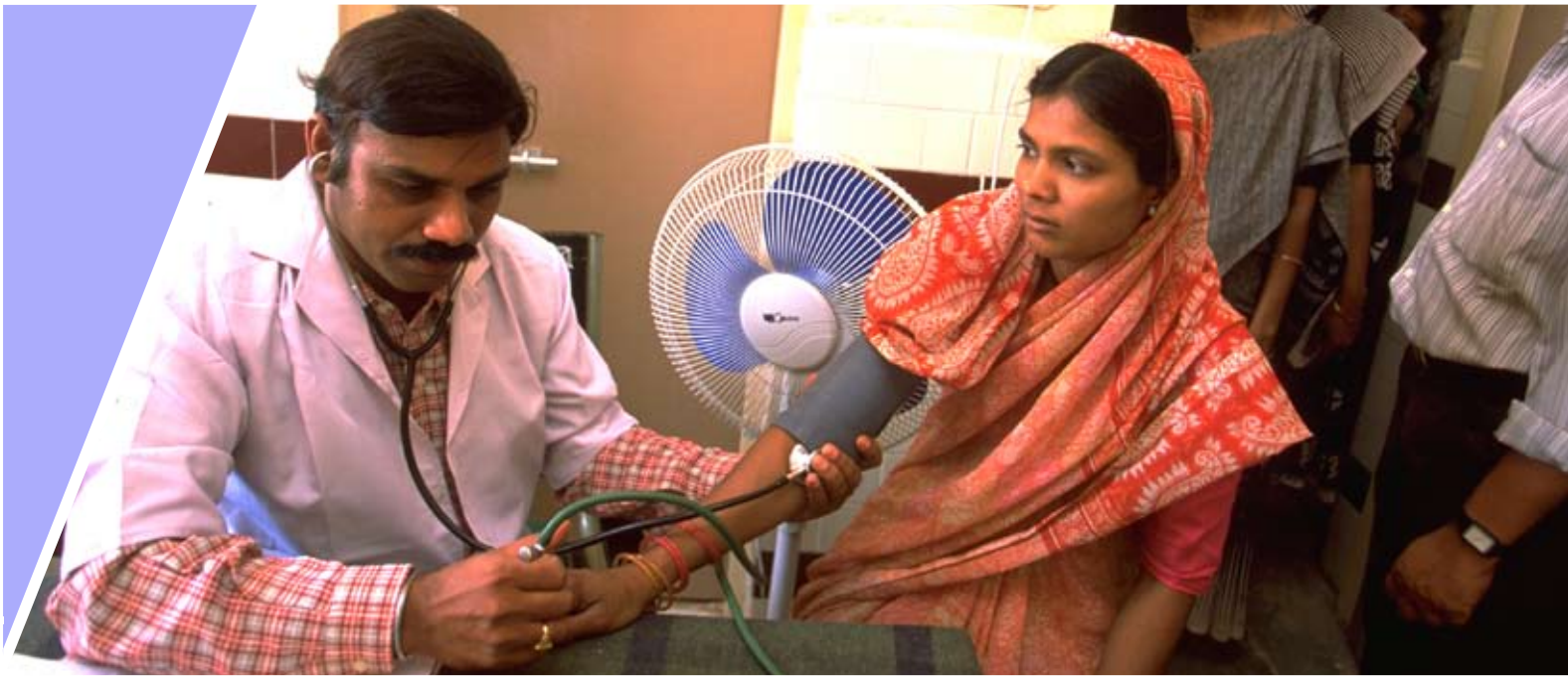
Systematic review

Private versus public strategies for health service provision for improving health outcomes in resource-limited settings



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Contents

List of abbreviations

BLDS	British Library of Development Studies
BMJ	British Medical Journal
CBA	Controlled before-and-after
CCT	Controlled clinical trial
CENTRAL	Cochrane Central Register of Controlled Trials
CI	Confidence interval
DFID	Department for International Development (UK)
DHS	Demographic Health Survey
EPOC	Effective Practice and Organisation of Care Group
GAVI	The Global Alliance for Vaccines and Immunization
GNI	Gross national income
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
HIV/AIDS	Human immunodeficiency virus/acquired immune deficiency syndrome
ICU	Intensive care unit
IDS	Institute of Development Studies
IFC	International Finance Corporation
IMCI	Integrated Management of Childhood Illnesses
IPAR	Kenya Institute of Policy Analysis and Research
IPS	Institute of Policy Studies Sri Lanka
ITS	Interrupted time series
LLMICs	Low- and low-middle-income countries
LMICs	Low- and middle-income countries
MSH	Management Sciences for Health
NGO	Non-governmental organization
NOQAS	Newcastle-Ottawa Quality Assessment Scale
NSA	Non-state actor
NTP	National treatment program
OR	Odds ratio
PAHO	Pan American Health Organization
PPM-DOTS	Public-private mix for directly observed treatment short-course
PPP	Public-private partnership
RCT	Randomized controlled trial(s)
RR	Risk ratio
SES	Socio-economic status
TB	Tuberculosis
USAID	United States Agency for International Development
WHO	World Health Organization
WMD	Weighted mean differences

Abstract

Background

Private healthcare providers deliver a significant proportion of healthcare services in low- and middle-income countries (LMIC). Poorer patients get sick and go without care more frequently, and spend more of their incomes on private healthcare than the wealthy.

This review is focused on comparing health outcomes in private versus public care settings. It seeks to summarize what is known regarding the relative morbidity or mortality outcomes that result from treatment by public or private providers in LMIC.

Methods

We conducted a systematic review of studies evaluating the impact of public and private healthcare provision. We performed meta-analyses on data within identified studies, in order to estimate the effects of type of healthcare provision on identified health outcomes.

Results

Twenty-one studies met our inclusion criteria and explicitly compared health outcomes between the public and private sectors. Of those, 17 were cohort studies, from 9 countries. Eleven studies were conducted in lower-middle-income countries ($996–$3,945 GNI per capita) and 10 studies from upper-middle-income countries ($3,946–$12,195 GNI per capita). Eighteen studies were conducted in urban settings. Fifteen of the 21 studies provided mortality for a health outcome, and studies examined a wide range of diseases, with tuberculosis (TB) being the most represented.

A meta-analysis of all studies exploring the impact of healthcare type and mortality showed that patients in a private healthcare setting are less likely to die than patients in a public healthcare setting (OR 0.60; 95% CI 0.41–0.88). The pooled analysis showed that patients in a private healthcare facility are more likely to have unsuccessfully completed TB treatment than patients in a public healthcare facility (OR 2.04; 95% CI 1.07–3.89).

Regardless of outcomes, the quality of evidence is rated, by objective measures, as either low or very low.

Conclusions

More evidence is needed to compare health outcomes between the public and private sectors. Governments and researchers can play a critical role in improving the evidence base for decision making about the contributions of the public and private sectors in a given country's health system.

Governments should encourage data collection in both public and private settings that would permit ongoing comparison of clinical data. When government facilities are absent or insufficient, contracting with private-sector facilities or providers would appear to be an acceptable option. Governments must consider appropriate profit margins, regulations and training for private providers.

Further research is needed in this area, and should include low-income countries and rural settings. Diseases of the poor – notably malaria and childhood illnesses –

are largely absent from the current literature, with the exception of one study on HIV/AIDS and six on TB.

Executive summary

Background

Based on evidence from demographic health surveys (DHS), private healthcare providers deliver a significant proportion of healthcare services in low- and middle-income countries (LMIC). Some of the reasons for seeking care from private providers cited by patients include better and more flexible access to providers, shorter waiting times, greater sensitivity to patient needs, and greater confidentiality. In many cases, governments fail to create systems to remove or penalize publicly funded staff who offer low-quality services to patients. As a result, patients seeking quality care may turn to private care.

For the purpose of this review, we have used the definitions of 'private' providers given within the surveyed literature so long as it approximates the more formal definitions. In contrast to services offered by government employees, private healthcare services involve a spectrum of providers and institutions, including non-profit or religious institutions. Private-sector services vary by country and range from sophisticated tertiary care facilities comparable to the highest of international standards, to individual doctors and nurses practicing out of one-room clinics and unqualified providers offering services that are neither regulated nor monitored. Private providers – institutions or individuals – are distinguished in economic terms from the public sector by their ownership characteristic. As such, a private provider's profits or losses accrue to the owner, rather than to the government or society. In practice, 'private' providers are often described as health practitioners who are not directly controlled by government authorities and regulations.

The private sector is particularly important for the poor. Poorer patients get sick and go without care more frequently, and spend proportionately more of their incomes on private healthcare than the wealthy. What this means for public health, and for the health of the poor in particular, depends upon the quality of care and the affordability of care provided – two topics which have been the subject of many studies, often with conflicting results.

This review will be of value to stakeholders both inside and outside the research community, helping public health practitioners, policy makers, donor agencies and global health institutions in making evidence-based decisions on healthcare and healthcare policy. Should private-sector doctors, clinics or hospitals provide better care than their government counterparts, then the focus of quality assurance must initially be within government and private providers could be considered for hire or contracting as a means of expanding government-funded care. If private providers have worse outcomes than government alternatives, then training, regulation or suppression of private practice should be considered.

Objective

We have focused in this review upon comparable health outcomes. The objective of this study is to determine the health outcomes from services delivered to the poor by private for-profit, private non-profit and public-sector providers, and the trade-offs between private for-profit, private non-profit and public-sector sources of care for low and middle-income countries (LMIC). The review asks what is known regarding the relative morbidity or mortality outcomes that result from treatment by public or private providers in LMIC.

Methods

This is a systematic review and meta-analysis using both Cochrane Collaboration and GRADE methods. The Cochrane Collaboration is an international network of healthcare professionals, researchers and consumers committed to developing and maintaining comprehensive, regularly updated systematic reviews of healthcare interventions. The GRADE approach is a systematic method of assessing the quality of studies included in a systematic review and developing recommendations or guidelines based upon the evidence. It has been adopted by the *British Medical Journal* (BMJ), the Infectious Diseases Society of America (IDSA), the World Health Organization (WHO), and numerous other agencies and organizations for use in assessing evidence quality and developing guidelines.

We included randomized controlled trials (RCTs), other types of controlled intervention studies, and observational studies that explored the impact of public and private healthcare provision in LMIC for this analysis. We limited the analysis to studies which reported on direct measures of improved health/health status/survival such as mortality or morbidity, lifestyle factors where evidence indicates an effect on the above, and/or adverse health effects of use of public or private healthcare.

Risk of bias in the included observational studies was assessed using the Newcastle-Ottawa Quality Assessment Scale (NOQAS). An overall assessment of the quality of evidence (high, moderate or low) was assigned to each main outcome in all included studies using the GRADE approach.

A meta-analysis for some outcomes was carried out, because we identified a sufficient number of studies to provide an acceptable body of evidence to examine the intervention. We assessed the extent of heterogeneity in results across comparable studies using forest plots, the I^2 statistic and the Chi^2 test.

Where there was evidence of heterogeneity, a random-effects model was applied. Data synthesis was performed using RevMan 5. We provided a summary estimate and 95% confidence interval and generated a forest plot for each meta-analysis.

We performed subgroup analyses by stratifying studies by factors that might be a source of bias or potentially added substantially to heterogeneity between studies for any outcome for which we found multiple comparable studies.

Details of the included studies

Twenty-one studies met our inclusion criteria and explicitly compared health outcomes between the public and private sectors. Of those, 17 were cohort studies, coming from 9 countries – Brazil, China, India, Jamaica, Jordan, Nigeria, South Africa, Thailand and Vietnam. Eleven studies were conducted in lower-middle-income countries ($996–$3,945 GNI per capita) and 10 studies in upper-middle-income countries ($3,946–$12,195 GNI per capita). Eighteen studies were conducted in urban settings. Fifteen of the 21 studies provided mortality for a health outcome, and studies examined a wide range of diseases.

No study examined health outcomes across primary, secondary and tertiary levels of care. Ten studies evaluated care in outpatient settings, nine in inpatient settings and two considered both inpatient and outpatient. Nine studies examined infectious diseases (TB, HIV and sepsis) and eight looked at chronic diseases (cardiovascular and respiratory diseases, rheumatoid arthritis, eye care, end-stage renal disease, hypertension and diabetes). Two studies evaluated end-of-life care and two reported on inpatient mortality. TB was the most represented disease area among included studies, and each TB study presented mortality data.

Synthesis results

Pooled analyses showed a significant reduction in mortality in patients in private care compared to public care (OR 0.60; 95% CI 0.41–0.88). The pooled analysis also showed that patients in private healthcare facilities were more likely to have unsuccessfully completed TB treatment than patients in public healthcare facilities (OR 2.04; 95% CI 1.07–3.89). Regardless of outcomes, the quality of evidence is rated low or very low by NOQAS and GRADE scoring measures, limiting the inferences that can be drawn from these findings.

Conclusions and recommendations

More evidence is needed to compare health outcomes between the public and private sectors. This is particularly true in low-income countries where we found no eligible studies meeting our inclusion criteria. By some measures, the majority of healthcare services in Asia and Africa are provided by the private sector. Without evidence to demonstrate whether this care is better or worse than publicly provided services, regulators and policy makers are challenged to define appropriate roles for private providers within broader health system planning.

The evidence found in this review offers foundations upon which to develop further research; however, the conclusions that can be drawn today are limited: the small number of studies and diverse range of services and settings evaluated constrain extrapolation.

Limitations

The qualitative results, e.g., effectiveness and quality of care, are only generalizable in the context of the included studies. Therefore, the overall picture of the qualitative results on the impact of private versus public healthcare provision in LMIC may be substantially different from our results. Because all of the studies identified were conducted in middle-income countries, the results within this review cannot be extrapolated to public and private facilities in low-income countries. While we are aware from the Demographic Health Surveys (DHS) and other sources that the majority of medical care occurs in outpatient settings, half of the studies we found compare inpatient care. Among outpatient illnesses addressed, only treatment for TB was represented in multiple studies.

