

Emergency Care Research in South Africa – a Delphi Study

By Dr Brenda Kathleen Barnetson



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Supervisor: Dr Daniël Jacobus van Hoving

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DECLARATION

By submitting this thesis electronically, I declare that the entirety of the work contained therein is my own original work, that I am the authorship owner thereof (unless to the extent explicitly otherwise stated) and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

Signature:

Brenda Kathleen Barnetson

Date: 18 September 2014

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List of Abbreviations

- Advanced Trauma Life Support (ATLS)
- Cardiopulmonary Resuscitation (CPR)
- Cerebrovascular Accident (CVA)
- Department of Health (DoH)
- Emergency Centre (EC)
- Emergency First Aid Responder (EFAR)
- Emergency Medicine (EM)
- Emergency Medical Services (EMS)

Emergency medical services for children (EMSC)
Emergency Point-of-Care Ultrasound (EPCUS)
Emergency Nurses Association (ENA)
Emergency Nurses Society of South Africa (ENSSA)
Emergency Triage Assessment and Treatment (ETAT)
Essential Steps in the Management of Obstetric Emergencies (ESMOE)
Federation of International Football Association (FIFA)
Human Immunodeficiency Virus / Acquired Immunodeficiency Syndrome (HIV/AIDS)
Intensive Care Units (ICU)
International Classification of Diseases (ICD)
International Federation of Emergency Medicine (IFEM)
Low to middle income countries (LMIC)
Major Incident Medical Management and Support (MIMMS)
Medical Research Council (MRC)
Millennium Development Goal (MDG)
National Health Insurance (NHI)
National Health Research Committee (NHRC)
The National Health Research Summit (NHRS)
The Negotiated Service Delivery Agreement (NSDA)
Non-Invasive Positive Pressure Ventilation (NIPPV)
Occupation Specific Dispensation (OSD)
The South African Triage System (SATS)
Rapid sequence intubation (RSI)
Transient Ischemic Attack (TIA)
Tuberculosis (TB)
United Kingdom (UK)
United States of America (USA)
World Health Organization (WHO)

Abstract

Objective

To collate and prioritize research topics from identified knowledge gaps in emergency care in South Africa.

Methods

A three phase modified Delphi study was conducted. A 10-point Likert scale determined agreement regarding the priority of the statements (consensus was achieved when >75% of participants agreed). Seventy six experts in the fields of pre-hospital medicine, emergency medicine, acute care nursing and policy making were invited to participate. Phase 1 focused on identifying research topics, phase 2 prioritizing topics and phase 3 identifying the best study designs for each topic.

Results

Three hundred and fifty research questions, received from 31 (40.8%) participants, were collated into 123 statements. Consensus was achieved for 39 statements as research priorities. Statements were grouped into three sub-categories (pre-hospital, clinical emergency care, and general safety and systems) as some participants were only experts in a specific field. After achieving consensus for ranking the topics in order of importance, the top research priorities that emerged in each sub-category were i) pre-hospital interventions that improve outcomes, ii) determining and improving competence in life-saving skills, and iii) quality improvement in emergency care. In phase 3, consensus was reached on the most appropriate study design in 25 of the ranked topics.

Conclusions

The study resulted in a comprehensive prioritized list of research topics that should guide future researchers to decrease the existing knowledge gap in emergency care in South Africa. It will simultaneously prevent duplication and should ensure that resources are allocated to the most important local issues in emergency care.

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CHAPTER 1: Introduction

According to the biomedical model, health research is the most scientific means of answering questions about the human body and how it functions; as well as understanding disease processes, their treatment and prevention. Health research aims to ultimately ensure high quality patient care with a reduction in morbidity and mortality. Ongoing research is vital to develop best practice guidelines and should contribute to the wellbeing of society in general.(1)

An ongoing issue of global significance is health research funding inequity, where only 10% of health research expenditure is on conditions that represent 90% of the global disease burden.(2) A national priority in South Africa is the Department of Health's strategy to revitalize and strengthen health research into South Africa's quadruple burden of disease.(3,4) This includes infectious diseases, chronic illness and mental health, violence and injury, and maternal, neonatal and child death.(5) It is a priority of the South African Government to improve the health status of the entire nation, and to create a "National Priority Health Research Fund" to achieve a long and healthy life for all South Africans.(3)(5)

Both human and financial resource constraints mean that South African emergency care providers need to establish resource tailored care – this can only be achieved through evidence based medicine and evidence-informed decision making (EIDM)(6) applicable to the developing world. The evolution of emergency systems needs to be evidence-based and appropriate to the country's needs (7). Research in the field of Emergency Medicine (EM) specifically related to developing countries is sparse. Emergency Medicine is a young specialty in South Africa and as a result, most EM research has been generated in less resource-constrained settings.(8) This evidence is mostly applicable to medical conditions considered important to the developed world.(9) Limited applicability and transferability of best evidence from these countries creates a knowledge vacuum in low to middle income countries (LMIC), including South Africa.(9)

Research priorities in the developed world related to emergency care are available in the literature – the majority relate to the paediatric or pre-hospital setting. A single consensus study in the developing world related to clinical research priorities, emergency centre (EC) management and administration has been done, but there are no lists or identified gaps for any aspects of emergency or acute care specific to South Africa.(10)

The purpose of the study was to produce a prioritized list of topics to guide future researchers in order to decrease the existing knowledge gap in all aspects of emergency care in South Africa.

This study highlights locally important and essential health issues. Consensus amongst an expert panel has been achieved for priority research areas covering all aspects of emergency medical care. Feasible interventions that will improve public health and emergency care have been suggested congruent with the interests and expertise of the investigators within the specialty of Emergency Medicine. The prioritized list should benefit all role players in the acute care setting by guiding future research, preventing duplication and assisting in prioritizing funding.

CHAPTER 2: Literature Review

2.1 Introduction

Emergency Medicine encompasses the technical and cognitive aspects of virtually all medical disciplines. According to the International Federation of Emergency Medicine (IFEM),

“Emergency medicine is a field of practice based on the knowledge and skills required for the prevention, diagnosis and management of acute and urgent aspects of illness and injury affecting patients of all age groups with a full spectrum of undifferentiated physical and behavioural disorders. It further encompasses an understanding of the development of pre-hospital and in-hospital emergency medical systems and the skills necessary for this development.”(11)

Emergency medical care comprises the whole spectrum of care delivered from the first point of contact with the health care system to the disposition of the patient from the Emergency Centre. Emergency care providers include pre-hospital and in-hospital personnel, in both the private and public health sectors.

Emergency care providers need to ensure that the care they provide is current and evidence based. This requires the generation of ongoing research relevant to the communities they serve. In South Africa, emergency care providers need to know where to focus their research attention by identifying gaps and gaining consensus on research priorities relevant to the South African setting.

An initial literature review was conducted up to December 2012 using MEDLINE, Google Scholar, and the TRIP Database. Search terms included “health research” (“priorities” and/or “importance”): “global”, “developing world”, “developing countries”, “South Africa”, “consensus”, “priority research lists”, “health services research”, “evidence-based medicine”, “consensus”, “Delphi technique”, “transferability” and “applicability”. The search was limited to human studies in English. All publications were screened for relevance (research, the importance of research and research priorities) by evaluating the title and abstract. Local guidelines (e.g. the Western Cape Guidelines for Emergency Medicine, National and Provincial policy documents) were also checked and experts in their fields of EM were contacted where available literature was relating to important topics was sparse or not available. Articles relevant to emergency medicine, emergency nursing, emergency medical services and disaster medicine were included in the literature review.

2.2 The importance of research

2.2.1 *The importance of health research in general*

There are many unanswered questions about the functioning of the human body, the causes of diseases and the best ways to prevent or treat them. Various factors are important in seeking a better understanding of human physiology; these include epidemiology, health systems research, medical sociology and anthropology, legal aspects of medicine and medical ethics.(12) Medical research is the most scientific means of answering these questions.

