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[Intervention Protocol]

Incentives for lay health workers to improve recruitment, retention in service and performance

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ABSTRACT

This is the protocol for a review and there is no abstract. The objectives are as follows:

To assess the effectiveness of financial and non-financial incentives for lay health workers in improving performance, increasing retention, and attracting appropriate LHW candidates.

BACKGROUND

Description of the condition

Low and middle income countries (LMICs) face severe health worker shortages across all levels of healthcare (Bangdiwala 2010). The World Health Organization (WHO) has estimated that 57 countries face critical health worker shortages (WHO 2006), and that 36 of these countries are in Sub-Saharan Africa (WHO 2006). While health worker shortages are exacerbated by increased demands placed on health services by infectious diseases and by the growing burden of non-communicable diseases (Callaghan 2010; Lehmann 2009a; Samb 2007; Samb 2010; Zachariah 2009), they are also the result of migration, poor staff morale and weak incen-

tives (Zachariah 2009). The problem is not limited to human resource shortages but also includes inequitable health worker distribution both within countries and between countries, with wealthy countries and wealthy urban areas within poor countries being better served (Coovadia 2009; Patel 2009; Zachariah 2009).

In response to these challenges to healthcare access, many countries have turned to lay health worker (LHW) programmes (WHO 2007). LHWs can be found in some form across the world, and proponents claim they serve a critical function in communities in which they work, often providing services to the most marginalised poor groups where no other services are available (Friedman 2003). LHWs have been defined as any health worker carrying out functions related to healthcare delivery; trained in some way in the context of the intervention; and having no formal professional or

paraprofessional certificated or degreed tertiary education (Lewin 2005; Lewin 2010).

At a country level, LHW programmes may be organised in a range of ways. Some countries have national LHW programmes managed by the government while, in other settings, LHW programmes are managed by bodies outside of government, such as non-governmental organisations or faith-based organisations. In many settings, multiple programmes co-exist, with different forms of organisation and management. Irrespective of organisational form, LHWs form a large part of the health care workforce in many LMICs. In South Africa, it has been estimated that 1636 non-governmental organisations employ a minimum of 38,500 LHWs across the nine provinces (Lehmann 2009b). Other countries are estimated to have even greater numbers: 246,076 in Brazil, 54,500 in Nepal, 100,000 in Pakistan (Earth Institute 2013). LHWs may be engaged in a range of activities including health promotion (such as breastfeeding support) (Tylleskär 2011), disease prevention (such as community mobilisation for immunisation) and treatment (such as community case management for pneumonia in children) (Glenton 2011; Lewin 2010; Soofi 2012; WHO 1998). They are known by many names including lay health workers, community health workers, community care givers, treatment supporters/buddies, community health agents, peer supporters and home/community-based carers. The education of LHWs appears to be very varied across programmes and settings. A review of LHWs in primary care found that training of LHWs could range between 0.4 to 146 days, and could include a variety of approaches including practical field training and more traditional classroom based training (Lewin 2010). Throughout this protocol this type of health worker will be referred to as LHWs.

Unlike formal health care which requires clients to seek out health services for themselves, LHWs are often engaged in household visits (Nkonki 2010), thus taking the service to the doorstep of families. Although the concept of LHWs as a component of primary health care has been around for at least 50 years, there has recently been a renewed focus on these workers (WHO 2007). This focus is part of a broader reorientation and revitalisation of primary health care in many countries (Global Health Watch 2011; WHO 2008b), as well as a response to the need to address key contributors to the global burden of disease such as HIV (Schneider 2008), poor child health (Friberg 2010; Haines 2007; Kinney 2010; Nair 2010), and non-communicable diseases (Lewin 2010). LHWs have, for example, been shown to contribute to increased exclusive breastfeeding (Lewin 2010; Renfrew 2012; Tylleskär 2011), as well as the promotion and administration of vaccines (Glenton 2011). Although LHWs are conventionally thought of in relation to their contribution to infectious disease care, they may also be successful in contributing to the management of chronic conditions such as mental illness (Patel 2009; WHO 2008a).

While LHWs may not require the same resource investment as higher levels of health workers in terms of training or salaries, they are not necessarily a low cost option either. Programmes require

substantial financial investments for training, equipping and supporting LHWs. It has been shown that the cost per woman of promoting exclusive breast feeding in South Africa, Uganda, and Zambia were USD\$220, USD\$139 and USD\$233, respectively (Chola 2011a; Chola 2011b; Nkonki 2012). However, these studies were all implemented alongside randomised controlled trials (RCTs) as vertical programmes. Thus, it could be expected that if such intervention were implemented at scale and integrated into on-going health programmes, these costs could be reduced substantially. All three studies estimated that in a scale-up or operational scenario, costs were reduced by more than 30%. McCord 2012 estimated that the cost of deploying sufficient LHWs so as to reach the entire rural population of sub-Saharan Africa by 2015 would amount to USD\$3750 per trained, equipped and supported LHW.

While most research on LHWs has focused on their impact and benefits to public health (Nkonki 2011), it is also important to consider what incentive strategies would motivate LHWs themselves. The WHO has defined motivation as “the level of effort and desire to perform well” and identified it as an important determinant of the overall quality of health care (Songstad 2012; WHO 2006). Thus, as with all other health workers (Hongoro 2004; WHO 2006), it is important to consider incentive strategies for LHWs, including general management and remuneration, in relation to how these might impact on the motivation of LHWs to perform at their best and remain in their post (i.e. improved retention). Research on LHW incentives, including factors contributing to motivation for improved performance, appropriate recruitment, and increased retention is both necessary and ongoing (Amare 2009; Nkonki 2011; Ruano 2012).