In the present analysis, selection bias is a pervasive threat that we made every attempt to obviate. This bias, however, is likely an ever-present factor in our analysis of only observational studies, thus yielding probably invalid results. Specifically, we were unable to definitively describe to what extent selection bias may have influenced our results. It is possible that private medical providers are selecting richer and healthier patients, though it is also possible that these patients are seeking care with public medical providers. Information concerning the wealth, education or baseline health of the patients attending either healthcare setting may have provided a better picture of the role of selection bias in the present study.

In an attempt to address a source of substantial confounding, we aimed to perform a subgroup analysis comparing the odds of mortality by studies that adjusted for socio-economic status (SES) of the included study participants. Unfortunately, measures of SES were either not standardized, precluding our ability to combine them, or not available. Specifically, we know the proportion of patients who were poor in five studies, but we were not able to correlate outcomes to that wealth stratification. Furthermore, no studies adjusted for SES in their mortality or unsuccessful TB treatment analyses.

Policy implications

The outcomes from privately provided clinical services appear to be broadly equivalent to or better than government-provided services in middle-income countries. In areas where government clinics or hospitals do not exist, or are insufficient to provide care for the population in need, governments should consider both legal and fiscal support for the development of private facilities, and contracting of services from private facilities as an acceptable alternative to public provision.

It is not clear, from this study, the extent to which there may be segmentation in medical care along the lines of cost and quality: private clinics may cost more per service and treat a wealthier population than government-equivalent services. The studies included suggest that this is often, but not always, the case. The conclusion for policy makers is that the viability of contracting from or encouraging the expansion of private providers must be examined on a case-by-case basis because local contexts vary widely.

The lack of data, particularly in low-income countries, makes clear that greater emphasis should be placed upon measurement of health outcomes within service programs implemented in both public- and private-sector facilities. Furthermore, these measurements should be conducted using equivalent metrics in both public and private settings. Knowing the quality level of private pharmacies, clinics or hospitals provides limited policy direction unless one also knows the quality level of the government-provided alternative sources of care.

Support is needed for studies and study methodology development to permit the comparison of state and non-state providers of primary care and outpatient care. Support for studies in low-income countries is particularly important.

Research implications

There is a striking lack of data comparing public and private healthcare providers, particularly in low-income countries. There is an urgent need for high-quality studies addressing childhood illnesses, as they constitute a large proportion of the mortality in low-income countries.

1 Background

1.1 Aims and rationale for current review

Based on evidence from Demographic Health Surveys (DHS), private healthcare providers deliver a significant proportion of healthcare services in low- and middle-income countries (LMIC) (Castro-Leal et al. 2000, Rutebemberwa et al. 2009, Zwi et al. 2001). Some of the reasons for seeking care from private providers cited by patients include better and more flexible access to providers, shorter waiting times, greater sensitivity to patient needs, and greater confidentiality (Zwi et al. 2001). With an abundance of private healthcare facilities in many LMIC, patients also seek care in the private sector due to shorter travel times as compared to travel times to government facilities (Castro-Leal et al. 2000, De Costa et al. 2008, Rutebemberwa et al. 2009, WHO). Meanwhile, in the public sector, governments often struggle to create systems to remove or penalize public providers offering low-quality services to patients.(Hanson et al. 2008). As a result, patients seeking quality services may turn to private care.

In contrast to services offered by government employees, private healthcare services include a variety of providers and institutions. These services vary by country and range from sophisticated tertiary care facilities comparable to the highest of international standards, to individual doctors and nurses practicing out of one-room clinics, to unqualified 'quacks' selling Western or traditional medicines and offering services that are neither regulated nor monitored (Hanson et al. 2008). Private healthcare institutions may also include non-profit or religious institutions. Private providers – institutions or individuals – are distinguished in economic terms from the public sector by their ownership characteristic: profits or losses accrue to the owner, rather than to the government or society. In practice, 'private' providers are often described as health practitioners who are not directly controlled by the government.

Available evidence indicates that across developing countries, private healthcare is significant in both rural areas and urban areas, and for lower-income groups as well as the wealthy (De Costa and Diwan 2007a, Goodman et al. 2007, Hanson and Berman 1998, Levesque et al. 2006, Meng et al. 2000). According to estimates by Hanson and Berman in the mid-1990s, based on a sample of LMIC, nearly 40% of doctors practice privately and 24% of the total numbers of hospital beds available are private (this includes for-profit and non-profit) (Hanson and Berman 1998). In Asia, private providers supply nearly 26% of all beds available, compared to 33% in Africa (Hanson and Berman 1998). In African countries, non-governmental organizations (NGO) provide a vast majority of all private services available (Hanson and Berman 1998). Though limited, evidence over time suggests an increased use of private healthcare services in LMIC (Boone and Zhan 2006, Hanson et al. 2008, International Finance Corporation 2008). The private sector is particularly important for the poor; poorer patients get sick and go without care more frequently, and spend proportionately more of their incomes on private healthcare than the wealthy (DHS MEASURE, Filmer 2005, Marek 2008, Zwi et al. 2001).

The implications of this for health systems are important: there are large quantities of privately provided care across a range of service levels, serving both the wealthy and the poor. What this means for public health, and for the health of the poor in particular, depends upon the quality of care provided and the affordability of this care – two topics which are not the focus of this systematic review but that have been the subject of many studies, often with conflicting

results (De Costa and Diwan 2007b, Floyd et al. 2006, Marseille et al. 2006, Patouillard et al. 2007, Smith 2009, Tuan et al. 2005, Voeten et al. 2001).

Quality care in developing countries has been defined most commonly based upon the Bruce-Jain framework (Bruce 1990). Developed initially as a structure for describing the quality of family-planning services, the Bruce-Jain Framework has been expanded to describe both a broader range of services (Mora G 1993) and a broader scope of healthcare, encompassing both socio-economic and environmental context (Das and Hammer 2007, Hardon 1997, Peabody and Luck 2002). Alternatively, the Donabedian quality of care framework based on the three dimensions of structure, process and outcomes is used and appropriate for comparisons between health sectors, because it considers a patient's frailty and behavioral compliance – two factors critical to health outcomes(Donabedian 1988). Quality care is now most commonly defined to include both clinical quality and patient perceptions of quality – important elements for ensuring continuation of care and health outcomes. In very few studies, however, is quality of care linked to health outcomes; the norm has been that quality – perceived or clinical or both – is studied as an independent attribute of care rather than as a predictor of biological outcomes. Studies that use the Donabedian framework are more likely to capture the linkages between quality of care and health outcomes, but evidence remains limited.

In the past decade, these quality studies have ranged from assessments of hospital-based inpatient care (Adisasmita et al. 2008, Andaleeb 2000a, Zonato et al. 2004) to outpatient services provided by formal, trained clinicians (Agha and Do 2009, Levesque et al. 2006). A large number of studies have examined quality aspects of delivery services, focusing in particular on rates of cesarean sections and/or rates of unrequested cesarean sections in hospitals (Almeida et al. 2008, d'Orsi et al. 2005, Dhar et al. 2009, Mandarino et al. 2009, Potter et al. 2001, Potter et al. 2008).

Much of the literature exploring quality studies in LMIC has been focused on family-planning services (Agha and Do 2009, Montagu and Graff 2009, Walker et al. 2001), patient perceptions of quality in inpatient services (Andaleeb 2000b, 2000a, Costa et al. 2006, Meng et al. 2000, Pongsupap and Van Lerberghe 2006) and maternity care (Baraidi et al. 2007, Giglio et al. 2005, Mandarino et al. 2009, Mendoza-Sassi et al. 2010, Perini et al. 2005, Victora et al. 2010). A small number of studies examine the quality of general medical care in outpatient clinics (Bhatia and Cleland 2004, Bos 2007, Gomez-Jauregui 2001, Levesque et al. 2006, Nordyke 2002, Sauceda-Valenzuela et al. 2010, Teng et al. 2006) and drug sellers or pharmacy outlets (Goodman et al. 2007, Jankovic et al. 2001, Maiga et al. 2003, Siddiqi et al. 2002, Syhakhang et al. 2004, Wijesinghe et al. 2007), while often they compare the quality of inpatient and outpatient services. Informal providers are not well studied, and a recent systematic review of informal providers(Ingram 2010) presented findings on provider quality *inferred* from publications of operations research designed to improve quality among these providers: baseline data on the quality of informal providers were non-existent.

The published literature is similarly inconclusive about the quality of care provided by the formal private sector. Private care at both tertiary and primary levels was documented as both better (Coimbra et al. 2003, Gomez-Jauregui 2001) and worse (Martins et al. 2004, Tayyem et al. 2008) than public alternatives, with qualitative and perceived quality measures often intermixed with clinical quality measures and outcomes with quality implications (e.g. provision of cesarean sections) reported with no attempt to measure or adjust for whether the interventions were clinically

appropriate (Leal Mdo et al. 2004). Most importantly, of the many studies identified in which private quality was measured, only six articles assessed whether there was a correlation between the quality assessment indicators and some form of clinical outcome (Coimbra et al. 2003, Gomez-Jauregui 2001, Leal Mdo et al. 2004, Martins et al. 2004, Sauceda-Valenzuela et al. 2010, Tayyem et al. 2008).

Financing of healthcare provides a similarly inconclusive collection of outcome measures across the public and private sectors. Depending upon the setting and the diseases being treated, private providers are more expensive or less expensive than public alternatives (Das and Hammer 2007, Waters et al. 2003). Few studies provided comprehensive details on clinical necessity for treatment provided, the quality of services, or the outcomes following treatment, making an understanding of the cost-effectiveness of treatment impossible. The exception to this is for retail sale of pharmaceuticals, where studies in Africa and Latin America found that private pharmacies had significantly higher prices than state drug sellers, along with a higher likelihood of having medicine in stock (Pinto et al. 2010, Twagirumukiza et al. 2010). While the high cost of medicines in private pharmacies places these medicines out of the reach of the poor (Russo and McPake 2010), the evidence available also makes clear that government alternatives are often lower priced but lack needed medicines. Policy conclusions cannot be made based on these limited data. A systematic review of the quality of private pharmacies(Smith 2009) led to similarly dichotomous conclusions: many private formal and informal pharmacies in LMIC deliver low-quality care, and a substantial percentage of medical care in developing countries is delivered by these providers because of the lack of alternative sources of care.

As David Gwatkin wrote in a review of the Integrated Management of Childhood Illnesses (IMCI), 'an intervention cannot help the poor unless it gets to them' (Gwatkin 2006). IMCI and many other initiatives have been successful at ensuring quality of care but have seldom been implemented effectively at a national scale (Ahmed et al. 2010). Quality and cost are not relevant if patients are not served.

We have focused in this review upon comparing health outcomes. We seek to confirm what is known about the relative benefits to health – to morbidity or mortality – of being treated by public or private providers in LMIC.

This review will be of value to stakeholders both inside and outside the research community, helping public health practitioners, policy makers, donor agencies and global health institutions to make evidence-based decisions on healthcare and healthcare policy.

1.2 Definitional and conceptual issues

The authors consistently used the following terms throughout the review process and in this paper.

- Low- and middle-income countries: According to the World Bank, economies are divided according to 2009 GNI per capita, calculated using the World Bank Atlas method. The groups are: low income, $995 or less; lower-middle income, $996-$3,945; upper-middle income, $3,946-$12,195; and high income, $12,196 or more.
- Private providers: In contrast to services offered by government employees, private healthcare services include a variety of providers and institutions.

These services vary by country and range from sophisticated tertiary care facilities comparable to the highest of international standards, to individual doctors and nurses practicing out of one-room clinics, to unqualified 'quacks' selling Western or traditional medicines and offering services that are neither regulated nor monitored. Private healthcare institutions may also include non-profit or religious institutions. Private providers – institutions or individuals – are distinguished in economic terms from the public sector by their ownership characteristic: profits or losses accrue to the owner, rather than to the government or society. In practice, 'private' providers are often described as health practitioners who are not directly controlled by the government. For the purpose of this review, we have used the definitions of 'private' providers given within the surveyed literature so long as it approximates the more formal definitions above.

- Quality of care: Quality care in developing countries has been defined most commonly based upon the Bruce-Jain framework (Bruce 1990). Developed initially as a structure for describing the quality of family-planning services, the Bruce-Jain framework has been expanded to describe both a broader range of services (Mora G 1993) and a broader scope of healthcare, encompassing both socio-economic and environmental context (Das and Hammer 2007, Hardon 1997, Peabody and Luck 2002). Alternatively, the Donabedian quality of care framework, based on the three dimensions of structure, process and outcomes, is used and appropriate for comparisons between health sectors, because it considers a patient's frailty and behavioral compliance – two factors critical to health outcomes(Donabedian 1988). Quality care is now most commonly defined to include both clinical quality and patient perceptions of quality – important elements for ensuring continuation of care and health outcomes. In very few studies, however, is quality of care linked to health outcomes; the norm has been that quality – perceived or clinical or both – is studied as an independent attribute of care rather than as a predictor of biological outcomes. Studies that use the Donabedian framework are more likely to capture the linkages between quality of care and health outcomes, but evidence remains limited.

1.3 Research background

While a number of systematic reviews have been conducted or are being conducted on specific areas of working with the private sector, these reviews have been primarily intervention focused. Recently, Patouillard et al. conducted a systematic review of 52 studies that assessed working with private for-profit providers in LMIC; these studies focused on interventions (such as social marketing, pre-packaging drugs, provision of vouchers, contracting out services, franchising, regulation and accreditation) to improve utilization of healthcare by the poor (Patouillard et al. 2007). While some of the studies showed an increase in the utilization of services and improvement in the quality of care, impact on equity could not be assessed because of data limitations. Because most of these interventions were not designed as research projects, the review was not able to explain what services were utilized by the poor and who provided these services (Patouillard et al. 2007).

Currently, a large body of literature documents the role of private for-profit and not-for-profit sectors in the provision of health services and commodities for the poor in developing countries. Much of this documentation exists in the form of grey literature: program reviews, program evaluations and summaries of experience from donor-supported interventions that support NGOs and/or private-sector

delivery of health services. A much smaller collection of peer-reviewed articles exists that documents the scale of private for-profit and not-for-profit provision of healthcare to poor populations in developing countries, and, in rare cases, the quality or affordability of those services.