Health research should ultimately ensure high quality patient care with subsequent reduction in morbidity and mortality.(13) This can only be guaranteed if research is ongoing, if the efficacy and adverse effects of medical interventions are continuously monitored and by ensuring that research is relevant to a specific patient population and without any therapeutic misconceptions.(1,12,14) Ongoing research is vital to develop best practice guidelines and should contribute to the wellbeing of society in general.(1)

2.2.2 *The importance of health research in South Africa*

South Africa has a quadruple burden of disease that has decreased the average life expectancy of South Africans by 20 years (See Box 1: The quadruple burden of disease in South Africa).(5)

A healthy nation however, is required for economic progress and growth and the National Department of Health (DoH) subsequently developed strategic priorities in order to address this burden of disease.(3) One strategy is to revitalise and strengthen health research by prioritizing and promoting research relevant to these diseases.(3,4)

- | | |
|----|--|
| 1. | Infectious Diseases (Mainly HIV/AIDS and Tuberculosis) |
| 2. | Chronic Illness and mental health |
| 3. | Violence and injury |
| 4. | Maternal, neonatal and child death |

Box 1: The quadruple burden of disease in South Africa

2.2.3 *Importance of research in Emergency Medicine in South Africa*

South Africa is a developing and resource-limited country, nevertheless effective and evidence based emergency medical care needs to be delivered. Emergency Medicine is a relatively young specialty that only became recognised by the Health Professions Council of South Africa in March 2003. In contrast to this, it has been a well-established specialty in higher income countries since as early as 1971.(8)

As a result, the majority of published studies (research and reviews) in the field of EM have been generated in developed and less resource constrained settings, and the results are not always applicable or transferable to the South African setting. The knowledge vacuum created by the limited applicability of best evidence from developed countries means that clinicians in South African EC's need to know what the highest standard of care for their patients would be when resources are constrained. Achieving this goal is only possible through the practice of evidence based medicine applicable to the developing world.(9) Resource optimized (or tailored) care has to be established in order to achieve the high quality standard of emergency care every South African deserves.(13)

2.3 Identifying research needs

2.3.1 Global priorities

Addressing global health research priorities are dependent on numerous factors: political commitments, national research strategies, infrastructures and skills development. Research is dependent on a culture of enquiry where people ask nationally relevant questions, a country's capacity to generate its own knowledge, and its ability to use external knowledge.

An ongoing issue of global significance in terms of health research is that only 10% of the world expenditure on health research and development is spent on health conditions that represent 90% of the global disease burden.(2) The 2002 World Health Organisation (WHO) World Health Report focuses on risks that contribute to the global burden of disease and death, both in developing and developed countries. Pneumonia, diarrheal diseases, tuberculosis and malaria, when combined, have been estimated to account for more than 20% of the disease burden in the world (mostly in developing countries), yet they receive less than 1% of the total public and private funds which are devoted to health research.(15) Today, various governmental bodies, in partnership with organizations like the WHO, the Canadian Coalition for Global Health and Commission on Health Research for Development, are working to address the global health research inequity, commonly known as the 10/90 gap.(2)

2.3.2 General priority health problems and research priorities in South Africa

Improving the health status of the entire nation is a priority for the government of South Africa and various national goals and strategies have been set in order to achieve this.

The Negotiated Service Delivery Agreement (NSDA) is a charter that reflects the commitment of key sectorial and intersectional partners linked to the delivery of identified outputs as they relate to a particular sector of government. For the health sector, the priority is improving the health status of

the entire population and to contribute to the government’s vision of “a long and healthy life for all South Africans”. To achieve this, four strategic outputs have been identified (See Box 2: Health outcomes of the National Service Delivery Agreement of the Department of Health)(5).

- | | |
|----|---|
| 1. | Increasing life expectancy |
| 2. | Reduction of maternal and child mortality rates |
| 3. | Combating HIV/AIDS and decreasing the burden of disease from Tuberculosis |
| 4. | Strengthening the effectiveness of the health system |

Box 2: Health outcomes of the National Service Delivery Agreement of the Department of Health

The National Health Research Summit (NHRS) was held in July 2011 in response to the legislative mandate of the National Health Research Committee (NHRC) to set priorities for health research, and to address the strategic priorities of the DoH and the government of South Africa. (3)

At this summit recommendations were made that, as a priority, funds should be used to create a “National Priority Health Research Fund” to achieve the outcomes of the NSDA.(3) Furthermore, numerous priority research questions for each of the NSDA’s health outcomes were also identified.(3) Examples of priority research topics specifically related to emergency care were:

- The prevention of violence and injury to increase life expectancy
- Investigation onto the high rates of out-of-hospital deaths to achieve an understanding of child morbidity and mortality
- Point of care diagnostic tests in support of the fight against HIV/AIDS and TB
- Determining what research is required to strengthen the effectiveness of the health system (staff levels, rational use of drugs and dealing with challenges of inadequate availability /utilization of resources in public health)
- How South Africa should prioritize and promote research on diseases that affect developing countries.

Other general priority research lists that have been generated in South Africa include the “National Health Research priorities” set at the “Essential Health Research Congress” in 2006.(16) The topics were ranked and included HIV & AIDS, all types of injuries, tuberculosis, diarrhoea and perinatal and neonatal mortality.(16)

The afore-mentioned research fields cover broad topics and are not always specific to emergency care. However, researchers in emergency care should be guided by these priority health problems in order to collectively achieve the required health outcomes at a national level.

2.3.3 Priority research lists in Emergency Medicine

EM research in the developed world

The importance of EM related research priorities in general is reflected in various studies done mainly in the developed world. A summary of these studies is included in Table 1: EM research priorities in the developed world.

Table 1: EM research priorities in the developed world

FIELD	STUDY	COUNTRY	OUTCOME
Pre-hospital	Snooks (2009)(17)	UK	Top 10 of 96 topics 3 Important themes
Physician provided pre-hospital care	Fevang (2011)(18)	Europe	5 Priority areas for research
Paediatric pre-hospital emergency care	Foltin (2010)(19)	USA	15 Clinical topics and 5 EMS Topics
	Seidel (1999)(20)	USA	36 Research priorities
	Miller (2008)(21)	USA	16 Multicentre Emergency medical services for children (EMSC) research priorities
Clinical emergency care	Thom 2013(22)	Australia	34 ranked research priorities
Emergency nursing care priorities	Bayley (2004)(23)	USA	20 priorities for nurses, 18 priorities of importance consumers
Geriatric emergency care	Carpenter (2011)(24)	USA	3 key research questions

EM research priority lists in developing countries (including South Africa)

In the only study applicable to the emergency care research needs in the developing world, consensus was achieved for various priority topics regarding clinical research, EC management and the administration of ECs.(10) Although not prioritized, topics in the “administration” category included cost-efficacy, applicability of developed world EM systems in the developing world, EC access, training efficacy, EM’s impact on society, affordable technology and ways to shorten or prevent hospitalization.(10) Consensus for priority clinical research topics included development of evidence-based algorithms, triage, safety, infectious disease, vulnerable patients, management of specific conditions in resource-poor settings and paediatric fluid management.(10)

There are no published lists of research priorities or published identified knowledge gaps for any aspect of emergency care or acute care for South Africa specifically. Many of the “general priority health problems” in South Africa discussed previously would include provision of emergency medical care as a part of the overall management of that priority problem. However these data cannot simply be extrapolated as priorities for research in EM as their presence or ranking on these general lists do not take into account other potentially greater priorities for research by EM specifically.

