaching critical appraisal skills in healthcare settings. *Cochrane Database of Systematic Reviews* 2011, Issue 11. Art. No.: CD001270. DOI: 10.1002/14651858.CD001270.pub2		

Table S12. Characteristics of included systematic review Hyde 2000

	What the review authors searched for	What the review authors found
Studies	Any comparative study design including RCT's, non RCT's, CBA's, interrupted time series, simple before-after designs	1 RCT; 8 Controlled trials; 7 Before-after studies
Participants	Participants in any clinical setting, including health care students, professionals, managers, purchasers, and health care users.	Medical students; Residents; Midwives; Intern doctors; Multidisciplinary (qualified doctors, managers and researchers)
Interventions	Educational interventions teaching critical appraisal (single intervention or package). Excluding studies where biostatistics and/or epidemiology were taught	Tutorial; Workshop; Lecture; Seminar; Study day; Journal club
Comparisons	Not specified	Not specified
Outcomes	Patient outcomes: Health outcomes (mortality and morbidity); Quality of life; Satisfaction. Learner outcomes: Behaviour, including process of care; Critical appraisal skills; Knowledge; Attitudes; Satisfaction. Teacher outcomes: Satisfaction	Skills; Knowledge; Behaviour; Attitude
Date of the most recent search: December 1997		
Limitations: Unclear whether language restrictions were used when searching for studies		
Citation: Hyde C, Parkes J, Deeks J, Milne R. Systematic review of effectiveness of teaching critical appraisal. ICRF/NHS Centre for Statistics in Medicine. 2000		

Table S13. Characteristics of included systematic review Ilic 2009

	What the review authors searched for	What the review authors found
Studies	Randomised controlled trials and non-randomised trials	3 RCT's; 1 CT; 1 (non-randomised) trial; 1 cross-over trial; 1 before after study
Participants	Under/postgraduate medical students or under/postgraduate allied health professionals	General practitioners (1 study); Medical residents (1 study); General surgeons (1 study); Undergraduate medical students (2 studies); Undergraduate nursing students (1 study); Naturopathic undergraduate students (1 study)
Interventions	EBP teaching: formulating an answerable question, searching medical databases, critical appraisal	Half day EBP workshop (2 studies); 7 week-2hour EBP workshop; EBP multimedia package; Supplemented EBP teaching (directed vs self-directed); 4 EBP tutorials; 2 four-hour EBP workshops
Comparisons	Not described	Not described for all studies; Alternative clinical topics; Directed vs. self-directed learning
Outcomes	EBP knowledge, skills or behaviour	EBP competency; EBP knowledge, skills and behaviour; Critical appraisal skills; Formulating questions; Searching skills
Date of the most recent search: September 2008		
Limitations: Search not comprehensive – did not address language and publication bias; Screening of full texts for inclusion as well as data extraction only done by one author; Results of risk of bias assessment not reported at all; Results of included studies not adequately reported – no measures of effect and CIs reported		
Citation: Ilic D. Teaching Evidence-based Practice: Perspectives from the Undergraduate and Post-graduate Viewpoint. Ann Acad Med Singapore 2009;38:559-63		

Table S14. Characteristics of included systematic review Norman 1998

	What the review authors searched for	What the review authors found
Studies	Studies with a control group (excluding before-after designs)	10 studies: 3 RCTs; 6 CT (1 with cross-over); 1 cohort with historical controls
Participants	Undergraduate medical residents or residents	6 studies involved medical undergraduate students and 4 studies involved residents
Interventions	Teaching EBM or critical appraisal	Undergraduate: EBM teaching in internal medicine clerkship (part of course credit) and Residents: Variation of journal club format
Comparisons	Not specified	Not specified
Outcomes	Measure of performance: knowledge, skill or self-reported use of the literature	Knowledge and skills; Self-reported use of the literature
Date of the most recent search: Not clearly stated (searched for studies between 1966 and 1995)		
Limitations: Selection criteria did not specify participants and interventions; Authors only searched MEDLINE database. Do not mention whether search was restricted for language and publication status; Authors do not clearly describe the process of selection of studies; Do not provide a list of excluded studies; Unclear how data extraction and risk of bias assessment were conducted; Did not mention heterogeneity and did not address the variability between studies regarding the intervention and the outcomes.		
Citation: Norman GR, Shannon SI. Effectiveness of instruction in critical appraisal (evidence-based medicine) skills: a critical appraisal. *Can Med Assoc J* 1998;158:177-81		

Table S15. Characteristics of included systematic review Taylor 2000

	What the review authors searched for	What the review authors found
Studies	Systematic reviews including studies with a control group	10 Studies: 1 RCT, 4 non-randomised trials; 3 prospective cohort studies; 1 retrospective cohort study; 1 Cross-sectional study
Participants	Health care professionals	Medical students (6 studies) and newly qualified physicians (4 studies)
Interventions	Educational intervention of critical appraisal	Educational interventions ranging from a total of 180 min over a 1-week period to 16h over the period of a year
Comparisons	No educational intervention or "placebo" educational intervention	No educational input (6 studies); general medical input (2 studies); traditional epidemiological education (2 studies)
Outcomes	Educational outcomes and health care outcomes	Knowledge of epidemiology/statistics; Attitudes towards medical literature; Ability to critically appraise an article; Medical literature reading behaviour
Date of the most recent search: December 1997		
Limitations: Study selection process unclear; Risk of bias assessment only reported as a score out of 12 – no details of risk of bias for specific domains reported; Vote counting done (according to statistical significance) – no individual results reported.		
Citation: Taylor R, Reeves B, Ewings P, Binns S, Keast J, Mears R. A systematic review of the effectiveness of critical appraisal skills training for clinicians. Medical Education 2000; 34:120-5		

Table S16. Characteristics of included systematic review Wong 2013

	What the review authors searched for	What the review authors found
Studies	RCTs, CTs or cohort studies (pre-post and longitudinal studies) reporting original data on outcomes evaluating an EBP educational intervention. Excluded: Case studies, cross-sectional studies, editorials, narrative and systematic reviews	8 included studies - 2 CT; 5 BA; 1 longitudinal study with four test occasions.
Participants	Entry-level health professional students. 'Entry-level' was defined as undergraduate and graduate entry programs that prepare students to enter their professions as beginning practitioners.	Entry level: Medical students (n=5); Nursing (n=1); Physiotherapy (n=1); Postgraduate physiotherapy and undergraduate occupational therapy students (n=1); Sample size ranged from 17 to 293
Interventions	At least one EBP educational intervention which include one or more of the five steps of EBP of any mode of delivery (e.g. lectures, tutorials, online or workshops) or the type of EBP educational interventions (e.g. formal or informal, stand-alone or integrated training).	Mix of lecture-based and clinically-integrated EBP training covering different steps of EBP. Duration varied from 4 days to 1,5 years.
Comparisons	Irrespective of the presence or absence of control groups.	
Outcomes	Self-reported EBP attitudes (value and importance placed on EBP), Behaviours (actual performance and use of EBP in practice), Knowledge (understanding of EBP), Skills (application of EBP knowledge by performing the EBP steps) and Confidence (perception of one's own ability with EBP skills).	Knowledge, attitudes and skills; All but two studies reported using valid and reliable instruments
Date of the most recent search: December 2011		
Limitations: Limited to English language articles; Only one reviewer selected studies; Independent data extraction done for a sample of included studies; Risk of bias approach not detailed. All study types assessed in same manner and no specific study related criteria used		
Citation: Wong SC, McEvoy MP, Wiles LK, Lewis LK. Magnitude of change in outcomes following entry-level evidence-based practice training: a systematic review. International Journal of Medical Education. 2013;4:107-14		