1.4 Objective

The review seeks to answer the following question: what difference exist in health outcomes following treatment in public or private settings in low- and middle-income countries?

2. Methods used in the review

2.1 User involvement

This is a systematic review and meta-analysis using both Cochrane and GRADE methods. DM oversaw the process at each step. MT developed the search terms and searched the grey literature. TH performed the searches of peer-reviewed literature. MT and AA reviewed all abstracts that fit the parameters of the review. AA and KD reviewed the full texts for all articles subsequently selected. AA performed the analyses and wrote the quantitative results. AA, KD and DM wrote the report. The authors sought the opinions and advice of colleagues through informal interviews, conversations and communications. In particular, faculty at the University of California San Francisco involved in past Cochrane Reviews provided both formal and informal peer review, and the research advisory team at the DFID provided formal peer review and comments. External review was also sought and received from experts in the field, including Roger England, David Bishai, Birger Forsberg, and April Harding. Advisors helped refine the question and search methods.

2.2 Identifying and describing studies

2.2.1 Inclusion criteria

Study designs

We included the following studies in our search:

1. Randomized controlled trials (RCTs)
2. Controlled clinical trials (CCTs)
3. Controlled before-and-after studies (CBAs) with a minimum of two study and two control sites
4. Interrupted time series (ITS) with a minimum of three points both before and after the intervention.

Given the paucity of studies, we also considered observational studies, including cohort, cross-sectional and case-control studies. We examined grey literature, and took into account the limited number of specialized reviews that have been conducted for particular areas of health service or health service provision.

We only included studies published in 2000 or later to ensure that the review reflects the most up-to-date findings.

Study focus

To be included, a study had to report at least one of the following primary outcomes:

1. Direct measures of improved health/health status/survival such as mortality or morbidity
2. Lifestyle factors where evidence indicates that these have an effect on the above
3. Adverse effects (e.g., undesirable impacts on any of the above outcomes or on existing public or private services, distortions in provision of services, inappropriate use of services).

If any title, abstract, or full study did not meet the above criteria, study design and study focus, they were not included. See further exclusion criteria in Figure 3.1.

Upon meeting the primary inclusion criteria, we extracted the following data, if available:

1. Equitable access or utilization (distribution of access across socio-demographic characteristics)
2. Patient satisfaction (e.g., intent to return, level of service from a societal perspective or the perspective of the franchiser, franchisee or patients)
3. Measure of access (e.g., affordability, utilization, client volume, attendance)
4. Quality of care (e.g., compliance with guidelines, case notification for specific diseases such as TB)
5. Economic evaluations.

2.2.2 Search strategies

In order to retrieve studies, the Global Health Group (GHG) developed search terms and strategies, following the recommendations of EPOC. These can be found in Appendix 2.1.

2.2.3 Search sources

A comprehensive search was performed in all languages in order to avoid both selection bias of published articles and language bias of publications. Abstracts, academic journals (peer-reviewed) and grey literature (non-published/internal or non-reviewed papers, reports) were searched:

- Bibliographic databases: PubMED, EMBASE, Web of Knowledge. The Cochrane Central Register of Controlled Trials (CENTRAL), and the Database of Abstracts of Reviews of Effectiveness were also reviewed.
- Development studies databases: ELDIS database – database of development references developed by the Institute of Development Studies (IDS); British Library of Development Studies (BLDS) – a database on economic and social issues in developing countries; IDS21 – database on international development research from the UK; The Antwerp Institute of Tropical Medicine database.
- Organizations and websites: we searched websites of organizations likely to be active in the field, including: the World Bank; the United States Agency for International Development (USAID); Management Sciences for Health (MSH); PSP One; Centre for Global Development, World Health Organization (WHO); Swiss Tropical Institute; Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ); KfW Entwicklungsbank; DFID; The Global Alliance for Vaccines and Immunization (GAVI); the Global Fund to Fight AIDS, Tuberculosis and Malaria; Asian Development Bank; Pan American Health Organization (PAHO); Partnerships for Health Reform; Save the Children; and Oxfam.
- Academic institutions: we also searched websites of academic institutions active in this field, such as the London School of Hygiene and Tropical Medicine, the Harvard School of Public Health, the University of Cape Town, the Institute of Policy Studies Sri Lanka (IPS), the Kenya Institute of Policy

Analysis and Research (IPAR), and the Institute of Tropical Medicine, Belgium.
- We searched ISI Web of Science for papers that cited studies included in the review. We also used Google Scholar for studies meeting our criteria.
- Country websites: databases and websites of the governments of India, Brazil, Namibia, Uganda and South Africa were also searched.
- Reference lists of key authors/papers.
- References on key web sites.

We checked references from included studies and related articles and documents to identify other relevant studies that met the inclusion criteria.

A database system was set up to keep track of studies found during the review. Titles and abstracts were imported and entered manually into this database.

2.3 Quality assurance

Two authors independently reviewed abstracts to identify all studies that potentially met the inclusion criteria for retrieval. Two authors independently assessed each full-text article that was retrieved to determine whether it met all of the selection criteria. Any disagreements and uncertainties were resolved by discussion and the involvement of a third author. KD and AA both independently extracted data and merged results. In the case of any discrepancy in extracted data, DM refereed. The quality assessment was jointly prepared by KD, AA, and DM to ensure transparency and agreement.

2.4 Data extraction

The following elements were extracted independently from each included study by two review authors:

1. Study references:
    a. Name of the first author and date of publication
    b. Date of the study
    c. Location of the study
    d. Health outcomes
2. Described intervention(s) and context:
    a. Nature of intervention
    b. Intervention (exposure) group
    c. Control group
    d. Broader context/reforms in place if mentioned in the article
3. Study characteristics and inclusion criteria:
    a. Type of study: ITS, Before-After Case Series (BACS) or RCT (or non-randomized study)
    b. Quality assessment (see below)
4. Results:
    a. Main outcomes measured
    b. Effect

2.5 Quality assessment

Risk of bias in observational studies was assessed using the Newcastle-Ottawa Quality Assessment Scale (NOQAS) and other guidance outlined in Chapter 13 of the *Cochrane Handbook for Systematic Reviews of Interventions* ('Non-Randomized Studies') (Higgins et al. 2008). Specifically, the NOQAS helps in identifying which studies are especially prone to bias and in assessing methodological quality by

systematically posing questions in the most objective manner possible. For example, the NOQAS asks questions about selection of the study participants, comparability of the study groups within studies (e.g. is confounding addressed?), and measurement of the outcome (measured the same way for both exposed and unexposed?) An overall assessment of the quality of evidence (high, moderate or low) was assigned to each main outcome in all included studies using the GRADE approach (Guyatt et al. 2008).

2.6 Methods for synthesis

Studies were included for data synthesis if they met the inclusion criteria and reported the outcomes of interest, and provided breakdowns between the public and private sectors. For the purposes of this review, the private sector is any healthcare delivered by a non-state actor.

For all studies, we recorded outcomes for each comparison. Where possible we recorded risk ratios (RRs) and odds ratios (ORs) for dichotomous outcomes and weighted mean differences (WMDs) for continuous outcomes. When adjusted analyses were reported (adjusting for potential confounders in non-randomized studies), we recorded the estimates of effect together with the standard error. For random effects meta-analysis, we recorded the number of events and total number in each group (for risk ratio), or mean and standard deviation in each group (for weighted mean difference). All outcome effects were shown with their associated 95% confidence intervals.

We assessed selective outcome reporting using the approach described in Chapter 8 of the Cochrane Handbook for Systematic Reviews of Interventions (Higgins et al. 2008). The Cochrane Collaboration recommends assessing publication bias qualitatively based on the results and characteristics of the included studies, including the extent to which only small effects in favour of the intervention were reported, the extent to which funders or investigators had vested interest in the results, and the extent to which the authors' interpretations of the results were supported by the actual results.

A meta-analysis for some outcomes was carried out, when we identified a sufficient number of studies to provide an acceptable body of evidence to examine the intervention. We assessed the extent of heterogeneity in results across comparable studies using forest plots, the I^2 statistic and the Chi^2 test for heterogeneity.

A random-effects model was applied due to the level of heterogeneity within our data. Data synthesis was performed using RevMan 5. We provided an estimate and 95% confidence interval and generated a forest plot for each meta-analysis and discussed the extent of evidence against homogeneity.

In cases where the unit of analysis was on a different scale from other studies, we standardized our estimates.

Additionally, we performed subgroup analyses by stratifying studies by factors that might be a source of bias or potentially added substantially to heterogeneity between studies for any outcome for which we found multiple comparable studies. Sources of heterogeneity, such as TB/non-TB studies in mortality outcomes, can bias the meta-analysis results. For example, if patients with TB are more likely to die than patients with any other illness (i.e. non-TB mortality outcomes) then these TB studies will have a greater impact on the summary estimate than non-TB studies. Similarly, if patients in upper-middle income countries are less likely to die than patients in lower-middle income countries, irrespective of their health

care status, then the results will likely add heterogeneity between studies and necessitate exploration.

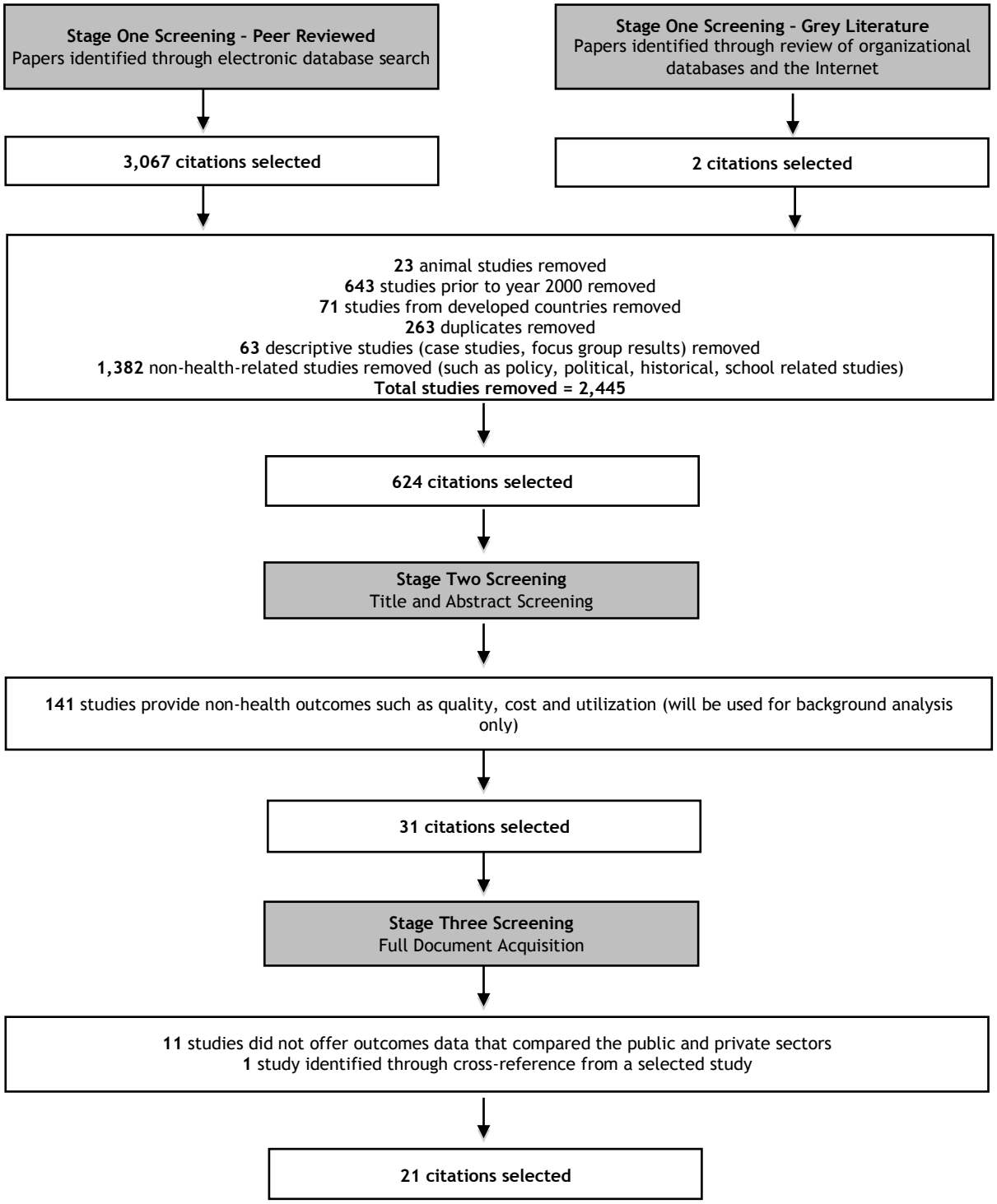
2.7 Deriving conclusions and implications

The health systems models used by the World Health Organization (WHO) and the World Bank/International Finance Corporation (IFC) provide a model for understanding the role of the private sector within the larger health system, and for analyzing the best role for governmental stewardship of the private sector according to the size and scope of private healthcare provision while balancing cost, quality and access (WHO). Study results that increase the understanding of the relative health outcomes of public versus private health delivery are interpreted in the context of a health systems model that makes various trade-offs between cost, quality and access. These findings can guide policy makers to decide which service delivery methods to support and where additional regulations are needed. Where results are lacking, targeted research is called for in order to inform policy and funding decisions as described above. Finally, the authors have built upon health systems models and the theoretical proposals for private-sector engagement put forward by others, adding evidence to improve the conceptual discussions to date (Bennett et al. 2005, Patouillard et al. 2007, Zwi et al. 2001).

3. Search results

Figure 3.1 gives a description of how papers were filtered from searching to mapping to synthesizing. Twenty-one studies met our inclusion criteria and explicitly compared health outcomes between the public and private sectors Appendix 3.1 gives a complete list and details of studies included in the review.