2.4 Addressing research needs

2.4.1 The challenge of research in emergency care

Performing research in emergency care is a challenge. Various reasons exist for this. Emergency medicine does not deal with a single organ; it is a very broad speciality with legitimate interests in

almost all other areas of medicine.(25,26) EC's serve a variable population - from vulnerable patient groups to patients that simply use ECs for out-of-hours convenience.(25) ECs are often overcrowded and understaffed, and physicians have short patient contact times.(25,27) The system is constantly challenged by resource constraints, specifically in the developing world.(13) Furthermore, obtaining informed consent, contemplating experimental therapies and explaining risks and benefits is difficult in the face of managing critically ill and injured patients. These factors have been described by many authors as major challenges to research and even a threat to the future of EM research.(25)

When the EM patient population has blocked access to medical research, they will not benefit from research and may have study findings from dissimilar populations applied to them. The intellectual growth of the specialty of EM and improving patient-centred outcomes will be limited.(25)

2.4.2 Transferability of research

Evidence for the lack of research in EM in the developing world, including South Africa, is evident in some of the major databases such as MEDLINE and EMBASE where research from less-developed countries is under-represented. Practitioners in low income countries have questioned the transferability of evidence from higher income countries and whether it can simply be imposed on lower to middle income countries.(9) The applicability of developed country research must be questioned as there are important differences between patient populations and the delivery of healthcare. In the developing world, patients may present later, self-medicate or use traditional treatments.(28) Poor facilities lead to delayed diagnoses and referrals and follow-ups are not always feasible or easily arranged.(28) Anaemia in women, malnourishment in children, poor infection control, lack of follow up or lack of adherence to treatments and problems because of staff shortages make the EM patient population vastly different to that in the developed world.(28) In contrast to this, none of the above patient experiences are typical of patient presentations in developed countries.(28)

2.4.3 Addressing locally important issues

The majority of available EM research is applicable to medical conditions considered important to the developed world.(28) Unfortunately, when resource constraints limit research opportunity, practitioners in developing countries continue to refer to the existing methodologically superior data which is inferior in terms of its external validity; or practice is limited to impressions or pathophysiological studies that are not backed up by epidemiological data.(9)

The main reason for the development of EM as a specialty was to deliver reliable quality patient care.(29) EM research priorities should therefore focus on locally important issues that are

congruent with the interests and expertise of the investigators within the specialty of EM.(10,12,29)
Funds and priorities for research should regularly be reviewed so that those topics relevant to the country at a particular point in time are addressed.

South Africa demonstrated the success of focusing research into locally important issues in preparation for the FIFA World Cup Soccer Tournament hosted by South Africa in 2010. Pre-hospital research priorities focused on major incident and disaster preparedness, the legacy of which continues to benefit the potential health care available to all South Africans.(30–32)

The focus of systematic reviews should also be on interventions that are feasible in the majority world, and not to preferentially only assess evidence of recent, high-tech interventions or more expensive technologies that will not be feasible in their applications in the developing world.(28)

2.4.4 A strategy to avoid replication of research within South Africa

Looking back at the history of EM from countries where the specialty has been in place for more than two decades, there are valuable lessons to be learnt in respect of strategies to optimize research efforts.(29)

With the support of national organisations, and careful prioritization of research interests based on recognized gaps, research should be centrally coordinated for expert input and to reduce duplication(10,29).

2.4.5 Resources for conducting priority research

Resources for conducting health research in South Africa are inadequate. This was formally communicated at the NHRS held in July 2011. Not only is there a lack of health research facilities and infrastructure in academic health complexes, but funding is also difficult to obtain.(3) There is currently no easy way to determine the exact amount of funding which has gone towards clinical research in South Africa. The information regarding funding streams for clinical research is confined to estimates because the Medical Research Council (MRC) does not itself regularly analyse its expenditures according to defined categories.(33) Thus there is little information regarding what areas of medical and health research are funded in South Africa and accurate data on actual expenditure are not available. Currently, 10.8% of all government expenditure is on health. The actual proportion spent on health research is very low, however.(33) The NHRC determined that the DoH invested only 0.37% of the 2011/2012 health budget, which falls short of the National Health Research Policy in South Africa to invest 2% of the health budget on health research.(3) As resources available for medical research are increasingly inadequate, social value has emerged as an important criterion for judging whether a project should be funded.(12)

The development of enhanced multicentre research networks such as those that have been successfully implemented in the USA and other developed countries have led to numerous research grants and proliferation of high quality clinical research publications. Collaborative research was deemed crucial because of its many benefits for emergency medicine researchers and the resulting improvements in the emergency care rendered to patients. The additional benefit and value of including experts in other fields or involving emergency medicine in external multicentre projects was evident.(29)

Following their lead, similar strategies can be employed in the developing world to avoid duplication and to optimize external validity so that the local EM population will benefit from research findings relevant to them.(27) Collaboration with developing world countries in this respect is ideal to facilitate research – research which in turn can also be performed by any of the staff associated with an EC.(10)

2.5 Conclusion

Evidence for lists of priority research topics and knowledge gaps in EM specific to developing countries in the literature searched in this review is sparse, and is available for general priority research topics in emergency care in South Africa specifically is lacking. Financial, organizational and human resources for health research need to be allocated to address areas of research that experts in the field of emergency care agree to be priorities.

An evidence-informed list that is current prioritized and in line with the needs of the population that is served by its emergency care providers, if supported by policy, could direct beneficial research endeavours towards South Africa's EC patient population.

CHAPTER 3: Methodology

3.1 Research Question

What should the research priorities be in emergency care in South Africa?

3.2 Aim

To identify, collate and prioritize research topics from identified knowledge gaps in emergency care in South Africa.

3.3 Study Design

A three phase modified Delphi study was undertaken from 1 March 2012 until 5 April 2013. The Delphi study design was modified in that each phase was limited to only two or three rounds (See Box 3: The Delphi process used to attain a coherent list of research topics for Emergency Care in South Africa).

Phase 1 – Identifying research topics

- Round 1: Submission of free-text suggestions regarding important research needed in emergency care
- Round 2: Rate agreement of proposed research statements
- Round 3: Delphi process used to determine consensus on research statements

Phase 2 - Prioritizing research topics

- Round 1: Ranking of agreed research statements
- Round 2: Delphi process used to determine consensus on ranking of statements

Phase 3 - Best approach to prioritized research topics

- Round 1: Select the most appropriate method to address the research statements related to study design, funding and collaboration
- Round 2: Delphi process used to determine consensus regarding most appropriate study design

Box 3: The Delphi process used to attain a coherent list of research topics for Emergency Care in South Africa

3.4 Study Population

Seventy-six participants were invited to represent the expert panel (Appendix 1). Purposive sampling was used. They included doctors, nurses, pre-hospital providers, and policy makers from all the provinces in South Africa. Doctors included private and public sector Emergency Medicine specialists, all academic programme heads in Emergency Medicine at the various universities, and representatives from emergency care related institutions (South African Red Cross Air Mercy Service and International SOS) or societies (Emergency Medicine Society of South Africa, Resuscitation Council of South Africa, Trauma Society of South Africa). Nursing panel members included heads of nursing education and senior lecturers of Emergency Nursing Care at private and public academic and training institutions. Furthermore, representatives of the Emergency Nurses Society of South Africa and nurses working in key roles in the private and public hospitals were also invited. Pre-

hospital panel members included academic heads and lecturers of public and private pre-hospital training programs. Policy makers in the panel comprised of national and provincial Members of the Executive Council (MEC's) and heads of Departments of Health, and all national and provincial Directors of Emergency Medical Services. Some of the invited panel members appointed an approved representative to participate in their place once the study was underway.

3.5 Data collection and management

All potential panel members were invited by e-mail and participation implied consent (Appendix 2). An online survey tool (SurveyMonkey®) was used to facilitate the process. The views of all participating panellists were given equal weight. Participants were given four weeks to complete each round; weekly reminders were sent by e-mail until a response was received or the four weeks expired.

All identified panel members were invited to participate in the first round of phase 1. Participants were requested to suggest important research topics in five categories of emergency care (Adult emergency care, Paediatric emergency care, Pre-hospital emergency care, Emergency Nursing care, and a "General" section for any other area related to emergency care). An example was provided for each category. Participants could offer any number of suggestions in each category, or no suggestions at all. Provision for general comments was also included. Categories were randomized to avoid question order bias. The suggested research topics were collated into research statements which were grouped into 29 different sections to cover the spectrum of care delivered by all emergency care workers in Table 2: **Sections covering priority research topic suggestions.**

Table 2: Sections covering priority research topic suggestions

1	Triage	16	Burden of Disease in Emergency Care
2	Transfer & Transport	17	Drugs
3	Major incidents	18	Toxicology
4	Resuscitation	19	Environmental
5	Advanced airway management	20	Forensic care
6	Ventilation	21	Management systems
7	Shock	22	Communication
8	Fluid therapy	23	Roles of Providers
9	The trauma / Critically unwell patient	24	Emergency care provider health & wellbeing
10	Competency in critical care	25	Education
11	Clinical care scenarios	26	Clinical Governance & quality assurance
12	Trauma in general	27	Patient safety
13	Paediatrics in general	28	Patient Rights
14	Obstetric care	29	Health economics
15	Infectious disease management		

All panel members were again invited to participate in the second round of phase 1; even if they did not respond during the first round. The sections per se and statements in each section were randomized to prevent question order bias. Participants were asked to rate their agreement that each statement was a priority for research in emergency care in South Africa, using a 10-point Likert scale (high scores implied strong agreement). Participants considered each statement in the context of their field of expertise, and had the option to select “not applicable” if the particular statement did not apply to them. Consensus statements were identified where >75% of participants strongly agreed (scores 8-10) or strongly disagreed (scores 1-3). The mean score for each statement was also calculated. Statements completed as “not-applicable” were excluded.