Description of the intervention

Health worker incentives can be defined in several ways. The WHO has defined them as “all the rewards and punishments that providers face as a consequence of the organisations in which they work... and the specific interventions they provide” (ICN 2008; WHO 2000). A narrower and more instrumental definition from Buchan 2000 defines an incentive as a “particular form of payment that is intended to achieve some specific change in behaviour”. Other definitions, however, provide a broader view of incentives as those features of a particular situation that may increase motivation towards a particular end. For this review, we have opted to use a more expansive definition of incentives which includes the possibility of LHWs being motivated by both financial and non-financial incentives. This is in keeping with both the international guidelines on health worker incentives (commissioned by the WHO) as well as an earlier review of LHW incentives (Bhattacharyya 2001; ICN 2008). The international guidelines suggest that financial incentives include terms and conditions of employment (e.g. salaries), performance payments (e.g. payment for achieving a target) and other financial support (e.g. loans or

bursaries) (ICN 2008). These guidelines also list a wide range of non-financial incentives including a positive work environment (e.g. sufficient resources, management support, employee representation), flexibility in employment arrangements (e.g. flexible working hours), support for career and professional development (e.g. supervision, mentoring, training), access to services (e.g. childcare, healthcare) and intrinsic rewards (e.g. respect of community, job satisfaction). Similarly, the earlier review lists monetary factors (e.g. remuneration), non-monetary factors (e.g. gaining respect, achieving status, personal growth) and community level factors (e.g. being selected by the community) as incentives for LHW motivation (Bhattacharyya 2001). Thus for the purposes of this review we have defined an incentive as any benefit provided to LHWs, or action undertaken in relation to LHWs, with the explicit intention of increasing motivation so as to improve measurable outcomes in relation to recruitment, retention and performance. This broad definition is based on the assumption that programme planners will not only be interested in specific financial incentives, which may be linked to performance (Witter 2012), but will also, and perhaps primarily, be interested in the many possible factors that may increase or shape the motivation of LHWs.

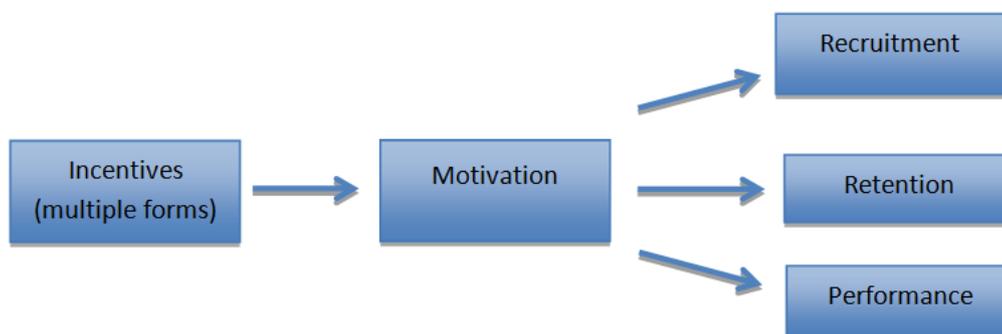
Incentives are also seen as being highly context specific (Bhattacharyya 2001). For example, informants in a study in Nepal noted that LHWs in that setting were motivated by social respect, religious and moral duty, and that payment for their services could challenge this social respect and therefore undermine motivation (Glenton 2010). In the South African context, where unemploy-

ment is high, factors such as avoiding idleness while unemployed, career opportunities and altruism were found to act as incentives for people to volunteer as LHWs (Akintola 2011). This review will also therefore consider the relationship between the context in which an incentive is implemented and its impacts.

How the intervention might work

Within a broader system of human resource management for health (Hongoro 2004; Hongoro 2006), incentives can contribute to motivating LHWs (Figure 1). Job-related incentives therefore need to be seen by existing or potential LHWs as a benefit of becoming and remaining a LHW and also as a factor that may enhance their work performance. As noted above, these benefits can be both financial and non-financial. Financial incentives, such as paying LHWs, may work through contributing to meeting the most basic needs of individual LHWs and their families (Colvin 2012). This is particularly important since many LHWs are economically marginalised and thus “there are some basic survival needs that their work as LHWs must address if they are to remain engaged and effective” (Colvin 2012). However, once day-to-day needs are met (Colvin 2012), motivation is often driven by more than just money (Hongoro 2004), and individuals and groups may be motivated by a wide range of non-financial incentives (Glenton 2010; ICN 2008; Ruano 2012). A package with the right mix of incentives may therefore motivate people to become LHWs, to remain in their positions, and to perform at their best (Alam 2012; Colvin 2012; Takasugi 2012) (Figure 1).

Figure 1. Model of the relationship between incentives, motivation and behavior for LHWs



Why it is important to do this review

Incentive strategies may influence efforts to recruit new LHWs with appropriate personal skills and characteristics that can be developed further with training. In contrast, poor motivation among LHWs may lead to attrition, which can threaten the sustainability of LHW programmes by disrupting the continuity of care and increasing costs, for example through having to recruit and train new LHWs (Nkonki 2011). While the importance of effective and sustainable incentives for LHWs is highlighted in most studies of LHWs, the available evidence regarding the effects of different types of incentives has not yet been reviewed systematically and synthesised. Given the potential contribution of LHWs to improving health outcomes (Lewin 2010), it is important to review the best available evidence on the effects of incentives for LHWs in order to develop a knowledge base that can support more sustainable programmes. A summary of this body of evidence could inform policy and programme development at national and international levels and also identify evidence gaps where further research is needed. It is particularly timely and necessary given the rapid scale-up of LHW programmes in many contexts. In addition, the last major review of lay/community health worker incentives was published 13 years ago (Bhattacharyya 2001), and focused mainly on providing a narrative overview of programmes, rather than examining the effectiveness of different incentive options. The existing Cochrane review on the effects of lay health workers does not address this question (Lewin 2010), and a Cochrane overview of reviews on the effectiveness of financial incentives in changing healthcare professional behaviours and patient outcomes does not address LHWs (Flodgren 2011). There are therefore no up-to-date reviews assessing the effect of incentives (financial and non-financial) for lay health work exclusively.