Figure 3.1: Process for filtering papers



4. Synthesis results

4.1 Further details of studies included in the synthesis

Twenty-one studies met the inclusion criteria. Of those, 17 were cohort studies. Overall nine countries were represented – Brazil, China, India, Jamaica, Jordan, Nigeria, South Africa, Thailand and Vietnam. Eleven studies were conducted in lower-middle-income countries ($996–$3,945 GNI per capita) and 10 studies from upper-middle-income countries ($3,946–$12,195 GNI per capita). Eighteen studies were conducted in urban settings. Fifteen of the 21 studies provided mortality for a health outcome, and studies examined a wide range of diseases, with TB being the most represented. Table 4.1 provides an overview of the included studies. For more details, please see Appendix 3.1.

Table 4.1: Overview of included studies

Author, Year	Location	Primary Outcome Measured	Disease	Level of Care	Outpatient or inpatient	Urban, Rural, Mixed	Country Income	SES Levels of Study Subjects	Private Sector Outcome*
Ambe, 2005	Mumbai, India	Mortality	TB	Primary Secondary	Outpatient	Urban	Lower Middle	NGOs targeted poor and slum dwellers	Lower
Arora, 2003	Delhi, India	Mortality	TB	Primary	Outpatient	Urban	Lower Middle	Less than 3% were low income	=
Chengsorn, 2009	Thailand	Mortality	TB	Primary Secondary	Outpatient	Urban	Lower Middle	Unknown	Lower
Eggleston, 2010	Guangdong, China	Mortality	n/a	Secondary	Inpatient	Urban	Lower Middle	Unknown	Lower
Ferreira, 2009	Bahia, Brazil	Mortality	Heart	Secondary	Inpatient	Urban	Upper Middle	70% of public and 19% of private healthcare patients had low income	Lower
Gidado, 2009	Kaduna State, Nigeria	Mortality	TB	Primary Secondary	Outpatient	Urban	Lower Middle	Research conducted in high-poverty area	=
Hutayanon 2007	Thailand	Mortality	Heart	Secondary	Inpatient	Mixed	Lower Middle	Unknown	Lower
Iucif, 2004	Sao Paulo State, Brazil	Mortality	End of life	Secondary	Inpatient	Urban	Upper Middle	Higher income patients within private healthcare and lower income patients within public healthcare	Lower
Kapadia, 2005	Mumbai, India	Death in ICU among hospitalized	End of life	Secondary Tertiary	Inpatient	Urban	Lower Middle	Unknown	Higher
Martins, 2004	Brazil	Mortality	Cardiovascular and respiratory diseases	Secondary	Inpatient	Mixed	Upper Middle	Unknown	Higher
Lonnroth, 2003	Ho Chi Minh City, Vietnam	Mortality	TB	Secondary Tertiary	Outpatient	Urban	Lower Middle	Public patients had 28% unemployment and 9% of private patients unemployed	=

Author, Year	Location	Primary Outcome Measured	Disease	Level of Care	Outpatient or inpatient	Urban, Rural, Mixed	Country Income	SES Levels of Study Subjects	Private Sector Outcome*
Panaratto, 2009	Brazil	A1C and Cholesterol	Diabetes	Primary	Outpatient	Urban	Upper Middle	Unknown	Lower
Quy, 2003	Ho Chi Minh City, Vietnam	Mortality	TB	Tertiary	Outpatient	Urban	Lower Middle	8% of public healthcare patients had high income and 24% of private healthcare patients had high income	=
Rosen, 2008	South Africa	Mortality	HIV	Primary Secondary	Outpatient	Mixed	Upper Middle	Unknown	Higher
Silva, 2004	Brazil	Mortality	Sepsis	Secondary Tertiary	Inpatient	Urban	Upper Middle	Unknown	Lower
Singh, 2000	Mysore, India	Blindness	Eye care	Secondary	Mix	Urban	Lower Middle	In the rural areas, 65% of the sample were low income; in urban areas, 55% of the sample were low income.	=
Sogayar, 2008	Brazil	Mortality	Sepsis	Secondary	Inpatient	Mixed	Upper Middle	Unknown	Lower
Solomon, 2005	Johannesburg, South Africa	Disability from rheumatoid arthritis	RA	Secondary	Outpatient	Urban	Upper Middle	Public healthcare patients were more likely to be less educated than private healthcare patients	Higher
Tavares, 2004	Niteroi, Brazil	Mortality	Heart	Secondary	Inpatient	Urban	Upper Middle	10% of private healthcare patients and 57% of public healthcare patients make less than minimum wage	=
Tayyem, 2008	Jordan	Severe malnourishment	ESRD	Secondary Tertiary	Mix	Urban	Lower Middle	Unknown	=
Wilks, 2000	Jamaica	Blood pressure control	Hypertension	Primary Tertiary	Outpatient	Urban	Upper Middle	Unknown	Lower

*Health outcome risk within the private sector as compared to the public sector.

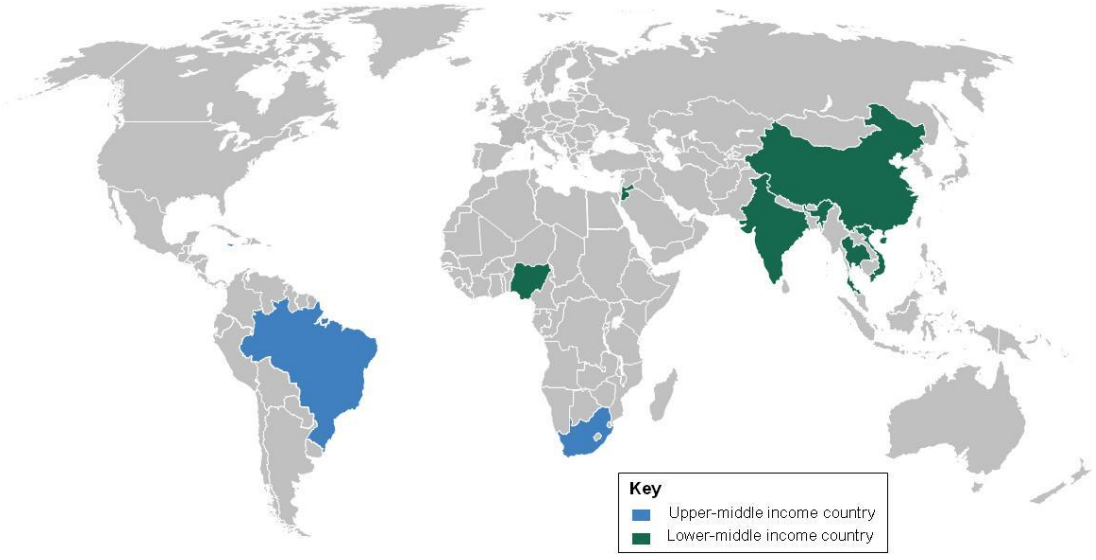
4.1.1 Study designs

All 21 included studies were observational in design, with 17 cohort studies (Ambe et al. 2005, Arora et al. 2003, Chengsorn et al. 2009, Ferreira et al. 2009, Hutayanon et al. 2007, Kapadia et al. 2005, Lonnroth et al. 2003, Martins et al. 2004, Panarotto et al. 2009, Quy et al. 2003, Rosen et al. 2008, Silva et al. 2004, Singh et al. 2000, Sogayar et al. 2008, Solomon et al. 2005, Tavares et al. 2004, Wilks et al. 2000) and four cross-sectional studies (Eggleston et al. 2010, Gidado and Ejembi 2009, Iucif and Rocha 2004, Tayyem et al. 2008).

4.1.2 Characteristics of settings and levels of care

All 21 included studies were conducted in middle-income countries. Eleven studies were set in lower-middle-income countries (Ambe et al. 2005, Arora et al. 2003, Chengsorn et al. 2009, Eggleston et al. 2010, Gidado and Ejembi 2009, Hutayanon et al. 2007, Kapadia et al. 2005, Lonnroth et al. 2003, Quy et al. 2003, Singh et al. 2000, Tayyem et al. 2008) and 10 in upper-middle-income countries (Ferreira et al. 2009, Iucif and Rocha 2004, Martins et al. 2004, Panarotto et al. 2009, Rosen et al. 2008, Silva et al. 2004, Sogayar et al. 2008, Solomon et al. 2005, Tavares et al. 2004, Wilks et al. 2000). Seven studies were set in Brazil (Ferreira et al. 2009, Iucif and Rocha 2004, Martins et al. 2004, Panarotto et al. 2009, Silva et al. 2004, Sogayar et al. 2008, Tavares et al. 2004), four in India (Ambe et al. 2005, Arora et al. 2003, Kapadia et al. 2005, Singh et al. 2000), two in South Africa (Rosen et al. 2008, Solomon et al. 2005), two in Thailand (Chengsorn et al. 2009, Hutayanon et al. 2007) and two in Vietnam (Lonnroth et al. 2003, Quy et al. 2003). Single studies were conducted in Jamaica (Wilks et al. 2000), Nigeria (Gidado and Ejembi 2009), Jordan (Tayyem et al. 2008) and China (Eggleston et al. 2010). See Figure 4.2 for a map of countries represented in the included studies differentiated by income. The socio-economic status (SES) of study participants is described in Table 4.1. In summary, of the 21 included studies, 10 studies detailed the SES of included study participants.

Figure 4.2: Countries represented in the 21 included studies, differentiated by income



None of the included studies evaluated health outcomes in rural settings; however, four studies were conducted in mixed settings that included rural environments (Hutayanon et al. 2007, Martins et al. 2004, Rosen et al. 2008, Sogayar et al. 2008). Of these, only Rosen et al. (2008) provided an evaluation across urban and rural

settings by comparing the following settings: 1) urban public hospital; 2) network of private providers in a small city; 3) rural HIV/AIDS clinic run by an NGO; and 4) a primary care clinic run by an NGO and located in an informal settlement.

No study examined health outcomes across primary, secondary and tertiary levels of care. Arora et al. (2003) and Panarotto et al. (2009) each authored a study that focused on primary care, while four other studies considered primary and secondary care (Ambe et al. 2005, Chengsorn et al. 2009, Gidado and Ejembi 2009, Rosen et al. 2008) and one study examined primary and tertiary care (Wilks et al. 2000). Nine studies focused exclusively on secondary care (Eggleston et al. 2010, Ferreira et al. 2009, Hutayanon et al. 2007, Iucif and Rocha 2004, Martins et al. 2004, Singh et al. 2000, Sogayar et al. 2008, Solomon et al. 2005, Tavares et al. 2004). Four studies evaluated outcomes across secondary and tertiary settings (Kapadia et al. 2005, Lonnroth et al. 2003, Silva et al. 2004, Tayyem et al. 2008) and one focused on tertiary care (Quy et al. 2003).

Ten studies evaluated care in outpatient settings (Ambe et al. 2005, Arora et al. 2003, Chengsorn et al. 2009, Gidado and Ejembi 2009, Lonnroth et al. 2003, Panarotto et al. 2009, Quy et al. 2003, Rosen et al. 2008, Solomon et al. 2005, Wilks et al. 2000). Nine studies examined outcomes from in-patient settings (Eggleston et al. 2010, Ferreira et al. 2009, Hutayanon et al. 2007, Iucif and Rocha 2004, Kapadia et al. 2005, Martins et al. 2004, Silva et al. 2004, Sogayar et al. 2008, Tavares et al. 2004). Two studies considered both outpatient and in-patient care (Singh et al. 2000, Tayyem et al. 2008).

4.1.3 Characteristics of outcomes

Outcome types varied among the included studies, with 15 studies reporting mortality outcomes (Ambe et al. 2005, Arora et al. 2003, Chengsorn et al. 2009, Eggleston et al. 2010, Ferreira et al. 2009, Gidado and Ejembi 2009, Hutayanon et al. 2007, Iucif and Rocha 2004, Lonnroth et al. 2003, Martins et al. 2004, Quy et al. 2003, Rosen et al. 2008, Silva et al. 2004, Sogayar et al. 2008, Tavares et al. 2004). The remaining studies reported outcomes for hypertension management (Wilks et al. 2000), cataract surgery (Singh et al. 2000), cholesterol control (Panarotto et al. 2009), end-of-life care (Iucif and Rocha 2004, Kapadia et al. 2005), rheumatoid arthritis disability (Solomon et al. 2005) and severe malnutrition (Tayyem et al. 2008).

Nine studies examined infectious diseases (HIV, TB and sepsis),(Ambe et al. 2005, Arora et al. 2003, Chengsorn et al. 2009, Gidado and Ejembi 2009, Lonnroth et al. 2003, Quy et al. 2003, Rosen et al. 2008, Silva et al. 2004, Sogayar et al. 2008) and eight looked at chronic diseases (cardiovascular and respiratory diseases, rheumatoid arthritis, eye care, end-stage renal disease, hypertension and diabetes) (Ferreira et al. 2009, Hutayanon et al. 2007, Panarotto et al. 2009, Singh et al. 2000, Solomon et al. 2005, Tavares et al. 2004, Tayyem et al. 2008, Wilks et al. 2000). Two studies evaluated end-of-life care (Iucif and Rocha 2004, Kapadia et al. 2005) and two reported on inpatient mortality (Eggleston et al. 2010, Martins et al. 2004).

TB was the most represented disease area among included studies, and each of those studies presented mortality data (Ambe et al. 2005, Arora et al. 2003, Chengsorn et al. 2009, Gidado and Ejembi 2009, Lonnroth et al. 2003, Quy et al. 2003).