Only panellists that participated in round 2 were invited to participate in the third round. Surveys were individualized and participants were presented with all non-consensus statements. Both the participant’s rating score, as well as the mean rating score for each non-consensus statement was provided to allow participants to consider an alternative rating score in order to get consensus.

All panel members were again invited to participate in the first round of phase 2. Consensus statements from phase 1 were regrouped into three new categories: (i) Pre-hospital, (ii) Clinical, and (iii) General Systems and Safety. Panellists were asked to rank the statements in each category in order of importance. Categories per se and statements within each category were randomized to prevent question order bias. Participants could exclude statements by indicating them as “not applicable” to their area of expertise. Submission was blocked until all statements were either ranked or excluded.

The rank order per category was determined. For each participant, the first ranked statement (i.e. most important) was given a value of 1. The lowest ranked statement (i.e. least important) received the value of the number of statements in that category less the number of statements selected as “not applicable”. An average ranking score was calculated for every statement by adding the values given by all participants, and dividing that by the number of participants that ranked that statement; the top ranking statement would therefore have the lowest average score (Table 3: **Examples to determine rank order of research statements**)

Table 3: Examples to determine rank order of research statements

	Ranked value			Average per statement	Ranking
	Participant A	Participant B	Participant C		
Statement A	1	2	N/A	1.5	1
Statement B	2	3	N/A	2.5	3
Statement C	3	4	3	3.3	4
Statement D	4	1	1	2	2
Statement E	N/A	5	2	3.5	5

Only panel members that participated in the previous round of phase 2 were invited to participate in the Delphi process in order to achieve consensus on the individually ranked statements. In this round, sections per se were randomized, but the statements in each section were presented in the order of the average ranking scores achieved in round 1. In round 2, the exact process as described during the first round was used to achieve average ranking scores for each statement.

For the final phase, all participants identified in phase 1 were re-invited. For each research statement, participants were requested to choose one or more study design options. Study design options were provided to select from (Box 4: Study design options). Participants were also given the option of using free text to suggest funding and collaboration options for each statement.

- Non clinical research (i.e. animal / laboratory etc.)
- Description Study
- Case control study
- Cross sectional study
- Cohort study
- Randomized control trial
- Non-randomized control trial
- Systematic Review +/- meta-analysis

Box 4: Study design options

Participants were again allowed to select “non-applicable” to exclude themselves from that statement if they considered the topic out of their area of expertise. Consensus was achieved if >75% of participants selected a particular study design option for a particular statement.

The last Delphi process to achieve consensus was used to determine only the most appropriate study design for each research statement. Only participants from the previous round were invited and the same process was repeated as already described.

Collected data were transferred to and analysed on a password protected electronic spreadsheet (Microsoft Office Excel 2010®, Microsoft Corporation, Redmond, WA).

3.6 Ethical and Legal considerations

Participants in the study were advised that participation implied consent. Anonymity between participants was maintained to ensure recipients remained unaware of other participants’ identities and responses. The principal investigator had access to each respondent’s answers in order to individualize surveys for the Delphi rounds. The online survey was linked to a dedicated password protected e-mail account only accessible by the principal investigator. Data was kept confidential in a password protected database on the principal investigator’s personal computer.

Ethics approval was obtained from the Human Research Ethics Committee at Stellenbosch University (Reference **Copyright**) (Appendix 3)

CHAPTER 4: Results

Seventy-six panel members were invited to participate in the study. Two medical, and three nursing panel members appointed representatives in their place. A summary of all study phases' response statistics are shown in Figure 1. Details of the response statistics for all rounds are available in Appendix 4.

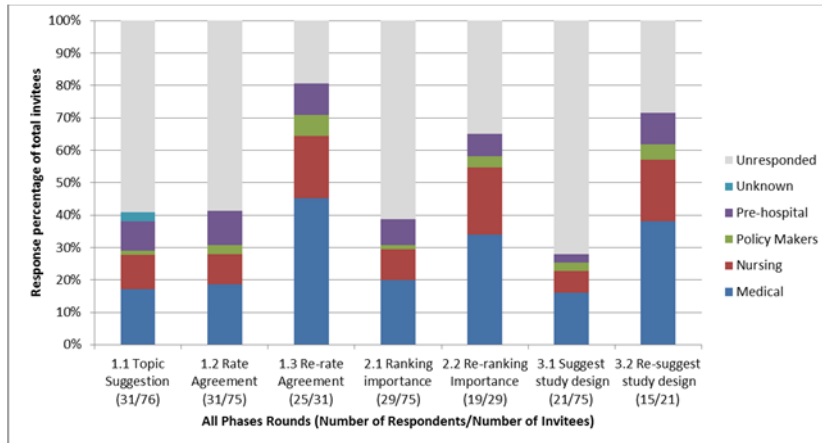


Figure 1: Summary of all study phases response statistics

Three-hundred and fifty research topics were suggested by 31 (41%) participants. The first 2 respondents' identities were unknown due to an initial technical error in the online survey tool. Once corrected, all subsequent respondents' identities were known to the primary investigator. The suggested topics were collated into 123 statements that were grouped into sections covering 29 themes. The original topic suggestions and collation details are available as Appendix 5.

Seventy-five of the original 76 panel members were invited to rate their agreement of the proposed collated research statements as a priority for research in emergency care in South Africa (Phase 1, Round 2)(Appendix 5). One panel member was unintentionally not invited. Thirty-one (41%) responded and consensus was achieved for 11 statements. The remaining statements were resent for re-rating. Consensus was achieved for 39 statements after 25 (81%) participants changed their initial scores. These statements were then grouped into the 3 categories as described in the methods section. One of the 39 consensus statements was identified only later in the study, and was subsequently not included in the second or third phase of the study.

The consensus statements were ranked by 29 (39%) panel members (one panel member opted out) during the first round of phase 2. Statements were re-ordered according to their average ranking scores achieved. The Delphi process used to determine consensus regarding the ranking of the research statements was completed by 19 (66%) participants. Tables 4, 5 and 6 provide the final consensus ranking order of consensus priority statements within in each category.

Table 4: Ranked pre-hospital emergency care research priority topics

1	Determine which pre-hospital INTERVENTIONS improve outcomes in trauma or critically ill patients.
2	Determine the most appropriate pre-hospital MANAGEMENT STRATEGIES in Southern Africa.
Tie 3rd	Optimize the USE OF RESOURCES in terms of transfers and transport in Emergency Medical Services.
Tie 3rd	Compile evidence-based guidelines for the CRITICAL CARE TRANSFER of patients.
5	Determine the outcomes of pre-hospital DRUG-FACILITATED INTUBATIONS.
6	Determine an appropriate MASS CASUALTY SYSTEM for Southern Africa.
7	Implications of the abuse of ambulance services to TRANSPORT NON-EMERGENCY cases.
8	Define the role of AEROMEDICAL TRANSPORT in RURAL areas.