OBJECTIVES

To assess the effectiveness of financial and non-financial incentives for lay health workers in improving performance, increasing retention, and attracting appropriate LHW candidates.

METHODS

Criteria for considering studies for this review

Types of studies

Following the Cochrane Effective Practice and Organisation of Care (EPOC) Group study design guidelines (Cochrane EPOC Group 2014c), we will include both randomised and non-randomised studies in this review as some incentive interventions for LHWs may be difficult to evaluate using randomised approaches

(e.g. new policies on financial incentives for LHWs implemented at the national level) and may therefore have been evaluated using other designs. We will also include studies that use both cluster and individual allocation. The review will include the following study types:

1. randomised controlled trials (RCTs);
2. non-randomised controlled trials (NRCTs);
3. controlled before-after studies (CBAs);
4. interrupted time series (ITS; these need to have a clearly defined point in time when the intervention occurred and at least three data points before and three after the intervention);
5. repeated measures studies.

We shall only include cluster-randomised trials, non-randomised cluster trials, and CBA studies with at least two intervention sites and two control sites. The inclusion of studies will not be restricted by language, geographic region, publication status or date of publication.

Types of participants

We will include the following participant groups.

- LHWs:
 - for the purposes of this review, the term 'lay health worker' will be defined as any health worker (paid or voluntary) who:
 - ◊ performs functions related to healthcare delivery;
 - ◊ is trained in some way in the context of the intervention, but has received no formal professional or paraprofessional certificate or tertiary education degree (Lewin 2005).
 - ◊ This definition does not exclude LHWs who receive a certificate on completion of their training but does exclude health care providers who receive pre-licensure or post-licensure training certified by a professional body, such as a nursing or midwifery council.
 - ◊ LHWs, as defined here, include community health workers, village health workers, birth attendants, trained traditional birth attendants, peer counsellors, nutrition workers, home visitors, community health agents, community care givers, treatment supporters/buddies, community health agents, peer supporters and home/community-based carers etc.
 - Health systems staff, managers and policymakers:
 - any staff, managers or policymakers involved in the planning or implementation of incentive programmes or interventions.
 - Clients of LHWs:
 - any person, group or community to whom LHWs deliver a health intervention, including treatment, health promotion, support, etc., and whose care may be affected by a LHW incentive intervention.

We will exclude studies if (Lewin 2010):

- the health care function undertaken is an extension of the participant's profession (e.g. teachers providing health promotion in schools). These 'other professionals with health roles' are qualitatively different to lay health workers (Ginneken 2011);
- the health care providers are formally trained and certified nurse aides, physician assistants, emergency and fire paramedical and other self defined health professionals and health paraprofessionals;
- the LHW is a family member trained to deliver care and provide support only to members of his or her own family (that is, in which LHWs did not provide some sort of care or service to others, or were unavailable to other members of the community);
- the LHW was trained as part of a tertiary certificate or degree;
- the intervention involves patient support groups only as these interventions are seen as different to LHW interventions in that the lay people involved meet only to provide each other with informal support rather than to provide care or services to others, and also seldom receive training in the context of the intervention;
- the intervention involves peer health counselling programs in schools where peers teach others about a health issue (we will not exclude studies where an individual is trained as a LHW and works among his/her peers);
- the LHWs are delivering care in a non-primary level institution e.g. within a referral hospital;
- the intervention is to train self-management tutors who are not lay persons or to compare lay self-management with other forms of management.

Types of interventions

We have defined LHW incentive interventions as any benefit provided to LHWs, or action undertaken in relation to LHWs, with the explicit intention of increasing motivation so as to improve measurable outcomes in recruitment, retention and improved performance. While it is understood that the effect of some incentives may be experienced intrinsically (such as a sense of well being gained from giving to one's community), the intervention must explicitly include some form of action (e.g. implementing a new policy, organising community recognition meetings, increasing salaries) on the part of health policy makers or managers to increase LHW motivation.

Such action could include:

- financial incentives paid directly to LHWs, such as salaries, loans, bursaries and performance bonuses;
- non-financial incentives that implementing agencies and governments may fund but which do not result in direct payment to LHWs:
 - incentives to enhance the working environment (e.g. management recognition in the form of certificates, fair distribution of work load, resources such as a bicycle);

- incentives for professional development (e.g. mentoring, supervision, training);
- incentives related to employment arrangements (e.g. allowing rural LHWs time off for agricultural work);
- incentives to enhance the intrinsic experience of being a LHW (e.g. programmes to enhance community recognition and respect for LHWs, national LHW days).

Eligible interventions may include both financial and non-financial incentives, or a combination of more than one financial or non-financial incentives. Studies where incentives are combined with other interventions will be eligible for inclusion only if disaggregation of the effect of the incentive is possible.

We will address the following comparisons:

- incentives for LHWs versus no incentives;
- one type of incentive for LHWs versus another type of incentive for LHWs;
- one intensity of LHW incentive compared with a different intensity of the same incentive (e.g. 10 leave days versus 20 leave days).