Table S17. Characteristics of ongoing systematic reviews

	RAY 2013	ROHWER 2013
Studies	No details provided	Randomised controlled trials and cluster randomised controlled trials will be included. Non-randomised study designs will be excluded.
Participants	Undergraduate medical students	Health care professionals, including doctors, dentists, nurses, occupational therapists, physiotherapists, dieticians, audiologists, mental health professionals, psychologists, counsellors, social workers in any year of postgraduate study with an academic institution. We will not be including continuing professional development activities.
Interventions	Teaching literature searching skills	A completely web-based (e-learning) module on EBHC, including any or all of the 5 steps of EBHC (Asking questions, searching the literature, critically appraising the literature, applying the results, evaluating the process); integrated into clinical learning or as a stand-alone module; as part of the postgraduate curriculum in the specific field of study
Comparisons	No details provided	A face-to-face module on EBHC including any or all of the 5 steps of EBHC; integrated into clinical learning or as a stand-alone module; or a blended module on EBHC consisting of face-to-face and e-learning components; as part of the postgraduate curriculum in the specific field of study
Outcomes	Knowledge and skills	*Primary outcomes*: Increased knowledge of EBHC including all or any one of the steps of EBHC (phrasing questions, searching the literature, critically appraising the literature, applying the results, evaluating the process); Improved skills in practicing the steps of EBHC. *Secondary outcomes*: Attitude towards EBHC, measured with a qualitative instrument; Practicing of evidence-based health care in the clinical setting (behaviour); Satisfaction of students with the method of learning; Self-perceived competency in EBHC; Satisfaction of educators with method of teaching
Citation	Ray A. Is the teaching of literature searching skills for medical students (undergraduates) an effective educational intervention to change their knowledge and skills (title registered with Best Evidence Medical Education (BEME) Collaboration) http://www.bemecollaboration.org/NewTopics/	Rohwer A, Young T. E-learning versus face-to-face learning on evidence-based health care (EBHC) for increased EBHC knowledge and skills in postgraduate health care professionals (title registered with Campbell Collaboration)

Table S18. Matrix of included systematic reviews and the studies included in each

	Primary studies							Systematic reviews														
	Study ID	*Type of study*	*Intervention*	*Participants*	*Sample size*	*Outcomes assessed*	*Location*	Ahmandi 2012 [26]	Audet 1993 [27]	Baradaran 2013 [41]	Coomarasamy 2004 [28]	Deenadayalan 2008 [29]	Ebbert 2001 [30]	Flores Mateo 2007 [31]	Green 1999 [32]	Harris 2011 [33]	Horsley 2010 [34]	Horsley 2011 [35]	Hyde 2000 [36]	Ilic 2009 [37]	Norman 1998 [38]	Taylor 2000 [39]	Wong 2013 [40]
1	Akl 2004	CT	MI	R,UG	40	K, S	USA							x									x
2	Alper 2005	CBA	MI	UG	90	S	USA			x													
3	Aronoff 2010	BA	MI	UG	153	S	USA			x													x
4	Baum 2003	BA	SI	R	73	A	USA							x									
5	Bazarian 1999	CT	SI	R	32	K, S, B	USA				x	X	x	x		x							
6	Bennett 1987	CT	SI	UG	92	S	Canada		x	x									x		x	x	
7	Bennet 2011	BA	MI	UG	59	K, A	Australia																x
8	Bolboaca 2006	CBA	MI	UG	40	K	Romania			x													
9	Bradley 2002	RCT	SI	R	10	S, A, B	USA				x						x						
10	Bradley 2005	RCT	MI	UG	175	K, S, A	Norway			x										x			
11	Burls 1997	BA	SI	HP	1880	K; A	UK												x				
12	Cabell 2001	RCT	MI	R	48	S	UK							x									
13	Caudill 1993	BA	MI	HP, R	70	K, S, A, B	USA				x								x				
14	Cheatham 2000	BA	SI	R	9	K	USA	x															
15	Cheng 2003	RCT	SI	HP	800	K, S, A, B	Hong Kong							x			x						
16	Cramer 2001	BA	SI	R	35	K	USA									x							
17	Cuddy 1984	BA	SI	UG	18	K	USA		x										x				
18	Davis 2007	RCT	SI	I	55	K, A	UK			x													
19	Davis 2008	RCT	SI	UG	229	K, A	UK			x													
20	Dinkevich 2006	BA	SI	R	69	K, S	USA							x									
21	Dorsch 2004	CBA	MI	UG	36	A, S	USA			x													
22	Forsetlund 2003	RCT	MI	HP	148	K, A	Norway							x									
23	Frasca 1992	CT	SI	UG	92	S	USA			x									x		x	x	

24	Fritsche 2002	BA	SI	R,UG	266	K, S	Germany	x		x				x								
25	Fu 1999	CT	SI	R	24	K, S, B	UK				x			x		x						
26	Gehlbach 1980	CT	SI	R	35	K	USA		x		x				x				x		x	x
27	Ghali 2000	CT	SI	UG	60	K, S, B	USA													x		
28	Grad 2001	BA	MI	PG	75	S, A, B	Canada				x											
29	Green 1997	CT	MI	R	34	B, K	USA				x			x	x							
30	Gruppen 2005	CT	SI	UG	92	S	USA			x												
31	Hadley 2010	RCT	SI	I	237	K	UK			x												
32	Haines 2003	BA	MI	PG	?	B	USA				x											
33	Haynes 1993	RCT	MI	HP	392	S	Canada							x								
34	Heller 1984	CT	SI	UG	?	S	Not stated														x	
35	Hicks 1994	BA	SI	HP	19	B, S	UK												x			
36	Hillson 1993	BA	MI	HP, R	29	S	USA				x								x			
37	Ibbotson 1998	BA	SI	HP	164	K, S	UK				x			x					x			
38	Johnson 2009	RCT	SI	UG	129	K, A	Hong Kong			x												
39	Kellum 2000	BA	MI	HP	12	K, S	USA				x			x		x						
40	Khan 1999	BA	MI	R	8	K, A, B	UK	x			x	X	x			x						
41	Kim 2009	CT	MI	UG	150	K, A, B	USA															x
42	Kitchens 1989	CT	MI	R	83	K	Canada		x		x				x				x		x	x
43	Krueger 2006	RCT	MI	UG	77	K, S	USA			x												
44	Kulier 2009	RCT	SI	R	61	K, A	UK and Netherlands	x														
45	Landry 1994	CT	SI	UG	146	B, K, A	USA			x									x		x	x
46	Langkamp 1992	CT	MI	R	27	K	USA				x	X	x		x							
47	Lai 2009	BA	MI	UG	72	S, K	Malaysia			x												x
48	Lai 2010	CBA	MI	UG	65	A	Malaysia			x												
49	Lee 2006	BA	SI	R	29	K, S	USA	x								x						
50	Lee 2007	RCT	MI	UG	155	K	Hong Kong			x												
51	Leung 2003	RCT	MI	UG	169	A	Hong Kong			x												
52	Linzer 1987	RCT	SI	R	85	S	USA		x			X	x			x					x	
53	Linzer 1988	RCT	SI	R	44	K, S, B	USA		x		x	X	x	x	x	x		x	x		x	x