Table 5: Ranked Clinical emergency care research priority topics

1	Determine how competent Emergency Care Providers are in performing common LIFE SAVING SKILLS within their scope of practice.
2	Determine if Emergency Care Providers are competent in recognizing and handling a FAILED AIRWAY.
3	Determine the BURDEN OF DISEASE and PATIENT CONDITIONS that present to the Emergency Centre.
4	Determine how competent Emergency Nurses are in RECOGNIZING CRITICALLY ILL patients.
5	Determine MARKERS OF SEVERITY in the trauma or critically ill patient.
6	Determine how competent Emergency Care Providers are in providing PAEDIATRIC CRITICAL CARE.
7	Develop effective PAIN MANAGEMENT strategies for all acute care patients.
8	Determine the knowledge and utilization of NON-INVASIVE VENTILATION by Emergency Care Providers.
9	Determine the efficacy of NURSE LED TRIAGE.
10	Determine the need for a NATIONAL POISON INFORMATION centre.
11	Determine appropriate SPINAL IMMOBILIZATION techniques in the South African context.
12	Determine if PAEDIATRIC SEIZURES are managed appropriately by all Emergency Care Providers.
13	Determine if TOXICOLOGICAL cases are appropriately managed by all Emergency Care Providers.
14	Determine if paediatric FEBRILE ILLNESSES are managed appropriately.
15	Determine the impact of LODOX on emergency trauma patient management.

Table 6: Ranked General systems & safety management EM research priority topics

1	Implement and review QUALITY IMPROVEMENT systems.
2	Determine if EVIDENCE BASED HEALTH CARE is adhered to in providing Emergency Care.
3	Develop strategies to reduce child and infant MORBIDITY & MORTALITY.
4	Comparison of the DIFFERENT ACUTE CARE SYSTEMS in order to improve understanding and implement integrated care pathways.
Tie 5th	Determine if life-saving EQUIPMENT is CHECKED before commencing duty.
Tie 5th	Determine the COST EFFECTIVENESS of providing Emergency Care.
7	Determine the true implication of PROLONGED LENGTH OF STAY in Emergency Centres.
8	Determine the impact of the NHI (National Health Insurance) on Emergency Care.
9	Determine EFFICACY OF INFECTION CONTROL measures in various acute care settings.
10	Determine valid and reliable assessment methods for Emergency Care EDUCATIONAL EXAMINATIONS.
11	Determine the efficacy of hospital CASE LOAD policies.
12	Determine if INFORMED CONSENT is appropriately undertaken in the Emergency Care setting.
13	Determine if adequate Emergency Centre DISCHARGE INSTRUCTIONS are given to patients.
14	Determine how Emergency Care trainees perceive their FUTURE IN EMERGENCY CARE in Southern Africa.
15	Determine the impact of OSD (Occupation Specific Dispensation) on recruitment and retention of EC staff.
16	To determine ways to improve all forms of emergency team communication and collaboration.

The response rate for suggesting study design options (Round 1, Phase 3) was 28% (n=21); only 3 statements achieved consensus. The last round of the study (reconsidering study design options) was completed by 15 (71%) participants. An additional 22 statements achieved consensus regarding the most appropriate study design to use. Between one and three suggestions per statement for funding options was received for 32 (84%) of the statements; while one to two collaboration suggestions per statement was provided for 29 (76%) statements (Appendix 6).

CHAPTER 5: Discussion

South Africa is considered a low to middle income country,(34) and research needs to focus on priority health problems that affect the majority of society. This requires health care researchers to understand why certain areas of emergency care are considered important for research. In this discussion, previously identified research priorities are compared to those statements that achieved consensus for research in this study. Global research priorities and top priorities in other studies (in low and middle to high income settings) are also compared. This will allow South African researchers to understand whether research items on priority lists in the developed world apply to the South African setting or not, and which items on other research lists are also priorities in South Africa.

5.1 Research priorities in pre-hospital emergency care

5.1.1 Pre-hospital interventions

Different models of pre-hospital emergency care exist. These are the Anglo-American Emergency Medical Services (EMS) system which minimises on-scene time, and the Franco-German model that is typically run by physicians with an extensive scope of practice and very advanced technology.(18) In South Africa, the Anglo-American system is used. Some experts in developing countries are of the opinion that core issues in pre-hospital care are related to the development of rapid transportation rather than advanced pre-hospital care.(10) In South Africa, advanced pre-hospital care is provided by EMS, and in this study, determining '*which pre-hospital interventions improve outcomes in trauma or critically ill patients*' was the top ranking pre-hospital statement. This priority is in line with high income countries where different models of EMS systems exist but their top priorities are similar in terms of efficacy and time windows for critical interventions.(19,20,35) Providing more advanced pre-hospital care in the South African setting, such as pre-hospital thrombolysis and rapid sequence intubation would need to add value and not prolong time to definitive care. Further research into this priority for research would address the feasibility of such interventions in the South African setting.

Pre-hospital airway management is another intervention that was highly ranked, and includes pre-hospital intubation – an intervention that has the potential risk to worsen patient outcomes. There are no guidelines validated in South Africa with respect to this practice, only guidelines providing advice on recommended practice.(36,37) Local studies highlight the need for further research attention. For example, uncertainty about the most appropriate pre-hospital airway techniques was described in a recent local study where pre-hospital intubation of patients with severe traumatic brain injury had adverse outcomes following rapid sequence intubation (RSI) – contrary to the

assumption that aggressive airway management is associated with better outcomes.(38) Although effective, local concerns regarding airway management safety have been demonstrated in a observational retrospective review of paramedic RSI in South Africa.(39) Unsurprisingly, *'the need to determine the outcomes of pre-hospital drug-facilitated intubations'* was ranked fifth as a priority for research in this study, although investigating the use of specific agents to facilitate endotracheal intubation was not a priority. Not only in South Africa is there consensus about the importance of airway management. Pre-hospital advanced airway management relating to patient outcomes and respiratory distress and asthma in children are also high ranking research priorities in higher income countries.(18,19)

5.1.2 Pre-hospital transfer, transport resources and management

Providing patients access to healthcare requires the provision of pre-hospital transport, including emergency and non-emergency transfers. Emergency cases are transported by road or air ambulance. In South Africa, organized non-emergency transport systems, such as "HealthNET", transport all non-emergency cases in an effort to make scarce resources affordable and available to everyone.(40) Initiation of pre-hospital care in developing countries by using the community based Emergency First Aid Responder (EFAR) system has been adopted with success in South Africa where high volumes of emergencies outweigh the available emergency care systems.(41) A substantial number of patients are transferred by EMS in South Africa, but there is minimal local research in the field of patient transfer statistics.(42) *'Optimising the use of resources in terms of transfers and transport'* given South Africa's resource limitations and access barriers have ranked as priorities for research in this study.

One such major resource is *'the use of rotawing transport'* – the role of which was also determined a research priority in this study. Studies on patterns and outcomes of patient transport from rural areas, and on-scene times for rota-wing transfers similarly identified the need for protocols for the use of rotor and fixed wing resources in South Africa.(42,43) Current local guidelines that dictate transfer and transport arrangements include "Case load management policies"(44), circulars and policy documents from the DoH at national and provincial levels (such as the "Transfer of Rural Emergency Patients Policy (H50/2009)") (45) and local hospital standard operating procedures. Policies such as "Call out pathway for paediatric emergencies" are available in some provinces, but not all,(37) and may be limited by local access to the internet or intranet. Documents are frequently out of date or overdue for review. A formalized national transfer guideline needs to be developed that will optimize transport in the South African setting. *'The need for critical care transfer*

guidelines' (such as the USA's National Highway Traffic Safety Administration Guide For Interfacility Patient Transfer (46)) is a global priority and also a consensus priority for research in this study.(18)

A further priority in this study, also relating to potential opportunity to optimize transport resources, is *'to determine the implications of the abuse / misuse of ambulance services to transport non-emergency cases'*. In a UK study, changes in the organisation of a local ambulance services and the need for increased teaching and awareness of the severity and first aid treatment of minor trauma was identified to address this issue.(47) Such studies have not been carried out in the South African setting. *'Determining the most appropriate pre-hospital management strategies in South Africa'* to address all these issues ranked as the second highest pre-hospital priority in this study.