Types of outcome measures

Primary outcomes

- Lay health worker recruitment as measured through the increase in numbers of applicants to an advertised LHW post or the number of volunteers enlisted in a LHW programme after an incentive intervention
- Lay health worker retention
 - Length of time LHWs remain in their posts, or remain as volunteers after an incentive intervention
 - Rate of attrition
- Lay health worker performance
 - Patient outcomes
 - ◊ Physical health and treatment outcomes: mortality, morbidity, surrogate physiological measures
 - ◊ Health behaviour outcomes, such as adherence to treatment plans, attendance at clinic appointments
 - ◊ Well being: measured sense of well being as a result of support, such as improved psychological health
 - Utilisation, coverage and access to services
 - The increase in demand for and uptake of a particular services
 - The decrease in incidence and prevalence of illness related to the targeted intervention (Fischer Walker 2013)
 - The number of individuals receiving a particular treatment at a point in time as a proportion of the number of individuals who are eligible to receive that particular treatment at the same point in time (Johnson 2011)

- Quality of care delivered by LHWs, including their adherence to recommended practice or clinical guidelines
- Adverse effects or harms
 - Clinical adverse effects (e.g. clinical activities/tasks that linked to incentives being prioritised over other activities)
 - Health system level effects (e.g. unanticipated increased workload, patient complaints, 'gaming' the system to increase access to incentives)

Secondary outcomes

- Lay health worker job satisfaction, including measures of self reported levels satisfaction and proxy measures for dissatisfaction such as sick leave
- Client (patients as well as other stakeholders such as communities, health system managers, families, etc.) satisfaction with care provided by LHWs
- Direct and indirect costs from the analytic perspective of the providers (LHWs) and the health system (government, donors, intervention implementers)
 - We will include both immediate costs and long term recurring costs where these are reported
 - We will note the time horizons of the costs
 - Examples of direct and indirect costs
 - ◊ Costs incurred by LHWs: lost productivity in other activities as a consequence of being in training; income gained or lost as a consequence of being a LHW
 - ◊ Costs incurred by the health system: cost of training new LHWs; costs saved by not having to train new LHWs (saving due to retention); recruitment costs (e.g. advertising); costs of non-financial material incentives (e.g. t-shirts, bicycles); costs of deploying supervisors (e.g. salary, fuel, telephone)

It is not clear at this stage which cost items are likely to be the most important in relation to making choices between alternative incentive interventions, but this is likely to relate to the specified primary outcomes (LHW recruitment and retention; service utilisation; coverage) and to the costs of the incentives themselves, and will be considered in relation to the interventions identified. Outcomes such as utilisation are forms of resource use. However, they are also goals in themselves for health services and are therefore listed as separate outcomes (rather than being included under 'Direct and indirect costs').

If we identify studies that meet our inclusion criteria in relation to study design, participants and interventions but do not assess any of the outcomes listed above, we will include these studies but only report on the outcomes narratively. An example of such a study would be of an incentive intervention to improve performance, retention and/or recruitment but that only measures changes in LHW's knowledge, attitudes and intentions. The inclusion of these studies will help us to assess if the review has been

hampered by selective outcome reporting. Selective outcome reporting may be a concern where studies do not report outcomes that might be expected, given the focus of the intervention.

Search methods for identification of studies

Electronic searches

We will search for eligible studies in the following electronic databases:

- the Cochrane Central Register of Controlled Trials (CENTRAL), part of *The Cochrane Library* (including the Cochrane EPOC Group Specialised Register);
- MEDLINE In-Process & Other Non-Indexed Citations and MEDLINE 1946 to present (Ovid);
- CINAHL 1980 to present (EBSCOHost);
- Global Health (CAB Direct);
- Global Health Library (WHO), including African Index Medicus (AIM), Index Medicus for the Eastern Mediterranean Region (IMEMR), Index Medicus for South-East Asia Region (IMSEAR), Western Pacific Region Index Medicus (WPRIM);
- PsycINFO (Ovid);
- Science Citation Index and Social Sciences Citation 1975-present (ISI Web of Science).

We will incorporate methodological components of the Cochrane Highly Sensitive Search Strategy and the Cochrane EPOC Group search strategy, combined with selected index terms and free text terms relating to LHWs and incentives in our search strategies. We present the strategy for MEDLINE Ovid in [Appendix 1](#). Strategies will be tailored to other databases and reported in the review.

Searching other resources

We will search for ongoing trials in the International Clinical Trials Registry Platform (ICTRP) search portal (<http://apps.who.int/trialsearch/>) and contact authors to obtain further information or eligible data if available.

We will search for grey literature in:

- the Grey Literature Report (<http://www.nyam.org/library/online-resources/grey-literature-report/>);
- OpenGrey (<http://www.opengrey.eu/>).

We will search the reference lists of all included papers and any key papers in the field. We will also search the ISI Web of Science (both the Social Science Citation Index and the Science Citation Index) and Google Scholar for papers that cited the studies included in the review. We will also contact authors of included studies and experts in the field to ask for additional references as well as published or unpublished cost data related to included effectiveness studies.

Data collection and analysis

Selection of studies

A core team of four authors (KD, WO, CH, LN), with assistance where necessary from two additional authors (CC, SL), will be responsible for the selection of studies. We will combine search results in a reference management database and remove duplicate records. The core team (KD, WO, CH, LN), working in duplicate, will each independently screen titles and abstracts of studies for potential inclusion. Thereafter, full-text copies of potentially eligible articles will be retrieved. Again working in duplicate the core team (KD, WO, CH, LN) will independently evaluate each retrieved full-text article for inclusion. In other words each title, abstract and full-text article will be assessed by at least two interchangeable members of the core team. Disagreements on the full-text articles will be resolved through discussion between whichever two review authors the article was assigned to and, where necessary, by consulting a third author from the core team for an independent assessment. Where articles do not provide sufficient information to determine eligibility, we will contact the study authors for further details.

Data extraction and management

Two authors (KD, WO) will independently and in duplicate, extract data from each included study. A standard form will be developed to extract descriptive and outcome data. Where necessary these two authors will discuss any disagreements related to the extraction process until consensus is reached. Any disagreement will be resolved through discussion with a third review author (SL). We will contact study authors in the case of missing data. Two authors (KD, WO) will double enter the checked data into the Cochrane Collaboration's statistical software, [Review Manager 2014](#).

We will extract the following information from all included studies.