54	Lucas 2004	BA	SI	HP	33	B	USA							x								
55	MacRae 2004	RCT	MI	HP	81	S	Canada					X		x				x		x		
56	McCluskey 2005	BA	MI	HP	114	K, S, A, B	Australia							x								
57	McGinn 2002	RCT	SI	PG	10	K, B	USA				x											
58	McLeod 2010	RCT	SI	R	441	S	USA, Canada	x														
59	Mills 2002	CT	SI	UG	83	S	Canada													x		
60	Mulvihill 1981	BA	SI	PG	?	K	Not stated				x				x							
61	Radack 1986	CT	SI	UG	34	S	USA		x	x								x		x	x	
62	Riegelman 1986	CT	MI	UG	296	K, S, B	USA		x									x		x	x	
63	Romm 1989	RCT	SI	UG	108	K,S	USA		x													
64	Rosenberg 1998	RCT	SI	UG	108	S	UK			x												
65	Ross 2003	CT	SI	R	48	K, B	USA				x			x								
66	Sastre 2011	CBA	SI	UG	100	B, A	USA			x												
67	Schaafsma 2007	CT	MI	HP	125	S	Netherlands										x					
68	Schilling 2006	RCT	SI	UG	238	K, S	USA			x				x								
69	Schoenfeld 2000	BA	SI	PG	24	K	USA				x											
70	Seelig 1991	BA	SI	R	14	K, S, A, B	USA				x	X			x	x			x			
71	Seelig 1993	CT	SI	I	30	K, S, A, B	USA				x								x			
72	Smith 2000	CT	SI	R	55	K, S, B	USA				x			x						x		
73	Stevermer 1999	RCT	SI	R	59	K, S	USA							x								
74	Straus 2005	BA	MI	R	47	P	UK							x								
75	Taheri 2008	BA	SI	UG	24	K, S	Iran			x												x
76	Taylor 2004	RCT	SI	HP	145	K, S, A, B	UK				x			x				x		x		
77	Toedter 2003	BA	MI	R	14	K, S	USA	x														
78	Villanueva 2001	RCT	SI	HP	52	S, B	Australia							x			x					
79	Vinegra 1986	CT	MI	UG,R	47	K	Mexico														x	
80	Weberschock 2005	CBA	SI	UG	132	K, S	Germany			x												
81	West 2011	CBA	MI	UG	99	K, S	USA			x												

SI – Single Intervention
MI – Multifaceted intervention
UG- Undergraduate
R – Residents
I – Interns
HP – Health Professionals
P – Practice
K – Knowledge
A – Attitude
S – Skills
BA – Before After study
B – Behaviour
CT – Controlled Trial
RCT – Randomized Controlled Trial
CBA – Controlled Before After study

Checklist S1: PRISMA checklist: *From:* Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097 **www.prisma-statement.org**.

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	Cover page
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	Abstract
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	Introduction
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	Introduction
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	Methods
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	Methods - Criteria for considering systematic reviews for inclusion
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	Methods - Search methods for identification of systematic reviews
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Methods - Search methods for identification of systematic reviews
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	Methods - Systematic review selection, data collection, quality assessment and analysis
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	

Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	n/a
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	n/a
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	Results - Results of the search and Table 2
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Results - Description of included systematic reviews, Table 4 and 5 and Tables S1 to S17
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	Results - Quality of systematic reviews and Table 5
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Results - Effects of various educational interventions, Table S18
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	n/a
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	n/a
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	n/a
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	Discussion
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	Discussion – Potential biases in the overview process
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	Conclusions
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	Sources of support

Appendix 3.1: International interviews – Ethics approval

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Approval Notice
New Application

04-Oct-2013
Young, Taryn TN

Ethics Reference #: S12/10/262(b)

Title: **Experiences and lessons learnt from the implementation of clinically integrated teacing and learning of evidence-based health care for undergraduate health professions students**

DearDoctor Taryn Young,

The **New Application** received on **09-Sep-2013**, was reviewed by members of **Health Research Ethics Committee 1** via Minimal Risk Review procedures on **02-Oct-2013** and was approved.
Please note the following information about your approved research protocol:

Protocol Approval Period: **02-Oct-2013 -02-Oct-2014**

Please remember to use your **protocol number** (**S12/10/262**(b)) on any documents or correspondence with the HREC concerning your research protocol.

Please note that the HREC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

After Ethical Review:
Please note a template of the progress report is obtainable on www.sun.ac.za/rds and should be submitted to the Committee before the year has expired.
The Committee will then consider the continuation of the project for a further year (if necessary). Annually a number of projects may be selected randomly for an external audit.
Translation of the consent document to the language applicable to the study participants should be submitted.

Federal Wide Assurance Number: 00001372
Institutional Review Board (IRB) Number: IRB0005239

The Health Research Ethics Committee complies with the SA National Health Act No.61 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 Part 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health).

Provincial and City of Cape Town Approval

Please note that for research at a primary or secondary healthcare facility permission must still be obtained from the relevant authorities (Western Cape Department of Health and/or City Health) to conduct the research as stated in the protocol. Contact persons are Ms Claudette Abrahams at Western Cape Department of Health (healthres@pgwc.gov.za Tel: +27 21 483 9907) and Dr Helene Visser at City Health (Helene.Visser@capetown.gov.za Tel: +27 21 400 3981). Research that will be conducted at any tertiary academic institution requires approval from the relevant hospital manager. Ethics approval is required BEFORE approval can be obtained from these health authorities.

We wish you the best as you conduct your research.
For standard HREC forms and documents please visit: www.sun.ac.za/rds

If you have any questions or need further assistance, please contact the HREC office at 0219389657.