5.1.3 Disaster Medicine

Globally, and in South Africa, the development and acceptance of disaster medicine is growing, as is the research in this field. The purpose of disaster medicine is not only to provide care to victims of a disaster, but to also prepare and mitigate for such eventualities.(48) In planning these responses, lessons learned from the South African response to the Haiti disaster stress the fact that responsibilities of a developing country lie primarily with the needs of its own citizens.(48) Mass casualty situations may occur with both disasters and major incidents. However, given the fact that 85% of disasters and 95% of disaster-related deaths occur in the developing world, a disproportionate amount of original research is contributed to by the developed world.(49) Major incidents are common in South Africa. An unpublished database presently being maintained by the Western Cape EMS shows that over the last 3 years, the average number of incidents is in excess of 100 per annum.(50) The Major Incident Medical Management and Support (MIMMS) system is currently used in South Africa. It originated in the UK and was adopted as part of the FIFA 2010 preparations by the National Department of Health. Ranked fifth in this study was *'research into disaster medicine systems appropriate for South Africa'*. This would include addressing issues such as South Africa's role in responding to international disasters as part of disaster management system planning.

5.2 Research priorities in clinical emergency care

5.2.1 Burden of disease and patient conditions

The main burden of disease in most African countries present as emergencies.(51) In South Africa the quadruple burden of disease has decreased the average life expectancy by 20 years (Box 1).(5) South Africa's National Department of Health (DoH) subsequently developed strategic priorities in

order to address this burden of disease.(3) One strategy is to revitalise and strengthen health research by prioritizing and promoting research relevant to these diseases.(3,4) The Medical Research Council has set up the “Burden of Disease Research Unit” to monitor South Africa’s health status and determinants of disease. By predicting the future burden of disease, plans can be made to improve the overall health of the nation.(52) The burden of disease presenting to EC’s is limited to a few local descriptive studies.(53) In this study, ranking third from the top, was *‘determining the burden of disease and patient conditions that present to the EC’*. Recognising the EM specific burden of disease will lead to funds generated towards prevention strategies. It will guide EM teaching so that clinicians are better empowered to manage common presentations, and it will encourage health research into locally important issues which in itself is a recognised priority for research in developing countries.(10,53)

5.2.2 The trauma or critically ill patient

The burden of disease regarding trauma and critical illness directly impacts all emergency centres in South Africa. Boundaries of care between high dependency and intensive care units (ICU) overlap with the critical care provided in the emergency centre. Overcrowding, prolonged length of stay and lack of EC structure and staffing mean that the management of the critically ill and trauma patient frequently extends beyond initial stabilization in the EC when ICU capacity is breached.(54) Research priorities for the trauma or critically ill adult or paediatric patient all ranked within the top six clinical research priorities in this study. These priorities include *‘determining markers of severity in these patients’* and *‘healthcare provider competency’*. Competence encompasses knowledge, skills, abilities, and traits. It is gained through pre-service education, training and work experience and is a major determinant of provider performance. Very few studies have been conducted in developing countries on measuring competence.(55) The top ranked priorities regarding competency in critically ill patient management included *‘performing life-saving skills, recognizing and handling failed airways, nurses recognizing critically ill patients and competency in the provision of paediatric critical care’*. Furthermore, with respect to addressing patient safety in the provision of critical care, a further priority was determining if *‘life-saving equipment was being checked before commencing duty’*. The latter is of great importance given the risk of preventable errors due to lack of familiarity with equipment.

5.2.3 Pain management

Pain is the single most common presenting complaint in ECs around the world.(56) Providing pain relief for all patients, both pre-hospital and in-hospital has been identified globally as a priority research area in emergency settings in the developed world.(16,19–21,23) Worldwide, healthcare

providers agree that pain relief is a patient's right, but that acute pain management is poor.(56) This is especially true for children in Sub Saharan Africa who are particularly vulnerable to disease and injury. Many developed countries have published specific acute care pain management guidelines.(57) Over the years, a trend for very low numbers of scientific publications from Africa regarding pain management in general has emerged.(58) In South Africa, current guidelines for EC management of pain are limited to provincial or local policies or general guidelines that are not EM specific.(56) Barriers to the provision of basic pain care include cultural diversity and language barriers, inadequate practitioner education and training, limited resources and disease burden.(59) Strategies to address these, as well as addressing assessment tools and consideration of drug delivery routes to develop patient-focused evidence based guidelines have also been suggested.(59) For example, implementing a standard pain assessment tool for children at triage can improve pain management in the EC.(60) Our expert panel agreed that "*an effective pain management strategy for all acute care patients*" needs to be developed.

5.2.4 Ventilation

In the developed world, research has shown that utilization of non-invasive positive pressure ventilation (NIPPV) is variable, and lower utilization rates are due to lack of physician knowledge, inadequate equipment and inefficient training.(61) Data from the developed world indicate that protocols for its use are lacking, use in private hospitals is less than public and academic or teaching hospitals, and not all staff use it.(62) Local guidelines for use of NIPPV in South Africa are not EC specific.(63) A recent study found that the knowledge of mechanical ventilation amongst emergency physicians and registrars is lower than expected.(54) Our expert panel achieved consensus '*that knowledge and utilization of non-invasive ventilation needs to be determined*'.

5.2.5 Toxicovigilance

Toxicovigilance, as defined by the WHO is the active observation and evaluation of toxic risks and phenomena in the community. Poison Information Centres have a fundamental role in toxicovigilance which is aimed at reducing or removing the risks associated with poisonings. In Southern Africa, AfriTox® is a program which provide information to health care providers in order to diagnose and treat poisoning cases.(64) It is supported by the Red Cross War Memorial Children's Hospital and contains information on more than 40,000 potential poisons (encountered worldwide and to South Africa specifically) and their treatment. Ongoing information regarding the incidence and spectrum of acute poisonings in South Africa is essential.(65) Within the field of toxicology, nationally the need for direct training on decontamination and the use of antidotes was recently identified in a local study.(66) Pre-hospital paediatric poisoning management has also been agreed a

research priority in the developed world.(19) Although the global death rate in children and young people under the age of twenty is generally low, Africa and some other LMICs have the highest mortality rates due to unintentional poisoning – 4 to 8 times higher than high income countries. (67) Hence its importance for research in developing countries including Africa. In this study, the need *‘to determine whether toxicological cases are appropriately managed by all emergency care providers’* and *‘the need for a National Poison Information Centre’* are priorities for research.

5.2.6 Trauma, violence & injury

In trauma patients, spinal immobilization is a global issue of importance.(19–21) Evidence shows inconsistencies in the application of spinal immobilization in children under two years.(68) Cervical-spine collars have come into question as their presumed benefit has been questioned in recent studies where they have been proven potentially harmful.(69) Although the Advanced Trauma Life Support (ATLS) program recommends their use as a standard of care, these concerns need further research to develop adequate immobilization techniques for the injured and unstable cervical spine. (69,70) *‘Determining appropriate spinal immobilization techniques’* was a lower ranking research priority in this study.

Considering the importance of violence and injury as contributing to the quadruple burden of disease affecting the average life-expectancy in South Africa(3), development and evaluation of injury prevention strategies was not considered a research priority in this study, whereas globally it has been highlighted in various studies.(10,19–21) Since 2009, criminal-justice enforcement has been emphasized as part of an integrated response to South Africa’s heavy burden of disease from violence and injury. Unfortunately, during the same period there have been few infrastructural responses to prioritize injury prevention issues (including traffic safety). At national level, the need for successful implementation of a strategic framework to address these issues is an ongoing concern.(4) The relative lack of participation and contributions from policymakers in this study may explain why these issues were not further supported as priorities for research.

5.2.7 Paediatric emergency care

Experts in the developing world agree that studies on the clinical aspects of emergency care provided to vulnerable patient groups are priorities for research.(10) Discussion relating to paediatric emergency care research priorities includes many of the priority topics already discussed elsewhere. In this study, and in line with priorities in the developed world, consensus for paediatric care specifically with regards to *‘appropriate seizure and febrile illness management’* was a priority

for research. (20,21) Other priorities relating to clinical paediatric emergency care have been further discussed elsewhere in this discussion.