- Study design.
- Country, geographical location (rural, urban, peri-urban), health care setting (e.g. facility-based, home-based).
- Participant characteristics:
 - description of the LHW (type/function, age, sex, length of training);
 - description of the clients served by the LHWs;
 - description of any other participants in the intervention.
- Intervention:
 - intervention purpose;
 - parties involved;
 - the nature (financial or non-financial) and content of the incentive(s);
 - delivery mode and those involved in the delivery of the incentive (where applicable);

- timing, duration and intensity of the incentive(s), resources used to enable the intervention including economic and human resources, if described;
 - where economic resources are described we will also try and establish and record the perspective (labour, government, consumers, etc) from which these resources are viewed;
 - the extent to which the intervention was implemented as intended;
 - health systems context, if described;
 - the theoretical basis for the intervention (i.e. the authors' description of how the incentive was hypothesised to work), if described;
 - details of the control or standard care as well as any co-interventions delivered alongside the incentive intervention.
- Outcomes assessed:
 - timing of outcome assessments;
 - method(s) of assessing these outcomes.
 - Results for each outcome.

Assessment of risk of bias in included studies

Two authors (KD, WO) will independently assess the risk of bias for each included study. We will follow guidelines from both the Cochrane Collaboration's tool for assessing risk of bias and the Cochrane EPOC Group, which includes criteria for assessing each of the included study designs ([Cochrane EPOC Group 2014b](#); [Higgins 2011](#)). We will summarise the risk of bias at two levels: within studies (across domains) and across studies (for each primary outcome). Judgement on the overall risk of bias will take into account the likely magnitude and direction of the bias and whether we consider that the bias will impact on the findings. We will assess studies to be at the highest risk of bias if they score high risk in one or more of the following domains: sequence generation; allocation concealment; or selective outcome reporting (based on growing empirical evidence that these three factors are the most important in influencing risk of bias) ([Higgins 2011](#)). We will judge the overall risk of bias as low if these key domains are assessed as low risk of bias, unclear if one or more key domains are assessed as unclear risk of bias, and high if one or more key domains are assessed as high risk of bias.

We will perform further assessment of the quality of evidence related to each of the key outcomes across studies using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach ([Guyatt 2008](#); [Higgins 2011](#)). The main findings of the review will be set out in 'Summary of findings' tables prepared using the GRADEpro software ([GRADEpro 2008](#)). We will list the primary review outcomes for each comparison with estimates of relative effects along with the number of participants and studies contributing data for those outcomes. For each individual outcome, we will assess the quality of the evidence using the GRADE approach ([Balslem 2011](#)), which involves consideration of limitations in design, inconsistency, indirectness, imprecision, publication bias, magnitude of the effect, dose-response effect and

other plausible confounders. We will express the results as one of four levels of quality (high, moderate, low or very low). Where appropriate, should we find outcomes related to resource use, we will also assess the methodological quality of service use and cost data using the resource use and service utilisation components of the quality assessment tools suggested by the Cochrane Campbell and Cochrane Economic Methods Group (CCEMG 2011). An example of such a tool is given in [Appendix 2](#).

Measures of treatment effect

Dichotomous outcomes

For RCTs, NRCTs and CBA studies, we will record outcomes in each comparison group. Where possible we will record or calculate risk ratios (RRs) for dichotomous outcomes. If CBA studies do not provide an appropriate analysis or reporting of results, but present the data for each district/region in the intervention and control groups respectively, for dichotomous outcomes we will re-analyse the data using a generalised linear model to calculate an adjusted RR.

Continuous outcomes

For continuous outcomes, the effect size will be expressed as mean differences (MDs) with standard deviations if outcomes are measured in the same way between studies. If some studies have reported endpoint data and others have reported change from baseline data (with errors), we will combine these in the meta-analysis if the outcomes are reported using the same scale ([Higgins 2011](#)). We will use standardised mean differences (SMDs) with 95% confidence intervals (CIs) to combine data from trials that measure the same outcome but use different scales. We will standardise the data to their effect size by dividing the estimated MDs by their standard deviations. For CBA studies, we will use difference in differences between pre- and post-observation in intervention and control group.

Meta-analysis of outcomes included in adjusted analyses

If adjusted analyses are reported for either dichotomous or continuous outcomes (adjusting for potential confounders in randomised and non-randomised controlled trials and CBAs), we will use estimates of effect from the primary analysis reported by the investigators and convert these to RRs, if possible. In the case where the adjusted analyses for dichotomous outcomes are reported using odds ratios and not risk ratios then we will use the Cochrane Collaboration's statistical software, [Review Manager 2014](#), to convert odds ratios (ORs) to RRs before including the result in a meta-analysis.

Interrupted time series (ITS) studies

For ITS studies we will record changes in level and in slope. If papers with ITS design do not provide an appropriate analysis or reporting of results, but present the data points in a graph or in a table that can be scanned, we will re-analyse the data using methods described in [Ramsay 2003](#).

Studies reporting multiple measures of the same outcome

When a single study uses two separate methods to measure the same outcome (e.g. two measures of LHW performance), or measures two different outcomes that could be considered part of the same outcome category (e.g. two different measures of the physical health of clients), we will adopt the approach to measures of treatment effect as outlined in [Brennan 2009](#), [Flodgren 2011](#) and [Giguère 2012](#):

- select the primary outcome identified by the study authors that correlates to our stated outcomes of interest;
- if no primary outcome is specified, select the one specified in the sample size calculation;
- if no sample size calculations are reported, we will rank the reported effect estimates and select the outcome with the median effect estimate.

When there is an even number of outcomes, we will include the outcome whose effect estimate is ranked $n/2$, where n is the number of outcomes.

Unit of analysis issues

For cluster randomised studies which do not adequately account for clustering in their analysis, we will adjust the analysis for clustering if the following information can be extracted:

1. the number of clusters (or groups) randomised to each intervention group, or the average (mean) size of each cluster;
2. the outcome data ignoring the cluster design for the total number of individuals included in the study (for example, number or proportion of individuals with events, or means and standard deviations); and
3. an estimate of the intracluster (or intraclass) correlation coefficient (ICC). Where no information on the ICC is reported, we will extrapolate the ICC from other cluster randomised studies, if available. If this is not possible, we will not combine the findings of these studies in a meta-analysis, but will present the results in an additional table.