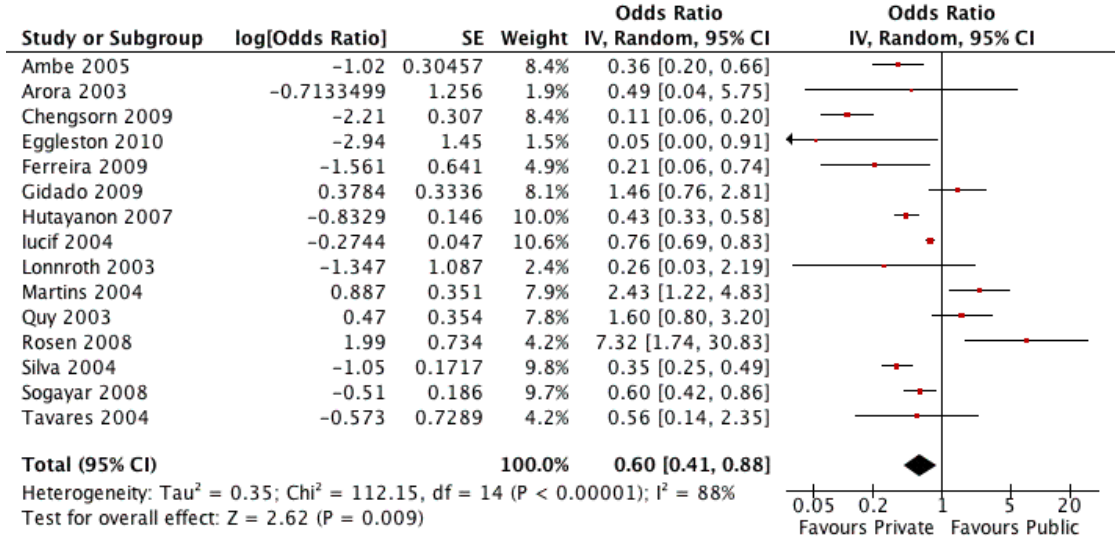
4.2 Synthesis of evidence

4.2.1 Quantitative synthesis

There was no disagreement regarding inclusion/exclusion of all 21 included studies. All available data from each study were pooled and analyzed as listed below. Subgroup analyses based on upper-middle/lower-middle income countries, TB/non-TB studies, and inpatient/outpatient settings were performed for the mortality outcomes as well.

Mortality (See Figure 4.2)
Fifteen studies reported mortality in general. Ten of the 15 studies found significant effects (Ambe et al. 2005, Chengsorn et al. 2009, Eggleston et al. 2010, Ferreira et al. 2009, Hutayanon et al. 2007, Iucif and Rocha 2004, Martins et al. 2004, Rosen et al. 2008, Silva et al. 2004, Sogayar et al. 2008). Of these 10 studies, eight showed evidence suggesting that private care was protective against mortality when compared to public healthcare (Ambe et al. 2005, Chengsorn et al. 2009, Eggleston et al. 2010, Ferreira et al. 2009, Hutayanon et al. 2007, Iucif and Rocha 2004, Silva et al. 2004, Sogayar et al. 2008), while two studies suggested that public healthcare was protective against mortality when compared to private care (Martins et al. 2004, Rosen et al. 2008). Pooled analyses showed a significant reduction in mortality in patients in private care rather than public care (OR 0.60; 95% CI 0.41–0.88). Heterogeneity in results between studies was significant (I^2 = 88%). Other specific mortality outcomes not pooled included mortality adjusted by the Charlson comorbidity index, severe septic mortality, septic shock mortality, death in an intensive care unit (ICU), cardiac-specific death, non-cardiac death, and systemic inflammatory response syndrome (SIRS)-related mortality within 28 days of ICU admission (Hutayanon et al. 2007, Iucif and Rocha 2004, Kapadia et al. 2005, Silva et al. 2004).

Figure 4.2: Forest plot of comparison: public versus private: mortality



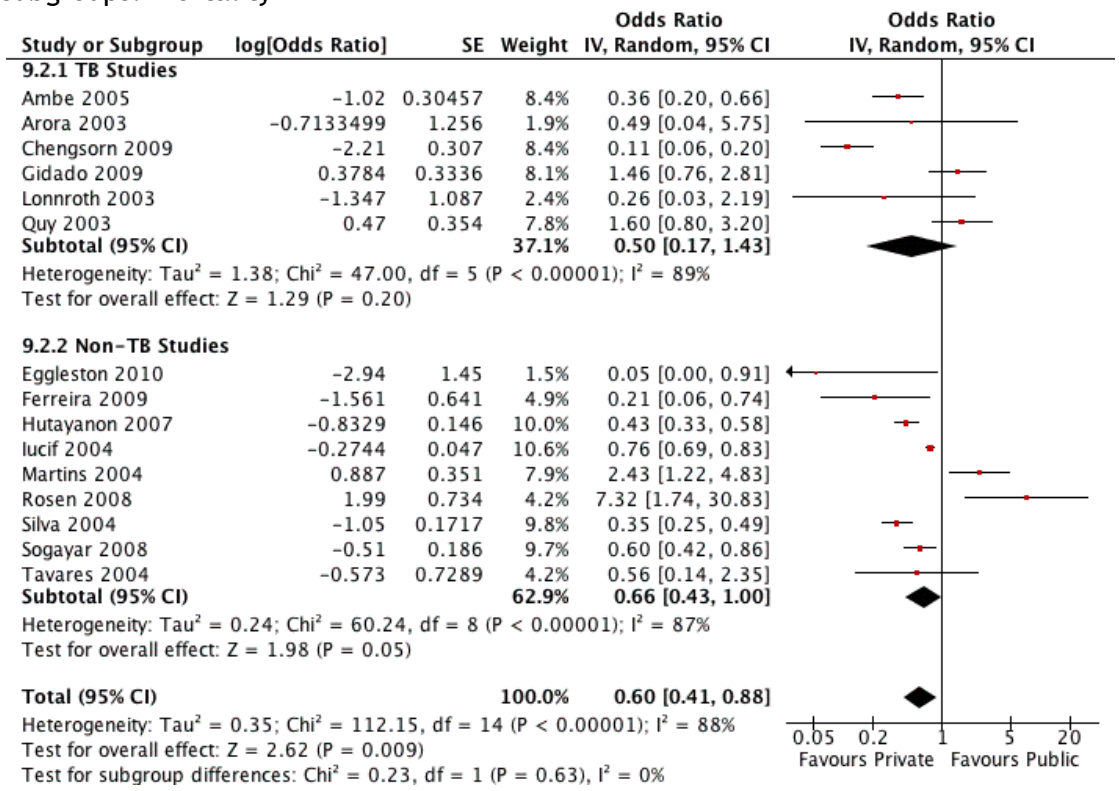
■ = Weighted effect estimates from individual studies.

◆ = Subtotal and total summary estimates.

TB studies versus non-TB studies (See Figure 4.3)

Among the 15 studies that reported mortality, six were in a TB treatment setting. Only two of these six studies found a significantly lower risk of mortality among patients in private care than in public care (Ambe et al. 2005, Chengsorn et al. 2009). Among the nine studies set in non-TB treatment settings, eight found a significant effect of type of care and mortality (Eggleston et al. 2010, Ferreira et al. 2009, Hutayanon et al. 2007, Iucif and Rocha 2004, Martins et al. 2004, Rosen et al. 2008, Silva et al. 2004, Sogayar et al. 2008). The pooled subgroup analysis for the TB setting studies yielded a non-significant protective effect of private care (OR 0.50; 95% CI 0.17–1.43), and the pooled subgroup analysis for the non-TB setting studies found a borderline significant protective effect of private care (OR 0.66; 95% CI 0.43–1.00). Tests for heterogeneity between TB studies and non-TB studies showed substantial heterogeneity (I^2 = 89% and 87%, respectively). Comparisons of subgroup differences show that mortality in private care versus public care in TB studies is not significantly lower than it is in non-TB studies.

Figure 4.3: Forest plot of comparison: public versus private, TB or non-TB studies subgroups: mortality

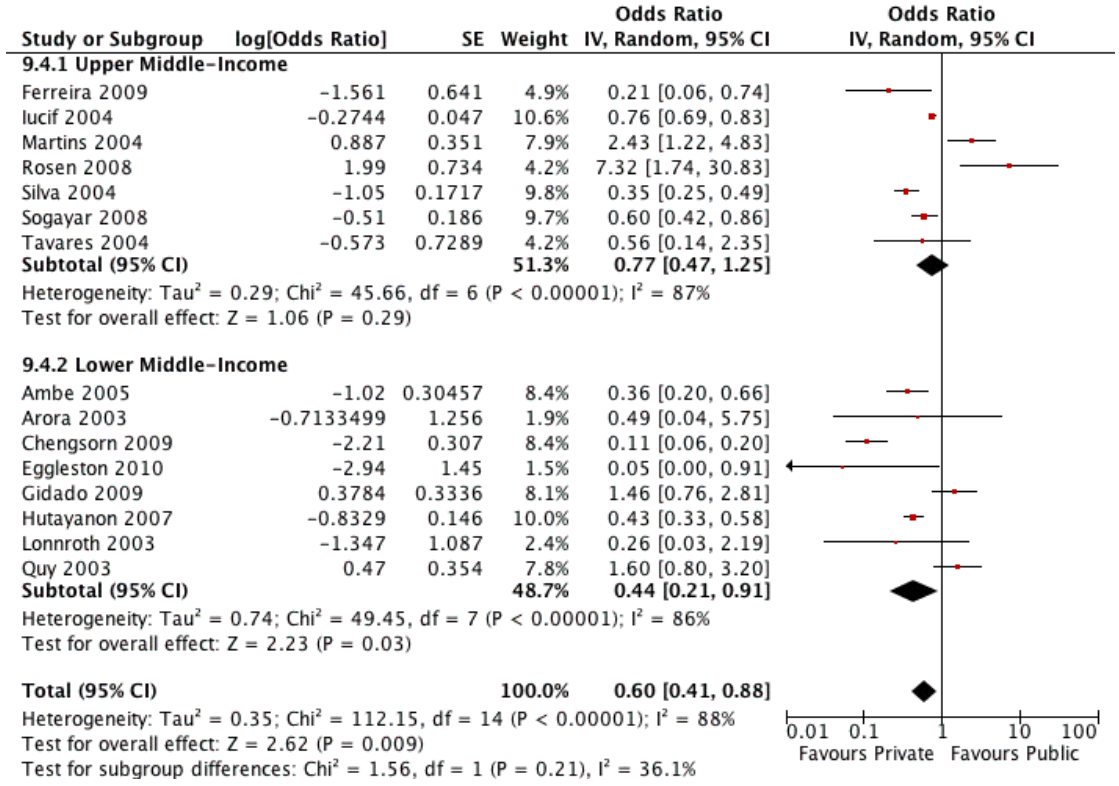


■ = Weighted effect estimates from individual studies.

◆ = Subtotal and total summary estimates.

Upper-middle income versus lower-middle income countries (See Figure 4.4)
Among the 15 studies that reported mortality outcomes, seven studies were in an upper-middle-income country. Four of these seven studies found a significantly lower risk of mortality among patients in private care than in public care (Ferreira et al. 2009, Iucif and Rocha 2004, Silva et al. 2004, Sogayar et al. 2008). Among the eight studies set in a lower-middle-income countries, four found a significant effect of type of care and mortality (Ambe et al. 2005, Chengsorn et al. 2009, Eggleston et al. 2010, Hutayanon et al. 2007). The pooled subgroup analysis for the upper-middle income country studies yielded a non-significant protective effect of private care (OR 0.77; 95% CI 0.47–1.25), and the pooled subgroup analysis for the lower-middle-income countries studies showed a significant protective effect of private care (OR 0.44; 95% CI 0.21–0.91). Tests for heterogeneity between upper-middle-income studies and lower-middle-income studies showed substantial heterogeneity (I^2 = 87% and 86%, respectively). Comparisons of subgroup differences show that mortality in private care versus public care in upper-middle-income countries is not significantly higher than mortality in private care versus public care in lower-middle-income countries studies.

Figure 4.4: Forest plot of comparison: public versus private, upper-middle- or lower middle-income countries subgroups: mortality



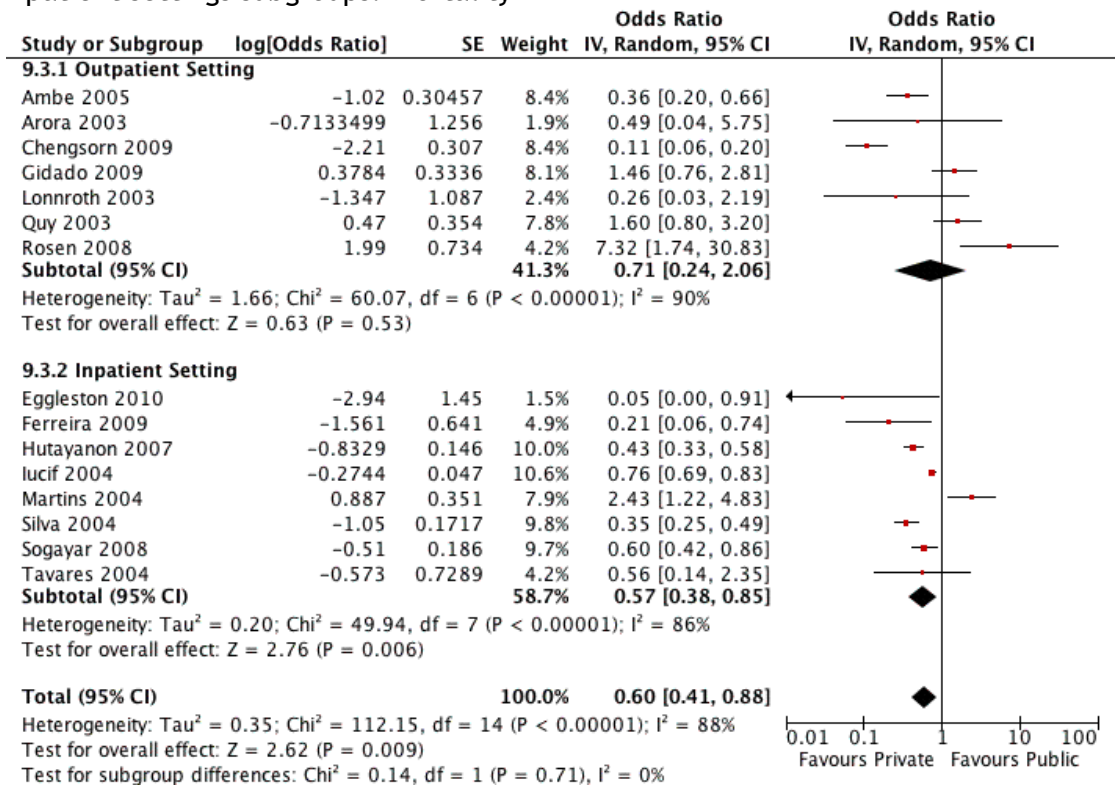
■ = Weighted effect estimates from individual studies.