5.2.8 Non-consensus statements for shock and fluid therapy

In severe sepsis and septic shock, Rivers' study in 2001 showed that early goal directed therapy significantly reduced mortality.(71) This included the use of venous oxygen saturation (ScvO₂) to guide the use of intravenous fluids. In more recent research though, protocol based resuscitation failed to improve outcomes.(72) This data was published only after this study's data collection was complete, which may explain why, at the time of this study, statements relating to priority research in EC fluid therapy, shock and sepsis campaign goals did not achieve consensus. In the paediatric setting, fluid management remains a global priority research area.(73) Updated guidelines in 2012 for management of Severe Sepsis and Septic Shock for adults and children are intended to be best practice and created to represent standard of care.(74) But resource limitations may prevent healthcare providers from accomplishing the recommendations. For term newborns and children, the recommendations are only for industrialized resource-rich settings with full access to mechanical ventilation in ICU's.(74)

However, evidence for fluid resuscitation in children is lacking. Potential dangers of fluid resuscitation in resource limited settings where significantly increased 48-hour mortality was demonstrated in fluid boluses given in critically ill children with impaired perfusion.(75) Given this risk, it is surprising that in the emergency care setting, this has not achieved consensus as a priority for research.

5.2.9 Non-consensus statements for Mental Health Disorders

More than 13% of the global burden of disease for mental disorders is due to neuropsychiatric disorders, and over 70% of this burden lies in low- and middle-income countries.(76) In South Africa, patients in need of emergency psychiatric services should first be admitted to a district hospital for a 72-hour observation period before being admitted to a tertiary psychiatric hospital, but various studies confirm that infrastructure and specialist personnel are mostly inadequate for providing emergency management and observation as required by the Mental Health Care Act.(77,78) A policy commitment to mental health in South Africa was demonstrated at the national mental health summit of April 2012, where one of the priorities was identified as the need to invest resources in 72-hour observation facilities at designated district and regional hospitals.(79) Perhaps having identified this as a priority already meant that in this study, no suggestions were made regarding the importance of research into this aspect of emergency care, other than perhaps the impact of violence against emergency care practitioners which did not achieve consensus as a priority to

research. Globally though, the same trend exists. The reasons why mental health does not get the attention it deserves has been contemplated.(76) Although greater prominence for mental health on the global health stage were made in recent years it still faces major challenges in establishing itself as a global initiative with meaningful political priority.(76)

5.2.10 Non-consensus statements for emergency obstetric care

Statements relating to the management of obstetric emergencies or the role of pre-hospital maternity practitioners did not achieve consensus for research in this study. Reasons for this are complex: Reducing maternal and child mortality rate was already identified as one of four outcomes of the NSDA of the DoH.(5) Also, obstetric emergencies are usually handled by obstetricians on site. The national ESMOE training (Essential Steps in the Management of Obstetric Emergencies),(80) as well as locally published provincial guidelines(81) addressing obstetric emergencies in South Africa are available to assist emergency care providers – perhaps then emergency care providers consider this topic as “already being addressed”. Local EM specific guidelines are limited to complications of 1st and 2nd trimester pregnancies only.(37)

5.3 Research priorities in safety and general systems management

5.3.1 Emergency care systems and health economics

Cost-effectiveness of EM interventions and quality assurance are considered global priorities. (10,16,20) Priorities for health systems research developed at the Essential National Health Research Conference in South Africa in 2006 included quality of care, quality of health delivery and support systems, and health care financing.(16) ‘*Implementation and review of quality improvement systems*’ was the top ranking priority for research in this study. This priority area of health care is already being addressed through audits following the development of health service quality norms and standards that aim to improve the quality of care in public health care.(4) In South Africa, health system priority issues include health economic evaluation and integration of care. Combining trauma and medical emergencies into one EC is one such example.(3,10) These priority issues were also high ranking priorities in this study – in the top five was ‘*cost-effectiveness of providing Emergency Care*’ and ‘*comparing the different acute care systems in order to improve understanding and to implement integrated acute care pathways*’.

The Ministerial Advisory Committees in 2009 planned to introduce a system of National Health Insurance (NHI) to transform the existing unequal and racially skewed health system.(4) Funding would be from a number of sources including the public treasury, a payroll tax, and a mandatory

tax.(4) Consensus in this study is that the *'impact of this system in emergency care'* is priority for research.

5.3.2 Child and infant mortality

One of the health outcomes of the NSDA is to reduce child mortality rates.(3,16) Identifying priorities for child health research to achieve this Millennium Development Goal (MDG) has resulted in suggestions for each of five major causes of child mortality: 1) preterm and low birth weight, 2)diarrhoea, 3)pneumonia, 4)birth asphyxia, and 5)newborn infections. The MDG's importance and applicability in all settings was evident in the topic *'strategies to reduce child and infant mortality'* being ranked second as a priority for research.

5.3.3 Triage, patient flow, case load and length of stay

The South African Triage System (SATS) was developed in 2004 in South Africa.(82) It is the scientifically proven essential standard of care that saves lives and reduces mortality.(82,83) In the developing world, consensus amongst experts was that EC nursing staff, and other non-doctors should be responsible for triage.(10) In South Africa though, with the ratio of doctors to nurses compared to developed countries (1:8 in South Africa vs 1:3 in countries like Canada, Australia and the UK), nurse led triage has been identified as a priority. *'Nurse led triage in South Africa'* ranked 9th as a priority for research, whereas determining *"best patient streaming practices"* and *"pre-hospital triage"* did not reach consensus for priorities for research. This may be explained by the fact that the latter two topics have already been identified as priorities for implementation by the South African Triage System.

Access block and EC overcrowding are one of the greatest threats to the delivery of quality emergency care. Research has shown an increase in errors, delays in care and increased mortality due to prolonged EC length of stay.(84) Strong evidence in the developed world suggests that additional EC staff should assist in addressing the implications of access block to reduce length of stay.(84) In South Africa, amongst other strategies, hospital case load policies have been developed to help address these problems.(44,84) Applying lean thinking principles in patient streaming in addressing the complex issue of EC overcrowding, flow and efficiency may be improved.(85) In the developed world, methods of decreasing length of stay, and addressing overcrowding as an issue of importance to consumers specifically has also been highlighted as a priority for research especially amongst EC nurses.(23) In this study, *'the true implication of prolonged length of stay'* and *'efficacy of hospital case load policies'* was also highlighted as research priorities.

5.3.4 Education & practising evidence-based medicine

In the developed world, education and training were high ranking research priorities for education.(19,20) Likewise, EM specialist training is a priority in the developing world including South Africa.(10) Long-term sustainability requires a system of peer training from international experts followed by training of local trainers.(10) A review of EM training in LMIC recommended reporting specifics of training in line with the recently published IFEM residency curriculum.(86) At present, the training of South African registrars are seen by the rest of the world as benefitting from state of the art educational principles by an enthusiastic, committed and clinically credible faculty.(87)

Although consensus in the developing world was achieved that distance education was a key area to develop, distance learning in under-resourced environments was not a priority for research in this study. The feasibility of teaching evidence based medicine in resource-limited settings is unclear. Nonetheless, it is arguably more important in these settings where clinicians firstly need to ensure the evidence from resource-rich countries applies to their poorer and uninsured patients, and secondly, that they are not out of date and providing poor quality of care to large patient loads with limited resources.(88)

Educators in EM focus on good assessment as a tool to ensure quality emergency care further down the line. Assessment and examination as part of education is a big pillar in the development of the specialty of EM in South Africa. (Direct communication with Dr Heike Geduld – Head of Education for EM, Cape Town) *‘Determining whether evidence based health care is adhered to’* and *‘developing valid and reliable assessment methods for emergency care exams’* are priorities for research in this study.