Included Documents:
CV - van Schalkwyk
Declaration - Supervisor (Volmink)
PhD Proposal Summary
Protocol Synopsis
Application Form
Declaration - Supervisor
Declaration - van Schalkwyk
Declaration - Supervisor (Clarke)
CV - Volmink
CV - Rohwer

CV - Clarke
Health General Checklist
Protocol
Declaration - Young
CV - Young
Cover Letter
Declaration - Volmink
Declaration - Clarke

Sincerely,

Franklin Weber
HREC Coordinator
Health Research Ethics Committee 1

Appendix 3.2: International interviews – Supplementary tables

S1: Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

No. Item	Guide questions/description	Reported on Page #
Domain 1: Research team and reflexivity		
Personal Characteristics		
1. Inter viewer/facilitator	Which author/s conducted the interview or focus group?	Discussion
2. Credentials	What were the researcher's credentials? E.g. PhD, MD	Discussion
3. Occupation	What was their occupation at the time of the study?	Discussion
4. Gender	Was the researcher male or female?	N/A
5. Experience and training	What experience or training did the researcher have?	Discussion
Relationship with participants		
6. Relationship established	Was a relationship established prior to study commencement?	N/A
7. Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	N/A
8. Interviewer characteristics	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	Discussion
Domain 2: study design		
Theoretical framework		
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	Methods
Participant selection		
10. Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	Methods
11. Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	Methods
12. Sample size	How many participants were in the study?	Findings
13. Non-participation	How many people refused to participate or dropped out? Reasons?	Methods
Setting		
14. Setting of data collection	Where was the data collected? e.g. home, clinic, workplace	Methods
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	Results
16. Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	Results
Data collection		
17. Interview guide	Were questions, prompts, guides provided	Methods

	by the authors? Was it pilot tested?	
18. Repeat interviews	Were repeat interviews carried out? If yes, how many?	N/A
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	Methods
20. Field notes	Were field notes made during and/or after the interview or focus group?	Methods
21. Duration	What was the duration of the inter views or focus group?	Methods
22. Data saturation	Was data saturation discussed?	Methods
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	N/A
Domain 3: analysis and findings		
Data analysis		
24. Number of data coders	How many data coders coded the data?	Methods
25. Description of the coding tree	Did authors provide a description of the coding tree?	N/A
26. Derivation of themes	Were themes identified in advance or derived from the data?	Methods
27. Software	What software, if applicable, was used to manage the data?	Atlasti
28. Participant checking	Did participants provide feedback on the findings?	No
Reporting		
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	Results
30. Data and findings consistent	Was there consistency between the data presented and the findings?	Relationship to existing knowledge
31. Clarity of major themes	Were major themes clearly presented in the findings?	Results
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	Discussion

Appendix 4.1: Document review and survey – Ethics approval

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03 August 2011 **MAILED**

Ms A Rohwer
Centre for Evidence -Based Healthcare
5th Floor
Teaching Block
5014

Dear Ms Rohwer

Document review of undergraduate MBChB curriculum to inform enhancement of public health (PH) evidence based health care (EBHC), health systems and services research (HSSR) and infection prevention and control (IPC) training at undergraduate level.

ETHICS REFERENCE NO: N11/07/205

RE : APPROVAL

It is a pleasure to inform you that a review panel of the Health Research Ethics Committee has approved the above-mentioned project on 2 August 2011, including the ethical aspects involved, for a period of one year from this date.

This project is therefore now registered and you can proceed with the work. Please quote the above-mentioned project number in ALL future correspondence. You may start with the project. Notwithstanding this approval, the Committee can request that work on this project be halted temporarily in anticipation of more information that they might deem necessary.

Please note a template of the progress report is obtainable on www.sun.ac.za/rds and should be submitted to the Committee before the year has expired. The Committee will then consider the continuation of the project for a further year (if necessary). Annually a number of projects may be selected randomly and subjected to an external audit.

Translations of the consent document in the languages applicable to the study participants should be submitted.

Federal Wide Assurance Number: 00001372
Institutional Review Board (IRB) Number: IRB0005239

The Health Research Ethics Committee complies with the SA National Health Act No.61 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 Part 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health).

Please note that for research at primary or secondary healthcare facility permission must still be obtained from the relevant authorities (Western Cape Department of Health and/or City Health) to conduct the research as stated in the protocol. Contact persons are Ms Claudette Abrahams at Western Cape Department of Health (healthres@pgwc.gov.za Tel: +27 21 483 9907) and Dr Hélène Visser at City Health (Helene.Visser@capetown.gov.za Tel: +27 21 400 3981). Research that will be conducted at any tertiary academic institution requires approval from the relevant hospital manager. Ethics approval is required BEFORE approval can be obtained from these health authorities.

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Approval Date: 2 August 2011

Expiry Date: 2 August 2012

Yours faithfully

MS CARLI SAGER
RESEARCH DEVELOPMENT AND SUPPORT
Tel: +27 21 938 9140 / E-mail: carlis@sun.ac.za
Fax: +27 21 931 3352

Fakulteit Gesondheidswetenskappe · Faculty of Health Sciences

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Approval Notice
New Application

08-Dec-2011
Willems, Bart B
Stellenbosch, WC

Protocol #: S11/10/004

Title: **A survey to assess the experience of medical school graduates on the appropriateness of Evidence Based Health Care, Health Systems and Services Research, Infection Prevention and Control and Public Health teaching at the Stellenbosch University, Faculty of Health Sciences**

Dear Dr Bart Willems,

The **New Application** received on **12-Oct-2011,** was reviewed by members of **Health Research Ethics Committee 1** via Expedited review procedures on **08-Dec-2011** and was approved.
Please note the following information about your approved research protocol:

Protocol Approval Period: **08-Dec-2011 -08-Dec-2012**

Please remember to use your **protocol number** **(S11/10/004)** on any documents or correspondence with the REC concerning your research protocol.

Please note that the REC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

After Ethical Review:
Please note a template of the progress report is obtainable on www.sun.ac.za/rds and should be submitted to the Committee before the year has expired.
The Committee will then consider the continuation of the project for a further year (if necessary). Annually a number projects may be selected randomly for an external audit.
Translation of the consent document in the language applicable to the study participants should be submitted.

Federal Wide Assurance Number: 00001372
Institutional Review Board (IRB) Number: IRB0005239

The Health Research Ethics Committee complies with the SA National Health Act No.61 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 Part 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health).

Provincial and City of Cape Town Approval

Please note that for research at a primary or secondary healthcare facility permission must still be obtained from the relevant authorities (Western Cape Department of Health and/or City Health) to conduct the research as stated in the protocol. Contact persons are Ms Claudette Abrahams at Western Cape Department of Health (healthres@pgwc.gov.za Tel: +27 21 483 9907) and Dr Helene Visser at City Health (Helene.Visser@capetown.gov.za Tel: +27 21 400 3981). Research that will be conducted at any tertiary academic institution requires approval from the relevant hospital manager. Ethics approval is required BEFORE approval can be obtained from these health authorities.

We wish you the best as you conduct your research.
For standard REC forms and documents please visit: www.sun.ac.za/rds

If you have any questions or need further help, please contact the REC office at 0219389657.

Included Documents:
Protocol
Checklist

Declaration
CV
Application
Questionnaire
Synopsis

Sincerely,

Franklin Weber
REC Coordinator
Health Research Ethics Committee 1

Appendix 4.2.1: Faculty interviews – Ethics approval

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Approved with Stipulations
New Application

16-Jan-2013
Young, Taryn TN

Ethics Refernce #: N12/11/081

Title: **Perspective of staff of the Faculty of Medicine and Health Sciences, Stellenbosch University, on undergraduate MB,ChB training in public health, evidence-based health care, health systems and services research, and infection prevention and control**

Dear Doctor Taryn Young,

The **New Application** received on **20-Nov-2012**, was reviewed by members of **Health Research Ethics Committee 1** via Expedited review procedures on **15-Jan-2013**.