◆ = Subtotal and total summary estimates.

Inpatient versus outpatient settings (See Figure 4.5)

Among the 15 studies that reported this outcome, seven studies were in outpatient settings. Only two of these seven studies found a significantly lower risk of mortality among patients in private care versus public care (Ambe et al. 2005, Chengsorn et al. 2009). Among the eight studies set in an inpatient setting, six found a significant effect of type of care and mortality (Eggleston et al. 2010, Ferreira et al. 2009, Hutayanon et al. 2007, Iucif and Rocha 2004, Martins et al. 2004, Silva et al. 2004, Sogayar et al. 2008, Tavares et al. 2004). The pooled subgroup analysis for the outpatient setting studies yielded a non-significant protective effect of private care (OR 0.71; 95% CI 0.24–2.06), and the pooled subgroup analysis for the inpatient studies yielded a significant protective effect of private care (OR 0.57; 95% CI 0.38–0.85). Tests for heterogeneity between outpatient studies and inpatient studies showed substantial heterogeneity (I^2 = 90% and 86%, respectively). Comparisons of subgroup differences showed that mortality in private care versus public care did not significantly differ between study settings.

Figure 4.5: Forest plot of comparison: public versus private, outpatient or inpatient settings subgroups: mortality



■ = Weighted effect estimates from individual studies.

◆ = Subtotal and total summary estimates.

Charlson Comorbidity Scale Adjusted (see Appendix 4.1 sections 5-10)

One study in Brazil examined the effect of type of healthcare, public or private, on mortality by adjusting by comorbidities using the Charlson Comorbidity Index.(Iucif and Rocha 2004) Among patients with no comorbidities (index=0), the odds of dying were significantly higher among patients in a private healthcare setting than among patients in a public healthcare setting (OR 1.34; 95% CI 1.24–1.45). The odds of mortality decreased, however, among patients with between one and three comorbidities when comparing private healthcare patients to patients in a public healthcare setting (OR 0.75; 95% CI 0.67–0.83). With four or more comorbidities, the mortality risk remains lower among private healthcare patients than among public healthcare patients, but this effect is not significant (OR 0.84; 95% CI 0.62–1.15).

After adjusting for age, the authors found similar results using the Charlson comorbidity index, though statistical significance among the group with the most comorbidities was improved. Specifically, the age-adjusted mortality among patients with six or more comorbidities was significantly lower among patients in a private healthcare setting than among patients in a public healthcare setting (OR 0.78; 95% CI 0.66–0.93).

Sepsis-related mortality (see Appendix 4.1 sections 11-12)

Another study in Brazil explored the effect of type of healthcare, private or public, on sepsis-related mortality.(Silva et al. 2004) The authors found that patients in a private healthcare setting were significantly less likely to die from severe septic mortality than patients in a public healthcare setting (OR 0.45; 95% CI 0.36–0.58).

Additionally, the authors found that patients in a private healthcare setting were less likely to die from septic shock than patients in a public healthcare setting (OR 0.38; 95% CI 0.30–0.48).

Death in ICU among hospitalized (see Appendix 4.1 section 13)
One study explored the effect of type of healthcare on death among patients in intensive care units (ICU) (Kapadia et al. 2005). The authors found that patients in an ICU in a private healthcare setting were significantly more likely to die than patients in a public healthcare setting (OR 0.20.77; 95% CI 13.08–32.99).

Cardiac-specific death (see Appendix 4.1 section 14)
Two studies examined the impact of healthcare setting and a cardiac-related death (Ferreira et al. 2009, Hutayanon et al. 2007). In one analysis in Thailand, Hutayanon et al. found that patients in private healthcare settings were less likely to die from a cardiac-specific illness than patients in public healthcare settings (OR 0.43, 95% CI 0.32–0.56). In an attempt to infer causality of healthcare setting, the authors adjusted for baseline comorbid conditions. Additionally, Ferreira et al. found that patients in Bahia in private healthcare settings were less likely to either die or have a severe cardiac illness than patients in a public healthcare setting (OR 0.26; 95% CI 0.12–0.56).

Non-cardiac-specific death (see Appendix 4.1 section 15)
One study explored the effect of type of healthcare on specifically non-cardiac-related death (Hutayanon et al. 2007). The authors found that patients in a private healthcare setting were significantly less likely to die from a non-cardiac illness than patients in a public healthcare setting (OR 0.35; 95% CI 0.20–0.62).

Systematic Inflammatory Response Syndrome-related mortality within 28 days of ICU admission (see Appendix 4.1 section 16)
Silva et al. found that patients in a private healthcare facility were less likely to die from SIRS-related illness than patients in a public healthcare facility (OR 0.46; 95% CI 0.31–0.68) (Silva et al. 2004).

TB outcomes

Unsuccessful TB treatment (see Appendix 4.1 section 17)
Six studies estimated the impact of healthcare facility on unsuccessful TB treatment outcomes. Four of these six studies found that patients in a private healthcare facility were significantly more likely to have an unsuccessful TB treatment than patients in public healthcare facility. Unsuccessful TB treatment in this pooled analysis was defined as defaulted, failed treatment, transferred out or death. Pooling all six studies yielded a summary estimate of OR 2.04 (95% CI 1.07–3.89), suggesting that patients treated in private healthcare are more likely to have an unsuccessful TB treatment than patients in a public healthcare. Heterogeneity between studies was substantial (I^2 =97%).

Non-death cardiovascular outcomes

Major bleeding (see Appendix 4.1 section 19)
One study explored the effect of type of healthcare on major bleeding (Hutayanon et al. 2007). The authors found that patients in a private healthcare setting were significantly less likely to have major bleeding than patients in a public healthcare setting (OR 0.49; 95% CI 0.35–0.69).

Severity of cardiac illness (see Appendix 4.1 sections 20-21)
Ferreira et al. (2009) estimated the effect of healthcare setting on severe cardiac illness. The authors found that patients in a private healthcare setting were significantly less likely to have a severe cardiac illness than patients in a public healthcare setting (OR 0.34; 95% CI 0.14–0.80).

Congestive heart failure (see Appendix 4.1 section 22)
One study explored the effect of type of healthcare on congestive heart failure (Hutayanon et al. 2007). The authors found that patients in a private healthcare setting were significantly less likely to have congestive heart failure than patients in a public healthcare setting (OR 0.64; 95% CI 0.56–0.72).

Blood pressure control (see Appendix 4.1 sections 23-24)
Wilks et al. (2000) found that patients in a private or public healthcare setting were no more or less likely to have uncontrolled blood pressure >= 140/90 mm Hg (OR 0.89; 95% CI 0.52–1.50). However, the authors found that private healthcare facility patients were less likely to have uncontrolled blood pressure greater than or equal to 160/95 mm Hg than patients in a public care setting (OR 0.52; 95% CI 0.34–0.79).

Cardiac arrhythmia (see Appendix 4.1 section 25)
One study estimated the effect of healthcare setting on cardiac arrhythmia (Hutayanon et al. 2007). The authors found no significant effect (OR 0.94; 95% CI 0.80–1.11).

A1C (glycemic control) (see Appendix 4.1 section 26)
Panarotto et al. (2009) found that patients in a private healthcare facility had significantly lower A1C (glycemic control) levels than patients in a public care facility (MD −0.80; 95% CI −1.29 to −0.31) after follow-up.

Cholesterol (see Appendix 4.1 section 27)
Panarotto et al. (2009) also found that patients in a private healthcare facility had significantly lower serum cholesterol than patients in a public care facility (MD −16.6; 95% CI −27.1 to −6.1) after follow-up.

Other outcomes

Remained blind after surgery (see Appendix 4.1 section 28)
Singh et al. (2000) found no association between healthcare type and remaining blind after ophthalmologic surgery (OR 0.66; 95% CI 0.18-2.37).

Severe malnutrition (see Appendix 4.1 section 29)
One study estimated the effect of healthcare facility type and severe malnutrition while under care among people with end stage renal disease (Tayyem et al. 2008). The authors found no significant effect of facility type on malnutrition (OR 0.15; 95% CI 0.02–1.18).

Rheumatoid arthritis disability (see Appendix 4.1 sections 30-31)
Solomon et al. (2005) explored the impact of healthcare facility and disability among African and Caucasian South Africans. The authors found that disability among Africans was more likely to occur if they were patients in private healthcare facilities than if they were in public healthcare facilities (OR 1.62; 95% CI 1.65–5.90). Disability among Caucasians was also more likely to occur if they were patients in private healthcare facilities than if they were in public healthcare facilities (OR 2.69; 95% CI 1.31–5.55).

SIRS (see Appendix 4.1 section 32)
One study estimated the impact of healthcare facility and systemic inflammatory response syndrome (SIRS) (Silva et al. 2004). The authors found that patients in a private healthcare facility were more likely to have SIRS than patients in a public healthcare facility (OR 1.46; 95%CI 1.16–1.84).

Sepsis (see Appendix 4.1 sections 33-35)
Silva et al. (2004) explored the effect of private or public healthcare on sepsis-related outcomes. The authors found no association between sepsis in general and

healthcare facility (OR 0.85; 95% CI 0.64–1.14). However, when examining severe sepsis, the authors found that patients in a private healthcare setting were less likely to get severe sepsis than patients in a public setting (OR 0.34; 95% CI 0.25–0.46). Furthermore, patients in a private healthcare facility were less likely to get septic shock than patients in a public hospital (OR 0.30; 95% CI 0.21–0.42).

4.2.2 Qualitative synthesis

In the comparison of health outcomes between the public and private sectors, many studies pointed to other relevant differences and correlations between sectors, including models of care, costs, incentives, provider motivations and patient satisfaction. Both opportunities and drawbacks exist for working with the private sector and evaluations between the public and private sectors continue to be full of evidence gaps.

Models of care and relative costs

In comparing the public and private sectors, many studies examined different models of delivery, resources and costs in order to determine effectiveness. Two studies noted the higher cost of health services provision in the public sector (Eggleston et al. 2010, Lonnroth et al. 2003). In China, public hospitals have a higher average value of total assets, more pieces of expensive equipment, more employees and more physicians than private hospitals, but health outcomes appear to be similar between the public and private sectors (Eggleston et al. 2010). In Thailand lengths of stay at hospitals were longer in the public sector and contributed to higher costs (Hutayanon et al. 2007). In contrast, patients with sepsis in Brazil experienced similar lengths of stay and direct costs between the public and private sectors, but mortality rates and resource constraints were significantly higher in public settings (Sogayar et al. 2008).

Rosen et al. (2008) found different patterns of resource utilization and subsequent costs across multiple types of public and private facilities. They could not draw conclusions on the relationship between patient outcomes and resource inputs, but found that cutting costs at the beginning of care correlated to poorer outcomes and higher costs down the road. This study makes the point that different delivery models exist for good reasons and what works for a rural NGO is most likely not going to be transferable to a large urban hospital.

Hutayanon et al. (2007) pointed to another finding regarding the difference between changing ownership of a facility (i.e. from public to private) and multi-sector approaches. Evidence presented by Eggleston et al. (2010) showed that changing ownership, not necessarily the model of care, appeared to have little impact on health outcomes and did not lead to increased scale, but that a multi-sector approach that was able to engage many public and private actors would be far more effective.

Provider incentives and motivation

Two studies noted the importance of incentive structures in any model of care. They matter especially in mixed systems where incentives differ between public and private providers, but the desired outcome is the same (Eggleston et al. 2010, Quy et al. 2003). Furthermore, system incentives need to be designed to reward desired hospital performance and protect vulnerable patients (Eggleston et al. 2010).

Arora et al. (2003) found that private providers do not make a profit on delivering free TB treatment. Despite the lack of profits, those private providers continued treating patients for TB, because they saw the community benefit of such work.

Patient satisfaction

In addition to reporting on outcomes, many studies assessed patients' expectations, health-seeking behavior and satisfaction measures. For instance, patients in Mysore, India who received cataract surgery at private facilities not only experienced better outcomes than at government-run mobile clinics, but they also reported higher satisfaction rates than patients seen in the public sector (Singh et al. 2000). Arora et al. (2003) found that TB patients expressed a high degree of satisfaction with the private providers, while Quy et al. (2003) found that even though patients knew that TB treatment was free at public facilities and full price at private facilities, they opted for private care because of perceptions of better quality.

Although perceptions of quality drive healthcare seeking behavior, affordability is always important. In one study, cost was cited as the main reason for treatment default among patients seeking TB treatment (Quy et al. 2003). Lonnroth's evidence suggests a similar finding and adds that private providers put patients' perceived needs first, which often undermines recommended treatment regimens and other clinical standards of care (Lonnroth et al. 2003).

Opportunities for effective stewardship of the private sector

Many included studies focused on Public-Private Mix (PPM) – Directly Observed Treatment Short-Course (DOTS), which are WHO-led strategies that link entities within the private and public sectors to the national TB program for treatment expansion. Evidence indicates that PPM-DOTS is an appropriate model for stewardship and coordination between the public and private sectors, given system-wide positive health outcomes following PPM-DOTS implementation. Prior to PPM-DOTS implementation in Thailand and Vietnam, Chengsorn et al. (2009), Lonnroth et al. (2003) and Quy et al. (2003) found that more regulation was needed to meet or exceed the quality of care in the public sector. Their findings show important differences in health outcomes in the absence of a well-designed partnership between the public and private sectors (Chengsorn et al. 2009, Lonnroth et al. 2003, Quy et al. 2003). Following effective implementation of PPM-DOTS, including appropriate regulations, subsidized products, financial incentives, information systems and training, researchers found increased detection and treatment across both the public and private sectors (Ambe et al. 2005, Arora et al. 2003, Gidado and Ejembi 2009, Quy et al. 2003). Valuable lessons can be learned from PPM-DOTS, a program that lends itself to research given differences between sectors that often impede comparative data and study design.

Relative benefits of private care provision in LMIC

There appear to be many benefits of the private sector compared to the public sector – most notably better health outcomes, but also higher perceptions of quality, better incentive structures and stronger overall health systems when the private sector was included in country-wide strategies. Another cited benefit involved high turnover of rotational doctors as part of training exposure in public facilities, as compared to private providers, who typically operate as a more stable and consistent provider in a community (Solomon et al. 2005).