5.3.5 Non consensus statements regarding emergency point-of-care ultrasound

In the developing world, consensus was achieved that training in and the use of ultrasound should be promoted in the EC.(10) In South Africa, emergency point-of-care ultrasound (EPCUS) is used at the bedside by EM clinicians to help clinical decision making and to improve patient outcomes. The optimal use of EPCUS is still in its infancy though. It is a growing core skill of the emergency physician, with new applications regularly added. Competency is key.(89) However, training (not limited to pre-hospital care) and research regarding use of EPCUS was not a priority for research in this study. Reasons for non-consensus regarding teaching methods may be that the skill is often learned and mastered “on the shop floor” without the clinician feeling the need to formalize their training. Furthermore, the demand for formal EPCUS training currently far exceeds both trainer and facility capacity.(89)

5.3.6 Recruitment and retention of staff

Health care professionals have the choice to live and work where they like. Recruitment, retention and supervision, and human resource development are top priorities for South Africa and other developing countries.(10,16) South Africa and Zimbabwe have the greatest economic losses in doctors due to emigration.(90) One of Africa's main responsibilities is to mitigate emigration "push factors" by creating conducive working environments to retain health care workers, or attract those that are abroad to return.(91) Even so, recent publications following the introduction of Occupation Specific Dispensation (OSD) suggest that Human Resources for Health do not only migrate for better salaries – there are other push factors such as working conditions that need further investigation in the public sector especially.(92) In addition to poor remuneration, the lack of appreciation or recognition, poor organisational communication, lack of control over workplace dynamics and limited promotional opportunities have been cited as important reasons for Advanced Life Support paramedics to withdraw from operational practice in South Africa.(93) *'Determining the impact of OSD in emergency care on recruitment and retention of staff'* achieved consensus for research in this study. There are no published studies in the literature regarding the *'perception of Emergency Care trainees own future in South Africa'* or in other developing countries. This topic, ranked 14th in the study and is important as it may predict and therefore further assist in the recruitment and retention of staff – essential too in the development on EM training programs in LMIC especially.(86)

5.3.7 Infectious Diseases

Considering the burden of infectious diseases (mainly HIV/AIDS and Tuberculosis) and the NSDA's efforts to combat these, HIV management issues and programs, drug-resistant infections and antibiotic profiles are major priority research topics in the developing world and in South Africa specifically.

In the public and private sector in South Africa, inappropriate antibiotic prescription practices in ICU's are associated with poor patient outcomes.(94) In a recent study conducted in a South African trauma ICU, a reduction in the emergence of multidrug-resistance pathogens could be demonstrated with policies supporting regular bacterial surveillance and antimicrobial stewardship.(95) In this study however, statements relating to infectious disease management did not achieve consensus.

Regarding safety in infectious disease management, *'the efficacy of infection control in various acute care settings'* was considered a priority for research in this study.

5.3.8 Non-consensus statements regarding staffing & roles in emergency care

In various developed world studies, determining the appropriate staffing, (including physicians in the pre-hospital field), staff to patient ratios, staff competency and the effect on outcomes were considered top priorities for research by pre-hospital, and in hospital providers of emergency care (including nurses).(18,23) By comparison, in this study, consensus was not achieved that determining the exact level of competence and skill required, nor to determine emergency care provider roles, (including roles in pre-hospital and major incidents), role overlap and responsibilities. In the pre-hospital setting, non-consensus about the importance of research into staff to patient ratios may be explained by the fact that these calculations have already been made. For example, a Modified Medical Resource Model for Mass Gatherings was developed in preparation for the FIFA 2010 World Cup Soccer tournament in South Africa, and since then also verified.(31,32)

On the other hand, mass gatherings aside, emergency centres have been identified as areas of risk for patient safety. Human factors involved in generating errors deserve priority - preventable medical errors may be avoided by appropriate system factors such as adequate staff to patient ratios, and adequate staff training.(96)

Regarding the roles of nurses in the EC, in resource-rich settings nurses that practice independently (as Advanced Practice Registered Nurses) result in high-quality emergency care and remarkable outcomes.(97) Locally, a resource-tiered approach framework on how EC nurses can have different roles was provided by organizations such as ENSSA (Emergency Nurses Society of South Africa).(98) This could then be utilized by other Sub-Saharan African countries that have a need for non-physicians to provide emergency care.

5.4 Study Design suggestions

Descriptive studies and systematic reviews were the two predominant study designs that achieved consensus for most statements.

Descriptive studies typically describe the characteristics of a population.(99) It's popularity in EM-related research in SA could be due to the fact that so little EM-related research have been done and descriptive studies are most often the preferred initial step to establish a baseline from where to work from.

On the other side of the spectrum, systematic reviews have been shown to be the best, least biased and most rational way to organize, eliminate, evaluate and integrate large amounts of evidence.(99) Systematic reviews allow synthesis of data to identify beneficial or harmful interventions and may be

less expensive and quicker to conduct. The impact and generalizability of results is greater due to the larger sample sizes.(99)

5.5 Collaboration and Funding Suggestions

The low response rate limits the applicability of funding and collaboration suggestions made in this study. Suffice to state that given the goals of the National DoH and Medical Research Council in terms of supporting health research in general, their contribution to funding for most priority topics is not an unexpected suggestion. For example, pneumonia, diarrhoea and new-born problems are the main causes of child mortality. According to the WHO, although these represent 70% of deaths in under-five children, they receive minimal funding.(100) Suggestions were made in this study that collaboration with all stake holders (including Public Health) and requests for funding from the WHO and the DoH is required to address this priority research area. Given the WHO's interest in reducing child mortality by 60% simply by optimizing the delivery of existing technologies(100), suggestions to have them contribute in terms of funding for this topic make sense.

Numerous suggestions for funding from pharmaceutical companies for studies relating to drugs (such as pre-hospital intubation, pain management strategies and toxicological case management), and funding from equipment manufacturers for topics such as ventilator management, spinal immobilization research and the impact of Lodox were provided.

Suggestions to obtain funding from private hospital groups to facilitate research into pre-hospital management strategies, transfers, strategies to reduce child and infant morbidity and mortality, improving outcomes and pre-hospital intubation, infection control and the efficacy of acute case load policies is important as they are equal role players in emergency care.

Appendix 6 lists all other collaboration and funding suggestions. Most were received from single individuals and represent their opinion only, and hence not further discussed.

5.6 Study limitations

A purposeful panel selection sampling technique was used by the research team; the sampling criterion being that experts were identified by their specialist qualification, roles as leaders in their fields or heads of EM academic institutions or societies, but limited to those who were contactable by e-mail. Inability to connect with the potential panellists excluded their potentially valuable opinion. Once the study was underway, it was mainly policy makers that remained non-contactable – this limited the recognition of gaps in knowledge and policies where policy change and resource allocation at provincial or national level to address priority problems could have been better achieved.

Using “expert” opinion in a Delphi study means that participants have an interest and involvement in the question being examined. If however they are to be directly affected by the research, the Delphi technique can lead to researcher and subject bias.(101) Also, as was the case in this study, the opinion of a sub-set of experts with special interests in emergency care (such as paediatric emergency care) may have been under-represented due to lack of participation or not being contactable initially.

Individual experts’ opinions were blinded to other parties – this meant that participants would have been less reluctant to express their honest views when a public expert panel’s hierarchy may have otherwise discouraged disagreement. On the other hand, lack of participant discussion in the Delphi process may have prevented participants to change their views, and respond simply according to the majority opinion.

Collating of free text statements by inductive reasoning was done in an effort to reduce the number of statements to avoid panel fatigue and attrition. Abstraction may have led to omission of details and to potential over-simplification of suggested priority topics.

In this study, 75% was chosen as positive (or negative) response as a reasonable threshold to achieve consensus, as there are no universally accepted or evidence-based criteria to define consensus. Various authors have suggested differing percentages, largely based on the type of research, sample size and aim of research.(102) Likewise, there is also no acceptable response rate, and for the purpose of this study, a 40% response rate was aimed for given the sample size. The response rate and consensus thresholds mean that final agreement is not implied, but rather that guidelines for further research are identified. The Delphi technique requires a continued commitment from participants. To avoid attrition, weekly reminders were sent and participants were allowed to return to their survey for later completion.

CHAPTER 6: Conclusions and recommendations

Evidence for priority research topics in EM specific to developing countries in the literature is sparse. This study provides expert consensus on the current priority research areas in emergency care in South Africa. It can ultimately guide emergency care providers to serve the South African EC patient population with evidence-based emergency medical care that is relevant and important to them.

A further recommendation in line with the DoH is that financial, organizational and human resources for health research need to be allocated to these areas of research that experts in the field of emergency care agree to be priorities. Research in emergency care in the developing world can be performed by any staff associated with the EC – from the pre-hospital providers, to the nurses and doctors.

Furthermore, if the ranked lists of priority statements produced in this study are centrally coordinated, duplication of research may be reduced and maximum expert input will be achieved.

Conflict of Interest

The author has no conflicts of interest to declare.

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