Please note the following information about your approved research protocol:

Protocol Approval Period: **15-Jan-2013 -15-Jan-2014**

The Stipulations of your ethics approval are as follows:
Dr Cameron should submit a signed investigator's declaration.

Please remember to use your **protocol number** (**N12/11/081**) on any documents or correspondence with the HREC concerning your research protocol.

Please note that the HREC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

After Ethical Review:
Please note a template of the progress report is obtainable on www.sun.ac.za/rds and should be submitted to the Committee before the year has expired.
The Committee will then consider the continuation of the project for a further year (if necessary). Annually a number of projects may be selected randomly for an external audit.
Translation of the consent document to the language applicable to the study participants should be submitted.

Federal Wide Assurance Number: 00001372
Institutional Review Board (IRB) Number: IRB0005239

The Health Research Ethics Committee complies with the SA National Health Act No.61 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 Part 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health).

Provincial and City of Cape Town Approval

Please note that for research at a primary or secondary healthcare facility permission must still be obtained from the relevant authorities (Western Cape Department of Health and/or City Health) to conduct the research as stated in the protocol. Contact persons are Ms Claudette Abrahams at Western Cape Department of Health (healthres@pgwc.gov.za Tel: +27 21 483 9907) and Dr Helene Visser at City Health (Helene.Visser@capetown.gov.za Tel: +27 21 400 3981). Research that will be conducted at any tertiary academic institution requires approval from the relevant hospital manager. Ethics approval is required BEFORE approval can be obtained from these health authorities.

We wish you the best as you conduct your research.
For standard HREC forms and documents please visit: www.sun.ac.za/rds

If you have any questions or need further assistance, please contact the HREC office at 0219389657.

Included Documents:
Declarations
Protocol, Synopsis, Consent, Questionnaire
CVs
Checklist
Application Form

Sincerely,

Franklin Weber
HREC Coordinator
Health Research Ethics Committee 1

Appendix 4.2.2: Faculty interviews - Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

No. Item	Guide questions/description	Reported on Page #
Domain 1: Research team and reflexivity		
Personal Characteristics		
1. Interviewer/facilitator	Which author/s conducted the interview or focus group?	Methods
2. Credentials	What were the researcher's credentials? E.g. PhD, MD	Title page
3. Occupation	What was their occupation at the time of the study?	Title page
4. Gender	Was the researcher male or female?	N/A
5. Experience and training	What experience or training did the researcher have?	Title page
Relationship with participants		
6. Relationship established	Was a relationship established prior to study commencement?	N/A
7. Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	N/A
8. Interviewer characteristics	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	Discussion
Domain 2: study design		
Theoretical framework		
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	Methods
Participant selection		
10. Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	Methods
11. Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	Methods
12. Sample size	How many participants were in the study?	Methods
13. Non-participation	How many people refused to participate or dropped out? Reasons?	Methods
Setting		
14. Setting of data collection	Where was the data collected? e.g. home, clinic, workplace	Methods
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	Methods
16. Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	Methods
Data collection		
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	Methods
18. Repeat interviews	Were repeat interviews carried out? If yes, how many?	N/A

19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	Methods
20. Field notes	Were field notes made during and/or after the interview or focus group?	Methods
21. Duration	What was the duration of the inter views or focus group?	Methods
22. Data saturation	Was data saturation discussed?	Methods
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	N/A
Domain 3: analysis and findings		
Data analysis		
24. Number of data coders	How many data coders coded the data?	Methods
25. Description of the coding tree	Did authors provide a description of the coding tree?	N/A
26. Derivation of themes	Were themes identified in advance or derived from the data?	Methods
27. Software	What software, if applicable, was used to manage the data?	Atlasti
28. Participant checking	Did participants provide feedback on the findings?	No
Reporting		
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	Results
30. Data and findings consistent	Was there consistency between the data presented and the findings?	Relationship to existing knowledge
31. Clarity of major themes	Were major themes clearly presented in the findings?	Results
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	Results

Appendix 5.1: KAP survey – Ethics approval

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Approval Notice
New Application

17-Jan-2014
Young, Taryn TN

Ethics Reference #: S12/10/262(C)
Title: Attitude and confidence of medical programme lecturers to practicing and teaching EBHC

DearDoctor Taryn Young,

The **New Application** received on **30-Oct-2013**, was reviewed by members of **Health Research Ethics Committee 1** via Minimal Risk Review procedures on **04-Dec-2013** and was approved.
Please note the following information about your approved research protocol:

Protocol Approval Period: **17-Jan-2014 -17-Jan-2015**

Please remember to use your **protocol number** (**S12/10/262(C)**) on any documents or correspondence with the HREC concerning your research protocol.

Please note that the HREC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

After Ethical Review:
Please note a template of the progress report is obtainable on www.sun.ac.za/rds and should be submitted to the Committee before the year has expired. The Committee will then consider the continuation of the project for a further year (if necessary). Annually a number of projects may be selected randomly for an external audit.
Translation of the consent document to the language applicable to the study participants should be submitted.

Federal Wide Assurance Number: 00001372
Institutional Review Board (IRB) Number: IRB0005239

The Health Research Ethics Committee complies with the SA National Health Act No.61 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 Part 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health).

Provincial and City of Cape Town Approval

Please note that for research at a primary or secondary healthcare facility permission must still be obtained from the relevant authorities (Western Cape Department of Health and/or City Health) to conduct the research as stated in the protocol. Contact persons are Ms Claudette Abrahams at Western Cape Department of Health (healthres@pgwc.gov.za Tel: +27 21 483 9907) and Dr Helene Visser at City Health (Helene.Visser@capetown.gov.za Tel: +27 21 400 3981). Research that will be conducted at any tertiary academic institution requires approval from the relevant hospital manager. Ethics approval is required BEFORE approval can be obtained from these health authorities.

We wish you the best as you conduct your research.
For standard HREC forms and documents please visit: www.sun.ac.za/rds

If you have any questions or need further assistance, please contact the HREC office at 0219389156.

Included Documents:
CV - Volmink
Declaration - Clarke
Declaration - Volmink

Declaration - Clarke (Supervisor)
Protocol Synopsis
Cover letter
Protocol
CV - Clarke
Declaration - Young
Declaration - Esterhuizen
Proposal summary
CV - Young
Application Form
CV - Esterhuizen
Declaration - Supervisor (Volmink)
Checklist

Sincerely,

Franklin Weber
HREC Coordinator
Health Research Ethics Committee 1

Appendix 5.2: KAP survey – Data collection tool

Dear FMHS staff member

I am pleased to invite you to take part in a study which will contribute to curriculum implementation here at Stellenbosch University. This is being done in support of the Graduate attributes project and is focusing on teaching of evidence-based health care (EBHC). This will inform faculty development initiatives to support lecturers in the implementation of EBHC teaching and learning.