Relative drawbacks of private care provision in LMIC

Three studies noted that the public sector reaches a more complex and serious case mix where the mix of cases, typically defined by diagnosis codes or the Charlson comorbidity index, reflects the diversity, clinical complexity and need for resources in the hospital's patient population (Eggleston et al. 2010, Iucif and Rocha 2004, Tayyem et al. 2008). Furthermore, as compared to the private sector, Rosen et al. (2008) found that public hospitals enjoyed substantial economies of scale, contributing to lower fixed costs per patient. In many cases, the cost of care

is passed on to patients seeking care in the private sector, and this may present an access barrier (Lonnroth et al. 2003, Quy et al. 2003).

Quality of qualitative evidence
Few studies examined similar qualitative outcomes; in turn, we must use caution when interpreting our results. Further, qualitative outcomes from disparate studies are context-specific, preventing us from making generalizations across studies. For example, three studies explored the impact of public or private healthcare services on patient satisfaction (Arora et al. 2003, Quy et al. 2003, Singh et al. 2000). Depending on the context, public healthcare patients may be more satisfied with their care than those served by the private healthcare (Arora et al. 2003). On the contrary, Singh et al. (2000) did not find any significant differences in patient satisfaction rates between public and private patients. Patient satisfaction, however, may be gauged from the patients' perspective by the success of the procedure. If some procedures are less likely to have a success than others, then asserting a relationship between provider type and patient satisfaction is even more difficult.

Gaps in evidence from quantitative and qualitative analysis
The principal focus of this review is on quantitative data. As a result, the qualitative findings summarized here have an inherent inclusion bias because our review only included qualitative evidence from quantitative studies that met our inclusion criteria. We cannot draw inferences from these findings that are attributable to other settings. There remain a number of important gaps in the evidence. First, we found no evidence from low-income countries on the comparison of health outcomes between the public and the private sector. Although both infectious and chronic diseases were well represented in our review, many important infectious diseases of poverty (e.g., malaria) were absent. A number of childhood illnesses that disproportionally affect low-income countries were also absent from the evidence. Additionally, no studies explicitly evaluated public and private healthcare in rural settings, and only one study examined them across urban and rural settings (Rosen et al. 2008). Finally, the comparative public-private evidence from outpatient care settings is too narrowly focused to reflect the wide range of services provided within an outpatient context.

4.3 Synthesis: quality assurance results

There was no disagreement regarding the inclusion of all 21 studies.

4.4 Summary of the results of the synthesis

Using a combination of both the Newcastle Ottawa Quality Assessment Scale(Juni P et al. 1999) for observational studies and the GRADE approach (Guyatt et al. 2008), we assessed the quality of evidence from all the evaluated outcomes. An overall picture of the quality of evidence is outlined in Table 4.7, though more detailed GRADE evidence profiles and summaries of findings can be found in Appendices 4.2 and 4.3.

- In estimating the impact of a healthcare setting on mortality, the quality of evidence is very low. Though 15 studies pooled together yielded a significant summary estimate favoring private care, the design of the studies and inconsistent findings ultimately proved to have a very low quality of evidence.

- In estimating the impact of a healthcare setting on unsuccessful TB treatment, the quality of evidence is moderate. Six studies pooled together yielded a significant summary estimate. Though the design of the studies and inconsistent findings yielded a low quality of evidence, the large effect estimate improved the quality.
- For all other outcomes, the quality of evidence was graded as very low. Though individual studies may have found a significant effect of private or public healthcare provision, no studies were pooled together as their comparison groups were too different or their outcomes were dissimilar

Table 4.7: GRADE evidence profiles

Factors affecting quality of evidence	Grading of quality of evidence (score)
Mortality	
Design	All observational studies (−2)[1]
Risk of bias (NOQAS)[8]	Minor (0)[2]
Directness (generalizability)	No serious indirectness (0)
Inconsistency	Serious (−1)[3]
Imprecision	No serious imprecision (0)
Publication/reporting bias	Unlikely (0)
Overall quality rating	Very low[4]
Unsuccessful TB treatment	
Design	All observational studies (−2)[1]
Risk of bias (NOQAS)[8]	Minor (0)[5]
Directness (generalizability)	No serious indirectness (0)
Inconsistency	No serious inconsistency (0)
Imprecision	No serious imprecision (0)
Publication/reporting bias	Unlikely (0)
Large Effect Estimate	Greater than 2.0 (+1)
Overall quality rating	Moderate[4]
All other outcomes	
Design	All observational studies (−2)[1]
Risk of bias (NOQAS)[8]	Minor (0)[6]
Directness (generalizability)	No serious indirectness (0)
Inconsistency	No serious inconsistency (0)
Imprecision	Serious imprecision (−1)[7]
Publication/reporting bias	Unlikely (0)
Overall quality rating	Very low[4]

1. Observational studies, in contrast to RCTs, are automatically considered low quality of evidence.
2. Only 2 of 15 studies had a moderate risk of bias.
3. Eight of 15 studies found a protective effect of private care, while 2 found a protective effect of public care.
4. The overall quality of evidence rating is assessed by the total of points 4 points, high quality; 3 points, moderate quality; 2 points, low quality; > 2 very low quality.
5. Only 1 of 6 studies had a moderate risk of bias.
6. Two studies had a moderate risk of bias.
7. Some outcomes were not statistically significant and their confidence intervals contained the null hypothesis.
8. Newcastle Ottawa Quality Assessment Scale

5. Strengths and limitations

We are confident that by applying Cochrane Review methods during our review process, we have identified the literature describing the effects of private or public healthcare provision on health outcomes in LMIC. Our systematic approach to evaluating the health impacts of private healthcare provision versus public healthcare provision allows for both reproducibility in results and also a full understanding of the body of literature. The Cochrane Review meta-analysis method and GRADE quality of evidence assessment are validated tools that help synthesize the evidence of healthcare and treatments.

The qualitative results, e.g., effectiveness and quality of care, are only generalizable in the context of the included studies. Therefore, the overall picture of the qualitative results on the impact of private versus public healthcare provision in LMIC may be substantially different from our results. While our meta-analysis results suggest a lower risk of death among private healthcare patients compared to public care patients, there remains the possibility of both publication bias and participation bias, with well-performing private facilities being more likely to participate in studies than their public counterparts. Self-selection bias among patients included in the studies found remains a possibility: more healthy patients may initiate care in private facilities. While three studies adjusted for bias from underlying illnesses (Hutayanon et al. 2007, Martins et al. 2004, Tavares et al. 2004), only one study adjusted for comorbidity (Iucif and Rocha 2004).

Most significantly, this review cannot be extrapolated to public and private facilities in low-income countries. All of the studies identified were conducted in middle-income countries. Nearly all of the studies we found compare facility-based care, while we are aware from DHS and other sources that the majority of medical care occurs in outpatient settings. Among outpatient illnesses addressed, only treatment for TB was represented in multiple studies, representing researcher selection bias. We found no comparisons of treatment of common childhood diseases such as diarrhea and pneumonia.

In the present analysis, selection bias is a pervasive threat that we made every attempt to obviate. Unfortunately, this bias is likely an ever-present factor in our analysis of only observational studies, thus yielding probably invalid results. Specifically, we were unable to definitively describe the extent to which selection bias may have influenced our results. It is possible that private medical providers are selecting richer and healthier patients, though it is also possible that these patients are seeking care with public medical providers. Information concerning the wealth, education or baseline health of the patients attending either healthcare setting might have provided a better picture of the role of selection bias in the present study.

In an attempt to address a source of substantial confounding, we aimed to perform a subgroup analysis comparing the odds of mortality by studies that adjusted for SES of the included study participants. Unfortunately, measures of SES were either not standardized, precluding our ability to combine them, or not available. Specifically, though we know the proportion of patients who were poor in five studies, we were not able to correlate outcomes to that wealth stratification. Furthermore, no studies adjusted for SES in their mortality or unsuccessful TB treatment analyses. Similarly, the studies included did not address issues of access or travel costs for patients. These are known to be important modifiers for use of facilities, and therefore for population-level outcomes, but data on this issue was not found in the included studies.

While we attempted to evaluate heterogeneity by performing subgroup analyses stratifying studies by likely sources of heterogeneity, we acknowledge that the heterogeneity between studies within our meta-analyses remained very high.

Finally, as reflected in the GRADE evidence profiles, the overall quality of evidence for most outcomes is low due to inconsistent results and moderate effects.

6. Conclusions and recommendations

More evidence is needed to compare health outcomes between the public and private sectors. Governments and researchers can play a critical role in improving the evidence base for decision making about the roles of the public and private sectors in a given country's health system.

Policy implications

The quality of privately provided clinical services appears to be broadly equivalent or better than government-provided services in middle-income countries. In areas where government-based clinics or hospitals do not exist, or are insufficient to provide care for the population in need, governments should consider both legal and fiscal support for the development of private facilities, and contracting of services from private facilities as an acceptable alternative to public provision.

LMIC governments should encourage, implement and oversee efforts to improve available data sets and measurement systems within their countries. The lack of data, particularly in low-income countries, makes clear that greater emphasis should be placed upon measurement of health outcomes within service programs implemented in both public and private sector facilities. Furthermore, these measurements should be conducted using equivalent metrics in both public and private settings. This will require cooperation from the private sector as well.

Support is needed for studies and study methodology development to enable the comparison of state and non-state providers of primary care and outpatient care. Support for studies in low-income countries is particularly important.

Research implications

There is a dearth of data comparing public and private healthcare providers, particularly in low-income countries. More research is needed on childhood illnesses, as they constitute a large proportion of the mortality in low-income countries, but no studies have explored differences in these outcomes between sectors.

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The 21 included studies are marked with an asterisk.

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Appendices

Appendix 1.1: Authorship of this report

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Conflicts of interest

Dr Montagu is currently drafting a non-systematic review of interventions for working with the private sector in developing countries as part of a forthcoming series on the private sector, to be published in *The Lancet*.

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Appendix 2.1: Search strategy

1. Public provider; government provider; public sector; public-sector; public physician; public hospital; government hospital; public service; public doctor; government doctor; public facility; public facilities; government facilities; government facility; public health
2. Non-state actors; NSA, non-state provider; nongovernment; NGO, nongovernmental organization; non-government; not-for-profit; non-profit; informal provider; private provider; private medical practitioner; private practitioner; private sector; private-sector; private physician; private hospital; private clinic; private service; private for profit; for-profit; private for-profit; private practice; private delivery; non-government; practicing privately; private doctor; private facilities; private facility; private ambulatory provider; private ambulatory health
3. Public – private; public versus private; public/private; public- and private-; private and public; public-private interventions; PPP; public private partnerships; public provider versus private provider
4. Healthcare; health care; care; health planning; health services; utilization; client volume; coverage; attendance; affordability; cost; compliance; quality; case notification; diagnosis; fees; fee for service; morbidity; mortality; death; outcomes; expenditure; out of pocket; out-of-pocket; patient care; provision; consultation; examination; equity; integrity; clinical exam; drugs; dispense; injection; recommend; disease; disease category; efficacy; prescribe; inpatient; outpatient; fee-for-service; health policy; primary care
5. Developing countries; LMIC; LLMIC; low middle income low-low middle income; low income; middle income; resource constrained; resource limited; poor; lower middle; middle; low- and middle-income. As defined by the World Bank[1] this list includes the following countries:
   Afghanistan, Bangladesh, Benin, Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Comoros, Congo, Eritrea, Ethiopia, Gambia, Ghana, Guinea, Guinea-Bissau, Haiti, Kenya, Korea, Kyrgyz, Lao, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Myanmar, Nepal, Niger, Rwanda, Sierra Leone, Solomon Islands, Somalia, Tajikistan, Tanzania, Togo, Uganda, Zambia, Zimbabwe

   Angola, Armenia, Belize, Bhutan, Bolivia, Cameroon, Cape Verde, China, Congo, Cote d'Ivoire, Djibouti, Ecuador, Egypt, El Salvador, Georgia, Guatemala, Guyana, Honduras, Indonesia, India, Iraq, Jordan, Kiribati, Kosovo, Lesotho, Maldives, Marshall Islands, Micronesia, Moldova, Mongolia, Morocco, Nicaragua, Nigeria, Pakistan, Papua New Guinea, Paraguay, Philippines, Samoa, Sao Tome and Principe, Senegal, Sri Lanka, Sudan, Swaziland, Syrian Arab Republic, Syria, Thailand, Timor-Leste, Tonga, Tunisia, Turkmenistan, Tuvalu, Ukraine, Uzbekistan, Vanuatu, Vietnam, West Bank and Gaza, Yemen

   Albania, Algeria, American Samoa, Antigua and Barbuda, Argentina, Azerbaijan, Belarus, Bosnia, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Fiji, Gabon, Grenada, Iran, Jamaica, Kazakhstan, Lebanon, Libya,

[1] According to the World Bank, economies are divided according to 2009 GNI per capita, calculated using the World Bank Atlas method. The groups are: low income, $995 or less; lower-middle income, $996–$3,945; upper-middle income, $3,946–$12,195; and high income, $12,196 or more.

Lithuania, Macedonia, Malaysia, Mauritius, Mayotte, Mexico, Montenegro, Namibia, Palau, Panama, Peru, Romania, Russia, Russian Federation, Serbia, Seychelles, South Africa, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Turkey, Uruguay, and Venezuela.