We will use inflated variances to adjust appropriately for clustering ([Higgins 2011](#)).

Dealing with missing data

We will attempt to obtain missing data from the investigators. If this is not possible we will report the data as missing and report this in the risk of bias tables and will not attempt to impute values.

For all outcomes, we will carry out analysis, as far as possible, on an intention-to-treat basis based on available cases. We will attempt to include all participants randomised to each group in the analyses, and analyse data according to initial group allocation irrespective of whether or not participants received, or complied with, the planned intervention.

When assessing adverse events, adhering to the principle of 'intention-to-treat' may be misleading and we will therefore relate the results to the treatment received. This means that for adverse effects we will base the analyses on the participants who actually received the intervention and the number of adverse events that are reported in the studies.

Assessment of heterogeneity

We will first make a qualitative assessment of the extent to which the studies are similar to each other or not. This will include an assessment of the settings, the interventions, the participants, and outcomes. We will also examine the forest plots from the meta-analyses to visually assess the levels of heterogeneity (in terms of the size or direction of treatment effect and by looking at the overlap between confidence intervals around the treatment effect estimate for each included study). We will employ the Chi^2 test to assess whether observed differences in results across studies are compatible with chance alone. When the observed intervention effects are more different from each other than one would expect due to chance alone, we will assume that the studies have 'clinical' and/or statistical heterogeneity.

We will use the I^2 statistic to quantify the level of statistical heterogeneity among the trials in each analysis. If we identify substantial or considerable heterogeneity (approximately $I^2 = 50$ to 100%) we will note this in the text and explore this heterogeneity through the pre-specified subgroup analyses ([Subgroup analysis and investigation of heterogeneity](#)). We will interpret results from meta-analyses with high levels of unexplained heterogeneity with caution.

Assessment of reporting biases

We will attempt to be as comprehensive as possible in our search strategy so as to find and include all relevant studies and to reduce possible publication bias. This will include a search of published studies, grey literature and registers of prospective trials as well as discussions with colleagues ([Higgins 2011](#)). We will use funnel plots to make a visual assessment of whether there is asymmetry, though this does not indicate publication bias. If we find more than 10 studies in this review that report similar outcomes, we will consider statistical testing for funnel plot asymmetry. For continuous outcomes with intervention effects measured as mean differences, we will use the test proposed by in [Egger 1997](#) to test for funnel plot asymmetry. For dichotomous outcomes with intervention effects measured as odds ratios, we will use the test by [Rücker 2008](#) as, due to the nature of this review, heterogeneity

variance is expected to be high. For dichotomous outcomes with intervention effects measured as RR, and continuous outcomes with intervention effects measured as SMDs, we will not consider funnel plot calculations because funnel plots using risk differences (RDs) are seldom of interest. We will interpret the results of tests for funnel plot asymmetry in the light of visual inspection of the funnel plot, as the statistical results may not be representative if there are small-study effects.

Data synthesis

Assuming the breadth of the data is not too wide, we will conduct a meta-analysis of the pooled outcome data [Review Manager 2014](#). We will report the results of the meta-analysis as part of a structured synthesis and will include forest plots where appropriate ([Cochrane EPOC Group 2014a](#)).

We will carry out meta-analysis to provide an overall estimate of treatment effect when more than one study examines similar interventions, provided that: studies use similar methods; studies are similar when it comes to setting; and studies measure the same outcome in similar ways in comparable populations. We will carry out the statistical analysis using [Review Manager 2014](#). We will not combine results from RCTs and NRCTs together in meta-analysis, nor will we present pooled estimates for NRCTs with different types of study designs. Evidence on different interventions may be available from different types of studies (for example, it is likely that data from interventions implemented at the national level will be reported in non-randomised controlled trials). Where there is evidence on a particular outcome from both RCTs and NRCTs, we will use the evidence from trials which are at lower risk of bias to estimate treatment effect.

We will use a random-effects meta-analysis for combining data, as we anticipate that there may be natural heterogeneity between studies attributable to the different interventions, populations and implementation strategies. For continuous variables, we will use the inverse-variance method while for dichotomous variables we will use the method proposed by Mantel-Haenszel. If cluster randomised trials are included, we will use the generic inverse-variance method in [Review Manager 2014](#) for meta-analysis.

For both RCTs and NRCTs, where results have been adjusted to take account of possible confounding factors, we will use the generic inverse-variance method in [Review Manager 2014](#) to carry out any meta-analysis. If both adjusted and non-adjusted figures are provided we will carry out a sensitivity analysis using the unadjusted figures to examine any possible impact on the estimate of treatment effect.

For ITS and repeated measures studies, the preferred analysis method is either a regression analysis with time trends before and after the intervention, adjusted for autocorrelation and any periodic changes, or autoregressive integrated moving average (ARIMA) analysis. We will attempt to present the results for outcomes as changes along two dimensions: change in level and change in slope. Change in level is the immediate effect of the

intervention and is measured as the difference between the fitted value for the first post intervention data point minus the predicted outcome as measured at the first post intervention data point after implementation of the intervention, based on the pre-intervention slope only. Change in slope is the change in the trend from pre to post intervention, reflecting the 'long-term' effect of the intervention. Since the interpretation of change in slope can be difficult, we will present the long-term effects similarly to the way we propose to calculate and present the immediate effects. We will present the effects after half a year as the difference between the fitted value for the sixth month post intervention data point (half a year after the intervention) minus the predicted outcome six months after the intervention based on the pre-intervention slope only. The effects after one year and two years, if available, will be measured similarly. Where studies report a transition phase, we will exclude these data.

We will use the generic inverse-variance method for combining the data in a meta-analysis for ITS and CBA studies.