Why have you been invited to participate? We are inviting all lecturers of undergraduate medical students at the Faculty of Medicine and Health Sciences (FMHS), Stellenbosch University, to participate in the study.

What will your responsibilities be? Should you agree to join this study, you will complete an online questionnaire. Your name will NOT appear on the questionnaire. The research team of this project will do the analysis of the survey. Raw data will not be released to any persons or entities other than the research team of this study. The anonymous scientific data – in which no individuals will be named or identified – resulting from the study may be presented at meetings (for example, within the FMHS), used for PhD theses and published in national or international journals, for dissemination purposes.

Will you benefit from taking part in this research? The results of this study will inform EBHC teaching and learning activities at the FMHS. All respondents are invited to enter the lucky draw, where one person will win a sponsored registration to the value of R5 000 for a conference of their choice.

Are there any risks involved in your taking part in this research? This study has been approved by the Health Research Ethics Committee at Stellenbosch University (S12/10/262(c)) and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.
Your participation in this study is completely voluntary. If you choose to participate, or not, it will not have any negative repercussions. You are free to withdraw from the study at any moment, or decline to answer any of the questions without penalty. The information obtained from the survey will be treated with strict confidentiality, the questionnaire will not contain any names and data analysis will be performed anonymously.

Will you be paid to take part in this study, or are there any costs involved? There will be no payment or costs involved for you, if you do take part.

Is there anything else that you should know or do? You can contact the Health Research Ethics Committee at 021-938 9207 if you have any concerns or complaints that have not been adequately addressed by the study team.

Principal investigator: T Young
Address: Centre for Evidence-based Health Care, Teaching building, Room 5014, Faculty of Medicine and Health Sciences, Stellenbosch University
Contact details: 021-9389886; tyoung@sun.ac.za

1. Age: ##
2. Gender: _ (M/F)
3. Highest qualification: (tick relevant option)

    - BSc
    - BSc Hons
    - MBChB
    - MSc
    - MMED
    - PhD
    - Other _____

    When obtained: DD/MM/YYYY

4. In which department are you working?: (tick option and specify which Division or Unit within the Department)
   Anaesthesiology and critical care
   Biomedical sciences
   Interdisciplinary health sciences
   Medical imaging and clinical oncology
   Medicine
   Obstetrics and gynaecology
   Paediatrics and child health
   Pathology
   Psychiatry
   Surgical sciences

   Specify which Division or Unit within the Department: _____

5. Are you a Stellenbosch University employee? Y/N

   If no, who is your employer? _____

6. What is your current position: (tick relevant option)

   - Lecturer
   - Senior lecturer
   - Associate Professor
   - Professor
   - Researcher
   - Senior researcher
   - Chief researcher
   - Other: _____

7. How long are you working at or with the Faculty of Medicine and Health Sciences, Stellenbosch University?: ## years
8. For how long have you been involved in teaching undergraduate medical students: ## years
9. Indicate during which year of study you teach medical students: (tick all applicable options)

   - Year 1
   - Year 2
   - Year 3
   - Year 4
   - Year 5
   - Year 6

10. Describe your understanding of evidence-based health care (EBHC)
    _____

11. Do you teach EBHC? Y/N
    If yes,
    - Which teaching methods do you use? (tick all applicable options)
      Lectures
      Small group tutorials
      At the bedside
      Online material
      Other
      If other, please specify _____

    - Please outline the content covered in your EBHC teaching: _____

12. Have you attended any training in research methodology? Y/N

    If yes,

    a. Type of training (tick all applicable options)
       i. Short course

ii. Workshop / seminar
iii. Online course
iv. Master's programme
v. PhD programme
vi. Other
Of other, please specify _____

b. Duration of training: ## hours or ## days or ## weeks

c. Content covered (tick all applicable options)
i. Epidemiology
ii. Research proposal writing
iii. Biostatistics / statistics
iv. Systematic reviews
v. Qualitative research methods
vi. Other
If other, please specify _____

13. Have you attended any continuing professional development (CPD) activities or training in EBHC? Y/N

If yes,

a. Type of training or CPD activity (tick all applicable options)
i. Short course
ii. Journal club
iii. Read article on EBHC
iv. Workshop / seminar
v. Online course
vi. Master's programme
vii. Other
Of other, please specify _____

b. Duration of training or CPD activity: ## hours or ## days or ## weeks

c. Please provide details of the content covered in the training or CPD activity.
_____

14. Have you attended any continuing professional development (CPD) activities or training in teaching and learning? Y/N

If yes,

a. Type of training or CPD activity (tick all applicable options)
i. Short course
ii. Workshop / seminar
iii. Online course
iv. Master's programme
v. Other
Of other, please specify _____

b. Duration of training or CPD activity: ## hours or ## days or ## weeks

c. Please provide details of the content covered in the training or CPD activity.
_____

15. Research experience (tick option)

a. Lead the conduct of a primary research project Y/N

If yes,
1. Number of projects: ##
2. Type of projects (tick option)
a. Quantitative methods
b. Qualitative methods
c. Both

b. Contributed to the conduct of a primary research project Y/N

If yes,
1. Number of projects: ##
2. Type of projects (tick option)
   a. Quantitative methods
   b. Qualitative methods
   c. Both

c. Lead or contributed to the conduct of a systematic review Y/N

16. The following are terms used in papers about EBHC which may be relevant to your practice and the department you work for. Please indicate your reaction to them by circling the appropriate number.

For each item, circle the number of the response that shows to what extent you understand the following terms.	**Yes, understand and I could explain to others**	**Some understanding**	**Don't understand, but would like to understand**	**Don't understand, it would not be helpful to me to understand**	**No Idea about this**
a. Absolute risk difference	1	2	3	4	5
b. Allocation concealment	1	2	3	4	5
c. Case control study	1	2	3	4	5
d. Case series	1	2	3	4	5
e. Cohort study	1	2	3	4	5
f. Confidence interval	1	2	3	4	5
g. Selection bias	1	2	3	4	5
h. Intention to treat analysis	1	2	3	4	5
i. Lost to follow-up	1	2	3	4	5
j. N.N.T. (number needed to treat)	1	2	3	4	5
k. Sample size	1	2	3	4	5
l. Systematic review	1	2	3	4	5
m. Odds ratio	1	2	3	4	5
n. Meta-analysis	1	2	3	4	5
o. Confounding	1	2	3	4	5
p. Sensitivity	1	2	3	4	5

17. For each of the following activities, please indicate how **confident** you are in your **current** level of ability by choosing the corresponding number *on the following rating scale*:

_ 0% _ 10 _ 20 _ 30 _ 40 _ 50 _ 60 _ 70 _ 80 _ 90 _ 100%
No Confidence — Completely Confident

How **confident** are you in your ability to:

- . . . identify a gap in your knowledge related to a patient or client situation (e.g. history, assessment, treatment)?
- . . . formulate a question to guide a literature search based on a gap in your knowledge?
- . . . effectively conduct an online literature search to address the question?
- . . . critically appraise the strengths and weaknesses of study methods (e.g. appropriateness of study design, recruitment, data collection and analysis)?
- . . . critically appraise the measurement properties (e.g. reliability and validity, sensitivity and specificity) of standardized tests or assessment tools you are considering using in your practice?
- . . . interpret study results obtained using statistical tests such as t-tests or chi-square tests?
- . . . interpret study results obtained using statistical procedures such as linear or logistic regression?
- . . . determine if evidence from the research literature applies to your patient's or client's situation?