We will present the results from the meta-analysis in 'Summary of findings' tables (Higgins 2011), prepared using GRADEpro software (GRADEpro 2008). If the review includes study results that cannot be pooled because the settings and/or interventions are too heterogeneous, we will still describe the results using a structured synthesis (Cochrane EPOC Group 2014a). This structured synthesis may include reporting on interquartile ranges and ranges of effects for relevant outcomes, including for direct and indirect costs, and will include a summary of the findings in plain language. Guided by the model presented in Figure 1, this structured analysis may also include a description of the intervention mechanisms described across the studies. We will include information from the structured synthesis in the 'Summary of findings' table.

Subgroup analysis and investigation of heterogeneity

We will perform subgroup analyses to check for variation in the intervention effect across different population, intervention or setting characteristics. Using Review Manager 2014, we will investigate the differences between two or more subgroups (Deeks 2011). This analysis will test for heterogeneity across subgroup results rather than across individual study results thus investigating genuine subgroup differences rather than sampling error. The analysis will only be conducted when the data in the subgroups are independent (i.e. a set of study participants do not form part of more than one subgroup).

These subgroup analyses will depend on having sufficient trials to perform a statistically significant comparison between groups. We will perform meta-regression to investigate both the effect of the intervention on the estimates of effects and to investigate the effect of multiple characteristics (regarding setting and the intervention) simultaneously (Deeks 2011), only if there are 10 times or more observations (studies) available than the number of independent variables (characteristics). This would mean that if we want to perform meta-regression simultaneously on two independent vari-

ables we would need 20 or more studies, and so on. If there are fewer than 10 studies per variable, for fixed-effect meta analyses we will assess subgroup differences by interaction tests (Altman 2003). For random-effects meta-analyses, we will use non-overlapping CIs to indicate a statistically significant difference in treatment effect between the subgroups.

It is anticipated that the studies will be grouped for analysis by incentive types:

- financial;
- non-financial.

We will also consider subgroup analyses for the following explanatory factors:

- location of the lay health worker programme (urban, rural), as we anticipate that certain kinds of incentives (e.g. community recognition, monetary incentives) may have different effects in rural and urban settings due to social and economic differences between rural and urban settings;

- nature of the primary task(s) undertaken by the lay health workers (health promotion, education, treatment, treatment support), as we anticipate that incentives may have different effects depending on the nature of the tasks undertaken by LHWs. For example, small incentives may be effective in improving delivery of health promotion activities but not of activities that involve travelling to clients' homes outside of working hours;

- number of hours worked per month (full-time, part-time), as the effects of (for example, small) incentives may be different for LHWs who work only a few hours a month compared to those who work full-time;

- whether paid or voluntary at baseline, as both financial and non-financial incentives may have different effects on LHWs who are paid (and consider themselves to be formal providers) compared to those who are volunteers (and consider themselves to be undertaking community service);

- point of service delivery (telephone, home visits, facility based) as greater incentives may be needed to motivate LHWs who need to travel to make home visits or do outreach work, compared to those delivering services by telephone or in health facilities.

We will also assess heterogeneity within each subgroup by "eyeballing" the forest plots and using the I^2 measure. If the decision has been taken not to perform a meta-analysis, we will summarise the results of the subgroups within the text of the review.

Sensitivity analysis

We will carry out a sensitivity analysis to examine the effects of removing studies at overall high risk of bias across domains (based on risk of bias assessment within studies) from any meta-analyses conducted. If we combine individually and cluster randomised trials, we will also perform sensitivity analyses based on varying the ICC used to adjust the results from cluster-randomised trials;

and based on removing data obtained from cluster randomised trials. If one or more quasi-randomised studies present both results adjusted for confounding factors and results not adjusted for confounding, we will carry out sensitivity analyses based on unadjusted results

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* Indicates the major publication for the study

APPENDICES

Appendix I. MEDLINE search strategy

#	Searches	Results
1	Community Health Workers/ed, and [Education, Organization & Administration]	883
2	Voluntary Workers/ed, and [Education, Organization & Administration]	910
3	Allied Health Personnel/ed, and [Education, Organization & Administration]	3399
4	“Delivery of Health Care”/ma [Manpower]	625
5	or/1-4 [LHW + Incentives]	5738
6	Community Health Workers/	2901
7	Voluntary Workers/	6870
8	Allied Health Personnel/	9781
9	Doulas/	19
10	(lay adj (aide? or assistant? or attendant? or care* or counselor? or clonsellor? or educator? or health* or helper? or member? or midwi* or person* or staff or trainer? or visitor?)).ti,ab	1231
11	((voluntary or volunteer? or untrained or un trained or unlicensed or un licensed or nonprofessional? or non professional?) adj3 (health work* or health care work* or healthcare work* or personnel or health personnel or health care personnel or healthcare personnel or health provider? or health care provider? or healthcare provider? or helper? or carer? or caregiver? or care giver? or caretaker? or care taker? or assistant? or staff or visitor? or attendant? or aide or aides or midwif* or midwiv* or educator? or counsellor? or counselor?)).ti,ab	1839
12	(community adj (health work* or health care work* or healthcare work* or health personnel or health care personnel or healthcare personnel or health provider? or health care provider? or healthcare provider? or health aide? or volunteer worker? or caregiver? or care giver? or caretaker? or care taker? or member?)).ti,ab	4108

(Continued)

13	(village adj (health worker? or health care worker? or healthcare worker?)).ti,ab	265
14	(paraprofessional? or para professional? or paramedical work* or para medical work* or paramedical personnel or para medical personnel or allied health personnel or allied health work* or support worker? or linkworker? or link worker? or barefoot doctor? or lay volunteer? or peer supporter? or treatment supporter? or peer counsellor? or peer counselor? or doula* or monitrice?).ti,ab	2986
15	((birth or childbirth or labor or labour) adj (attendant? or assistant?)).ti,ab	1352
16	((outreach or out reach) adj (worker? or health worker? or health care worker? or healthcare worker?)).ti,ab	338
17	or/6-16 [LHW]	28727
18	Personnel Management/	15044
19	Employee Incentive Plans/	1477
20	Motivation/	46157
21	Reward/	11357
22	Community Networks/	4917
23	Social Support/	46900
24	Staff Development/	6804
25	Income/	20045
26	Token Economy/	849
27	Pensions/	3121
28	Remuneration/	47
29	“Salaries and Fringe Benefits”/	12715
30	Reimbursement, Incentive/	2676
31	Workers’ Compensation/	6475
32	Family Leave/	281