- . . . ask your patient or client about his/her needs, values and treatment preferences?
- . . . decide on an appropriate course of action based on integrating the research evidence, clinical judgment and patient or client preferences?
- . . . continually evaluate the effect of your course of action on your patient's or client's outcomes?

18. What do you experience as barriers to practicing EBHC? _____

19. If you have to rank these barriers which will you choose as the top two barriers? _____

20. Considering these top two barriers, what are your suggestions of how these can be addressed?
_____

21. Read the following statements and rate each on a scale of 1 to 5:

    1: strongly disagree; 2: disagree; 3: don't know; 4: agree; 5: strongly agree

- EBHC is realistic to practice in routine patient care.
- EBHC is useful on a daily basis.
- I think it is important to practice EBHC on a regular basis.
- I rarely formulate questions about patients.
- Literature searches are too time-consuming to do in a clinic.
- My questions can be answered faster when referring to a textbook or a consultant, than performing the steps of EBHC.
- All types of studies are of equal value to me.
- EBHC is irrelevant to my practice.
- I think EBHC is cookbook medicine where one follows a recipe.
- As a healthcare practitioner, life-long learning is vital.

22. For each of the following activities, please indicate how **confident** you are in your **current** level of ability by choosing the corresponding number *on the following rating scale*:

    _ 0% _ 10 _ 20 _ 30 _ 40 _ 50 _ 60 _ 70 _ 80 _ 90 _ 100%
    No Confidence — Completely Confident

    How **confident** are you in your ability to:

- Assist a medical student to phrase a clear question following a clinical encounter with a patient
- Help a medical student find relevant articles in Medline (or other medical databases)
- Guide a medical student critically review article(s)
- Guide a medical student in considering the application of the results of their critique of article(s) to the patient's care
- Evaluate a medical student's EBHC knowledge

23. What do you experience as barriers to teaching EBHC? _____

24. If you have to rank these barriers which will you choose as the top two barriers to teaching EBHC?
_____

25. Considering these top two barriers, what are your suggestions of how these can be addressed?
_____

We are having a lucky draw for a sponsored conference registration (for a conference of your choice) to the value of R5 000, using the cell phone numbers of respondents. If you want to participate, please provide the cell phone number: ##########. This will only be used for the purpose of notifying the winner.

Appendix 6.1: EBHC reflection Africa - Journal correspondence

From: ees.jce.2a9d.33f5e0.ef97d635@eesmail.elsevier.com on behalf of Anneke Germeraad-Uriot
To: Young, TN, Prof <tyoung@sun.ac.za>
Cc: anneke.germeraad@maastrichtuniversity.nl
Subject: JCE-15-478: Interim Decision
Date: 15 September 2015 09:25:22 AM

Ms. Ref. No.: JCE-15-478
Title: Evidence-based Health Care in Africa: past, present and future
Journal of Clinical Epidemiology

Dear Prof. Young,

We are happy to tell you that your manuscript "Evidence-based Health Care in Africa: past, present and future" has been provisionally accepted for publication in the Journal of Clinical Epidemiology. The "provision" is that you address the suggestions and requests made in the enclosed comments of the reviewer.

In addition, according to the guidelines to authors, we request that your abstract is structured in the following format: Each original article must have an abstract/summary not exceeding 200 words. Abstracts must be structured with the following headings: Objective, Study Design and Setting, Results, and Conclusion. Double-space abstracts. Abstracts not in compliance with this format will be returned to the authors for revision. The bottom of the abstract page should list six key words (index-appropriate terms) and a running title.
The Journal of Clinical Epidemiology uses titles that include the 'answer' in the title. If not already done within a limit of 15 words, please would you modify your title to incorporate the main message of the conclusion? Please state verbs in the past tense for individual studies (whose results might be over-ruled by later studies or meta-analyses), and in the present tense for systematic reviews (whose results are less likely to be over-ruled by later studies).

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This should be a separate file labeled "Response to Reviewers" that carefully addresses, point-by-point, the issues raised in the comments appended below. You should also include a suitable rebuttal to any specific request for change that you have not made. Mention the page, paragraph, and line number of any revisions that are made.

Manuscript and Figure Source Files (mandatory)

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Please accompany the revision with a letter (uploaded as "Response to Reviewers") numbering the comments and responding to each indicating the specific changes you have made in the text to deal with the comments. If the changes are not too extensive, you might also enclose a "Marked Revision" that shows how the changes were made. If you have not made the requested changes or have other explanations for questions raised by the

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I would appreciate receiving your revised manuscript by Nov 14, 2015. Please let me know if more time is required.

Sincerely yours,

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Reviewer's comments:

Reviewer #1: "Evidence-based Health Care in Africa: past, present and future"
Reviewer's comments

General
This regards and interesting and relevant paper on the status and future of health care research in the continent of Africa. It is not a research paper but rather an overview.

Comments
Africa can be seen as the most diverse continent on earth, making it very difficult to summarize for instance the state of health and socio-economic status of its total population. Consequently, it is difficult to summarize its research efforts. Where particular countries, like South-Africa, can afford considerable investments in research, other countries are daily facing the consequences of war. For that reason, systematic reviews of previous research done in Africa raise questions about the availability of sufficient original research to review, and the urge to do more systematic reviews. I would recommend individual countries to initiate original research on medical and health care issues relevant for that particular country, rather than conducting and implying (the results of) systematic reviews. One nice example is a recent publication by Mahmud Abdulkader Mamud, in PlosMedicine (D01:10.1371/journal.pmed.1001837). The latter study is not at all a systematic review, but the study results are expected to steer evidence-based health care in Ethiopia.

The above illustrates a second confusing issue: the manuscript seems to synonymize evidence-based health care with the implementation of the results from systematic reviews. I would say that the vast majority of health care in the Western world has never been summarized in a systematic review, making it again questionable to what extent we need more systematic reviews on health care research in Africa.

Finally, I was wondering what exactly needs to be done for further developing research initiatives in different African countries. One requirement most likely is the education of young intelligent Masters in doing relevant research, supervised by experienced researchers from anywhere in the world.

Response to Reviewer:
Ms. Ref. No.: JCE-15-478
Title: Evidence-based Health Care in Africa: past, present and future, Journal of Clinical Epidemiology

General
This regards and interesting and relevant paper on the status and future of health care research in the continent of Africa. It is not a research paper but rather an overview.