(Continued)

33	Parental Leave/	446
34	Sick Leave/	3435
35	Health Benefit Plans, Employee/	8896
36	Education/	17938
37	Education, Nonprofessional/	65
38	Vocational Education/	1730
39	Feedback, Psychological/	1939
40	Mentors/	6670
41	Employment/	34321
42	Occupational Health/	23190
43	Occupational Health Services/	9373
44	Work Schedule Tolerance/	4665
45	Workplace/	11963
46	Workload/	14132
47	Personnel Selection/	10470
48	Personnel Turnover/	3653
49	Quality of Health Care/	53473
50	Quality Improvement/	2445
51	Employee Performance Appraisal/	4095
52	(motivat* or incentiv*).ti,ab.	79476
53	(social support or peer support or management support or staff development or career development or professional development or personal development or advancement? or personal growth or social prestige or social recognition or personal recognition or community recognition).ti,ab	52325

(Continued)

54	(education or training or lecture? or workshop? or work shop? or mentoring or coaching or counseling or counselling or feedback or feed back or supervis*).ti,ab	617390
55	(financial support or economic support or monetary support or financial drive* or economic drive* or monetary drive* or reward* or income or pension? or remuneration or salary or salaries or wage or wages or fringe benefit? or compensation or pay for performance or health insurance? or benefit plan? or payment? or loan? or bursary or bursaries or bonus or bonuses or stipend* or honorarium or gift? or token? or allowance?).ti,ab	166420
56	(family leave or parental leave or sick leave or medical leave or paid leave).ti,ab	3305
57	(employment or employee representation).ti,ab.	33785
58	(workplace or work place or workload or work load* or work condition? or working condition? or work environment? or working environment? or (work* adj3 flex*) or (job adj3 flex*)).ti,ab	52090
59	(recruit* or retain* or retention or scale up or scaling up).ti,ab	415442
60	((increas* or expand* or enlarge* or extend or enhanc*) adj3 (proportion* or number* or amount*).ti,ab	198424
61	(task shift* or turnover or turn over).ti,ab.	70954
62	(performance or participation or quality of care or quality of health care or quality of healthcare or health care quality or healthcare quality or quality improvement).ti,ab	585554
63	or/18-62 [Incentives/outcomes]	2175793
64	17 and 63 [LHW + Incentives/outcomes]	13366
65	5 or 64 [LHW + Incentives/outcomes]	16110
66	randomized controlled trial.pt.	342319
67	controlled clinical trial.pt.	85680
68	multicenter study.pt.	152987
69	(randomis* or randomiz* or randomly).ti,ab.	491478

(Continued)

70	(groups or trial).ti,ab.	1482319
71	((multicenter or multi center or multicentre or multi centre) adj study).ti,ab	19819
72	(intervention? or control* or (before adj5 after) or ((pretest or pre test) adj5 (posttest or post test)) or quasiexperiment* or quasi experiment* or evaluat* or time series or time point? or repeated measur*).ti,ab	4342218
73	(effect? or impact?).ti.	1369319
74	or/66-73	6092331
75	exp Animals/	16503677
76	Humans/	12693705
77	75 not (75 and 76)	3809972
78	review.pt.	1756563
79	meta analysis.pt.	37793
80	news.pt.	155361
81	comment.pt.	525270
82	editorial.pt.	321682
83	cochrane database of systematic reviews.jn.	9287
84	comment on.cm.	525269
85	(systematic review or literature review).ti.	37846
86	or/77-85	6297318
87	74 not 86 [Methods filter: RCT, CCT, CBA, ITS]	4201453
88	65 and 87 [LHW + Incentives/outcomes + RCT-CCT-CBA-ITS]	5926

Appendix 2. Consensus on Health Economic Criteria (CHEC) checklist

	Item	Yes	No	Extract
1.	Is the study population clearly described?			
2.	Are competing alternatives clearly described?			
3.	Is a well-defined research question posed in answerable form?			
4.	Is the economic study design appropriate to the stated objective?			
5.	Is the chosen time horizon appropriate to include relevant costs and consequences?			
6.	Is the actual perspective chosen appropriate?			
7.	Are all important and relevant costs for each alternative identified?			
8.	Are all costs measured appropriately in physical units?			
9.	Are costs valued appropriately?			
10.	Are all important and relevant outcomes for each alternative identified?			
11.	Are all outcomes measured appropriately?			
12.	Are outcomes valued appropriately?			
13.	Is an incremental analysis of costs and outcomes of alternatives performed?			

(Continued)

14.	Are all future costs and outcomes discounted appropriately?			
15.	Are all important variables, whose values are uncertain, appropriately subjected to sensitivity analysis?			
16.	Do the conclusions follow from the data reported?			
17.	Does the study discuss the generalizability of the results to other settings and patient/client groups?			
18.	Does the article indicate that there is no potential conflict of interest of study researcher(s) and funder(s)?			
19.	Are ethical and distributional issues discussed appropriately?			

CONTRIBUTIONS OF AUTHORS

The review was conceived by SL, CC and KD. All authors contributed to the development of the protocol. KD and SL wrote the final version of the protocol. All authors approved the final version of the protocol.

DECLARATIONS OF INTEREST

Simon Lewin is an editor for the Cochrane EPOC Group and the Cochrane Consumers and Communication Review Group. The other authors declare no known conflicts of interest.

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