Comments
Africa can be seen as the most diverse continent on earth, making it very difficult to summarize for instance the state of health and socio-economic status of its total population. Consequently, it is difficult to summarize its research efforts. Where particular countries, like South-Africa, can afford considerable investments in research, other countries are daily facing the consequences of war. For that reason, systematic reviews of previous research done in Africa raise questions about the availability of sufficient original research to review, and the urge to do more systematic reviews. I would recommend individual countries to initiate original research on medical and health care issues relevant for that particular country, rather than conducting and implying (the results of) systematic reviews. One nice example is a recent publication by Mahmud Abdulkader Mamud, in Plos Medicine (D01:10.1371/journal.pmed.1001837). The latter study is not at all a systematic review, but the study results are expected to steer evidence-based health care in Ethiopia.

Thanks for your comment. We agree that relevant research needs to be conducted and point out on page 7 of the manuscript that new research needs to be informed by the existing body of research to avoid unnecessary duplication of research. Furthermore, global evidence from systematic reviews can be accessed, assessed for methodological quality using instruments and approaches such as GRADE, and, taking into consideration the local realities, recommendations made for action. This is highlighted in our paper where we show case the Ghana work on the development of evidence informed guidelines where they considered both the international evidence base and the local applicability of the evidence and presented these as structured summaries to be used by guideline development teams.

The above illustrates a second confusing issue: the manuscript seems to synonymize evidence-based health care with the implementation of the results from systematic reviews. I would say that the vast majority of health care in the Western world has never been summarized in a systematic review, making it again questionable to what extent we need more systematic reviews on health care research in Africa.

We have now included a definition of EBHC. Systematic reviews summarise existing research on a specific question following systematic, transparent processes to reduce publication, indexing, language and selection biases. In this manuscript we promote the use of systematic reviews to not only identify what works and what does not, but also the use of systematic reviews to identify gaps in the research base and thus guide decisions about which new studies are needed. We also included the growth in research productivity and initiatives, both technical and supportive, which are promoting the conduct of primary research.

Finally, I was wondering what exactly needs to be done for further developing research initiatives in different African countries. One requirement most likely is the education of

young intelligent Masters in doing relevant research, supervised by experienced researchers from anywhere in the world.

We agree that postgraduate programmes support the capacity development of regional researchers. We also put forward that '*these will need to be complemented by* efforts to improve science literacy in schools, broad-based initiatives to empower a critical mass of local researchers to conduct and deliver internationally competitive research, support senior researchers to become role models and leaders, create enabling institutional environments for research, and build closer relationships between researchers on the one hand and health decision makers, funders and the public on the other.'

In addition, according to the guidelines to authors, we request that your abstract is structured in the following format: Each original article must have an abstract/summary not exceeding 200 words. Abstracts must be structured with the following headings: Objective, Study Design and Setting, Results, and Conclusion. Double-space abstracts. Abstracts not in compliance with this format will be returned to the authors for revision. The bottom of the abstract page should list six key words (index-appropriate terms) and a running title.

The abstract has been revised, key words listed and a running title included.

Appendix 7: Related publications

1. Dudley LD, **Young TN**, Rohwer AC, Willems B, Dramowski A, Goliath C, et al. Fit for purpose? A review of a medical curriculum and its contribution to strengthening health systems in South Africa. *African Journal of Health Professions Education*, [S.l.], v. 7, n. 1, p. 81-85, jun. 2015. ISSN 2078-5127.
   Available at: http://hmpg.co.za/index.php/ajhpe/article/view/7987

2. Rohwer A, Schoonees A, **Young T**. Methods used and lessons learnt in conducting document reviews of medical and allied health curricula - a key step in curriculum evaluation. *BMC Medical Education*.2014, 14:236
   Available at: http://www.biomedcentral.com/1472-6920/14/236

3. Rohwer A, Rehfuess E, **Young T**. E-learning of Evidence-Based Health Care to Increase EBHC Competencies in Healthcare Professionals. 2014. Available at: (http://www.campbellcollaboration.org/lib/project/224/)

4. Machekano R, **Young T,** Conradie W, Rusakaniko S, Thabane L. Workshop report: building biostatistics capacity in Sub-saharan Africa-taking action. *The Pan African Medical Journal.* 2015;21:167
   Available at: http://www.panafrican-med-journal.com/content/article/21/167/full/

5. Machekano R, **Young T,** Rusakaniko S, Musonda P, Sartorius B, Todd J, Fegan G, Thabane L, Chikte U, on behalf of the participants at the workshop on Building Biostatistics Capacity in Sub-Saharan Africa. The Africa Center for Biostatistical Excellence: a proposal for enhancing biostatistics capacity for sub-Saharan Africa. *Statist. Med. 2015* (wileyonlinelibrary.com) DOI: 10.1002/sim.6572

6. **Young T,** Garner P, Kredo T, Mbuagbaw L, Tharyan P, Volmink J. Cochrane and capacity building in low- and middle-income countries: where are we at? [editorial]. *Cochrane Database of Systematic Reviews* 2013;(11): 10.1002/14651858.ED000072

Appendix 8: Presentations

1. **Young T**, Rohwer A, Volmink J, Clarke M. What are the Effects of Teaching Evidence-Based Health Care (EBHC)? Overview of Systematic Reviews Campbell Colloquium, Belfast, Ireland, 16-19 June 2014 (oral presentation)

2. **Young T**, Volmink J, Clarke M, Rohwer A. Taking Stock Of Systematic Reviews On Teaching Evidence-Based Health Care (EBHC):Overview Of Systematic Reviews . Stellenbosch University, Faculty of Medicine and Health Sciences, Annual Academic Day: Health systems strengthening, Cape Town, South Africa. 13 August 2014 (oral presentation)

3. **Young T**, Rohwer A. Learning EBHC at undergraduate level: what are the lessons learnt. International Joint conference: 2nd Conference of International Society for EBHC and 6th International Conference for EBHC Teachers and Developers, Taormina (Italy), 30th October – 2 November 2013 (theme group)

4. **Young T**, Rohwer A, van Schalkwyk S, Volmink J, Clarke M. Experiences and lessons learnt from the implementation of clinically integrated teaching and learning of evidence-based health care. 7th International Conference for EBHC Teachers and Developers, Taormina (Italy), October 2015 (oral presentation)

5. **Young T**. The history and the future role of Evidence-based Health Care in Africa: a reflection. 3rd Annual Symposium, Collaboration for Evidence Based Healthcare in Africa, CEBHA, Addis Ababa, Ethiopia, 25 April 2014 (invited keynote talk)

6. **Young T**. Sustainable capacity development for research: taking the agenda forward. Cochrane Colloquium, Hyderabad, India, 22-26 September 2014 (Plenary)

7. **Young T**. Leadership development to enhance evidence-informed decision-making. 8th Global Health Conference on Promotion. Health in all policies. 10-14 June 2013, Helsinki, Finland (invited oral presentation)

8. **Young T**. Promoting evidence-informed health policies in the African region: a reflection on the past decade. African Cochrane Indaba, Cape Town 6-8 May 2013 (invited plenary)

9. **Young T**, Rohwer A, v Schalkwyk S, Volmink J, Clarke M. Experiences and lessons learnt from the implementation of clinically integrated teaching and learning of evidence-based health care. AMEE, Glasgow, Scotland, 6-9 September 2015 (oral presentation)