Appendix 3.1: Study details

Study details, part 1

Study reference	Location	Study topic	Study goal/ objective	Study design	Exposure, intervention, case group 1	Exposure, intervention, case group 2	Exposure, intervention, case group 3	Exposure, intervention, case group 4	Exposure, inter-vention, case group 5
Ambe, 2005	Mumbai, India	Public-private mix approach to TB control	Assess impact on case notification and treatment outcome of PPM approach for TB control involving private providers not previously involved in NTP	Cohort	TB/public hospitals	NGOs	Private practitioners	Medical colleges	RNTCP[4]
Arora, 2003	Delhi, India	Public-private mix approach to TB control	Assess the feasibility of a PPM for improved TB control and determine impact on case detection, case management quality, treatment outcome and patient convenience	Cohort	Models 2 and 3 (private diagnosis and treatment)	Malviya Nagar Government Chest Clinic			
Chengsorn, 2009	Thailand	Public-private mix approach to TB control	Inform PPM scale-up in Thailand	Cohort	(Public) small facilities	(Public) large facilities	(Private) facilities		

Study reference	Location	Study topic	Study goal/ objective	Study design	Exposure, intervention, case group 1	Exposure, intervention, case group 2	Exposure, intervention, case group 3	Exposure, intervention, case group 4	Exposure, inter-vention, case group 5
Eggleston, 2010	Guangdong, China	Comparison of public and private hospitals	Compare operations and performance of public and private hospitals focusing on differences in patient case-mix and quality of care	Cross-sectional	Government general acute hospitals	Private non-profit general acute hospitals	Private for-profit general acute hospitals		
Ferreira, 2009	Bahia, Brazil	AMI[5] mortality and morbidity	Compare mortality and morbidity in patients with AMI hospitalized in public and private hospitals	Cohort	Public hospitals	Private hospitals			
Gidado, 2009	Kaduna State, Nigeria	Public-private mix approach to TB control	Compare public and private facilities for TB management practices and treatment outcomes	Cross-sectional	Public facilities	Private facilities			
Hutayanon, 2007	Thailand	Management practices and patient outcomes for acute coronary syndrome	Determine patient characteristics, management practices and in-hospital outcomes between public and private hospitals for patients with ACS	Cohort	Public hospitals	Private hospitals			

Study reference	Location	Study topic	Study goal/ objective	Study design	Exposure, intervention, case group 1	Exposure, intervention, case group 2	Exposure, intervention, case group 3	Exposure, intervention, case group 4	Exposure, inter-vention, case group 5
Iucif, 2004	Sao Paulo State, Brazil	Inequalities in hospital mortality between public and private	Compare mortality among elderly patients attended within either private or public setting	Cross-sectional	Brazilian National Health System (SUS)	Private network			
Kapadia, 2005	Mumbai, India	end of life care	Describe the practices in intensive care units in Mumbai hospitals regarding limitation and withdrawal of care at the end of life.	Cohort	Public	Private			
Lonnroth, 2003	Ho Chi Minh City, Vietnam	Public-private mix approach to TB control	Compare TB case management and treatment outcome between a semi-private chest clinic and public NTP	Cohort	Public (publicly run NTP)	Private (chest clinic)			
Martins, 2004	Brazil	private vs public hospital comparisons	Assesses the variations in mortality, length of stay between public and private hospitals	Cohort	Public	Private			
Panaratto, 2009	Brazil	Private clinic vs public health service clinic care for type 2 diabetic patients	Compare clinical outcomes for diabetic patients attending private clinic or public health clinic	Cohort	Public	Private			

Study reference	Location	Study topic	Study goal/ objective	Study design	Exposure, intervention, case group 1	Exposure, intervention, case group 2	Exposure, intervention, case group 3	Exposure, intervention, case group 4	Exposure, inter-vention, case group 5
Quy, 2003	Ho Chi Minh City, Vietnam	Public-private mix approach to TB control	Determine treatment outcome among patients treated by private lung specialists in a PPM project for improved TB control	Cohort	Public (NTP facilities)	Private			
Rosen, 2008	South Africa	ART[6] outcomes and costs	Estimate average outpatient cost per patient in care and responding to treatment 1 year after initiation of ART under different models of treatment delivery	Cohort	Public hospital (urban): Site 1	Private (contracted providers): Site 2	Public (rural NGO): Site 3	Public (peri-urban NGO): Site 4	
Silva, 2004	Brazil	Private vs public hospital	Verify the actual incidence density and outcome of sepsis in Brazilian ICUs	cohort	Public	Private			
Singh, 2000	Mysore, India	Cost-effectiveness of public funded options for cataract surgery	Compare outcomes, costs, cost-effectiveness of strategies for provision of cataract surgery	Cohort	Public (government mobile camps)	Public (state medical college hospital)	Private (NGO hospital)		
Sogayar, 2008	Brazil	Sepsis in intensive care units	Assess the standard direct costs of sepsis management in	Cohort	Public hospitals	Private hospitals			

Study reference	Location	Study topic	Study goal/ objective	Study design	Exposure, intervention, case group 1	Exposure, intervention, case group 2	Exposure, intervention, case group 3	Exposure, intervention, case group 4	Exposure, inter-vention, case group 5
			Brazilian ICUs and disclose factors that could affect those costs						
Solomon, 2005	Johannesburg, South Africa	Rheumatoid arthritis	Impact of RA on disability in private and public facilities in South Africa	Cohort	Public	Private			
Tavares, 2004	Niteroi, Brazil	Decompensated heart failure in public and private hospitals	Compare the epidemiological and socioeconomic profiles, clinical features, etiology, length of hospitalization, and mortality of patients with decompensated heart failure admitted to public and private hospitals	Cross-sectional	Public hospitals	Private hospitals			
Tayyem, 2008	Jordan	ESRD[7] treatment	Assess nutritional status and compare quality of treatment among hemodialysis patients in public and private hospitals	Cohort	Public hemodialysis treatment centers	Private hemodialysis treatment centers			

Study reference	Location	Study topic	Study goal/ objective	Study design	Exposure, intervention, case group 1	Exposure, intervention, case group 2	Exposure, intervention, case group 3	Exposure, intervention, case group 4	Exposure, inter-vention, case group 5
Wilks, 2000	Jamaica	Hypertension in three clinical settings	Determine quality of monitoring and control of hypertension	Cohort	Public (general clinic)	Private (specialist HTN clinic)	Private (group general clinic)		

Study details, part 2

Study reference	Outcomes (our main outcome of interest is mortality)	Secondary outcomes	Number of participants included in study	Results: Outcome 1 (mortality) (e.g. 100/200 in private and 150/200 in public died or relative effects)	Results: Outcome 2 (other)	Results: Outcome 3 (other)	Results: Outcome 4 (all other outcomes)
Ambe, 2005	Mortality	1) Successful tx; 2) unsuccessful	(7,117+296+ 49+275+180) =7,917	Pvt: 7/296; NGOs: 4/275; TB hospital: 29/180; med colleges: 0/49; RNTCP: 352/7,117	Successful (cured/tx completed): pvt: 239/296; NGOs: 249/275; TB hospital: 131/180; med colleges: 43/49; RNTCP: 6,067/7,117	Unsuccessful tx : pvt: 57/296; NGOs: 26/275; TB hospital: 49/180; med colleges 6/49; RNTCP: 1,050/7,117	
Arora, 2003	Mortality	1) Successful tx; 2) unsuccessful	(101+143)= 244	Mortality among new sputum cases: pvt: 1/101; RNTCP in all of Delhi: 2%	Successful: pvt: 72/101; govt: 123/143	Unsuccessful tx: pvt: 29/101; govt: 20/143. the govt deaths may not be included in this unsuccessful tx because no info on it	
Chengsorn, 2009	Mortality	1) Successful tx; 2) unsuccessful	7,526 (small pub: 4,539; large pub: 2,275; pvt: 712)	Death (small pub: 530/4,539; large pub: 364/2,275; pvt: 12/712)	Successful: small pub: 3529/4,539; large pub: 1620/2,275; pvt: 475/712	Unsuccessful tx: pvt: 237/712; small public: 1,018/4,539; large public: 655/2,275. no direct comparisons of pvt vs public, so we use the count data given for outcome	

Study reference	Outcomes (our main outcome of interest is mortality)	Secondary outcomes	Number of participants included in study	Results: Outcome 1 (mortality) (e.g. 100/200 in private and 150/200 in public died or relative effects)	Results: Outcome 2 (other)	Results: Outcome 3 (other)	Results: Outcome 4 (all other outcomes)
Eggleston, 2010	Inpatient mortality		276 (176 govt; 49 NGO; 51 pvt)	Death: pvt: 51; NGO: 49; govt 176; the rate is number of deaths per 1000 admissions. Median mortality rates (IQR): pvt: <0.0001 (<0.0001-6.52); NGO: 7.39 (<0.0001-20.98); govt: 9.5 (5.34-16.49): (9.5/1000)/(.5/1000): SE^{8}=sqrt(1/9.5 + 1/.5)			
Ferreira, 2009	Mortality from AMI	Killip >1; death/Killip >1	150	Death: pvt: 3/63; pub 17/87	Killip >1: pvt: 9/60; pub: 24/70	Killip/death: pvt: 12/63; pub: 41/87	
Gidado, 2009	Mortality	1) successful tx; 2) unsuccessful	492 (258 pvt and 234 public)	Death: pvt: 9.7% (25); pub 6.8% (16)	Successful TB: pvt: 83.8% (216); pub: 78.6% (184)	unsuccessful TB: pvt: 16.1% (42); pub: 21.4% (50)	
Hutayanon, 2007	Mortality	Congestive heart failure; cardiac arrhythmia; cerebro-vascular accident (CVA) complication ; major bleeding	9,373	Any death: pvt: 71/1,209; pub: 1,107/8,164. aOR 2.3 (1.76-3.12)	Cardiac death: pvt 58/1209; pub: 862/8,164. aOR 2.1 (1.55-2.91)	Non-cardiac death: pvt: 13/1,209; pub:245/8,164. aOR 2.7 (1.47-5.05)	Congestive heart failure: pvt 431/1209; pub: 3797/8,164. aOR 1.5 (1.34-1.77). Cardiac arrhythmia: pvt: 192/1,209; pub: 1,365/8,164. aOR 1.0 (0.91-1.31). CVA complication: pvt: 2.4%; pub: 1.9%. aOR 0.76 (0.48-1.18). Major bleeding: pvt 39/1209; pub: 518/8,164. aOR 2.1 (1.48-3.23)

Study reference	Outcomes (our main outcome of interest is mortality)	Secondary outcomes	Number of participants included in study	Results: Outcome 1 (mortality) (e.g. 100/200 in private and 150/200 in public died or relative effects)	Results: Outcome 2 (other)	Results: Outcome 3 (other)	Results: Outcome 4 (all other outcomes)
Iucif, 2004	Charson Mortality Index		21,695 (pvt 9,289; pub 12,406)	Death: pvt: (0.097*4,832)+ (0.09*4,457); pub: (0.125*6,307)+ (0.115*6,099)	Charson comorbidity index (adjusts for other comorbidities): 0 comorbidities among pvt: (.087*15,976) among pub (.09*15,976); 1-3 comorbidities among pvt: (0.096*2,691) +(0.113*2,288)+ (0.157*515); pub: (0.17*2,691)+ (0.186*2,288)+ (0.315*515); 4 or more among pvt: (0.311*183)+ (0.25*42); among pub: (0.459*183)+ (0.529*42)	Charson comorbidity age index (adjusts for other comorbidities): 1-2 comorbidities among pvt: (0.05*3,755)+ (0.069*5,325) among pub (0.061*3,755)+ (0.076*5,325); 3-5 comorbidities among pvt: (0.082*5,626)+ (0.126*4,206)+ (0.154*1,864); pub: (0.102*5,626)+ (0.150*4,206)+ (0.226*1,864); 6 or more among pvt: (0.161*658)+ (0.338*202)+ (0.417*59); among pub: (0.344*658)+ (0.434*202)+ (0.714*59)	
Kapadia, 2005	Mortality		1,045 (pvt1: 87; pvt2: 24; priv-pub: 88; pub: 846)	Death in ICU out of all deaths in hospital: pvt1: 59/87; pvt2: 10/24; pvt-pub: 12/88; pub: 62/846			
Lonnroth, 2003	Mortality	1) successful tx; 2) unsuccessful	502 (semi pvt=176; NTP=326)	Death: pvt: 1/176; NTP: 7/326	Successful tx: pvt: 86/176; NTP: 277/326. aOR pvt vs pub for successful tx: 6.04 (3.49-10.45)	Unsuccessful tx : pvt: 90/176; NTP: 49/326	
Martins, 2004	Mortality rate		32,906	log(RR): 0.887 SE=0.351			

Study reference	Outcomes (our main outcome of interest is mortality)	Secondary outcomes	Number of participants included in study	Results: Outcome 1 (mortality) (e.g. 100/200 in private and 150/200 in public died or relative effects)	Results: Outcome 2 (other)	Results: Outcome 3 (other)	Results: Outcome 4 (all other outcomes)
Panaratto, 2009		A1C; cholesterol	357		A1C: pvt: 7.5 sd: 1.8; pub: 8.3 sd: 2.0	Cholesterol: pvt:172.1 sd 39.0; pub:188.7 sd: 42.9	
Quy, 2003	Mortality	1) Successful tx; 2) unsuccessful	4,545 (107 for pvt and 4,438 for NTP)	Death among all cases: pvt (0.025*362); NTP: (0.033*7,298)	Successful tx: pvt: (0.077*362)+ (0.522*362); NTP: (0.529*7,298)+ (0.352*7,298)	Unsuccessful tx : pvt:(0.367*362)+ (0.025*362)+ (0.008*362); NTP: (0.021*7,298)+ (0.028*7,298)+ (0.036*7,298)+ (0.036*7,298)	
Rosen, 2008	Mortality (we removed 'stopped attending site' from this outcome category)		400 (100 for each site)	Death (obtained from text about "no longer in care"): pvt: (0.42*45); pub (0.08*26); NGO AIDS: (0.46*28); NGO PC (0.54*13)			
Silva, 2004	Mortality rate	Sepsis	884	12.5% from private; 28.9% for public	SIRS: pvt 47.3%; pub 38.1%	Sepsis: pvt: 18.4%; pub 20.9%.	Severe sepsis: pvt: 15.3%; pub 35%. Septic shock: pvt: 11.7%; pub 30.7%. SIRS-related mortality at 28 days: pvt: 8.8% vs pub 17.5%. Severe septic mortality: pvt 32.7%; pub 51.6%. Septic shock mortality: pvt: 33.3%; pub 57.1%
Singh, 2000	Patients blind in the operated eye	Blindness remained	175 (126 in pvt hospital, 49 at medical college)		Remained blind after surgery: pvt: 7/126; med college: 4/49		

Study reference	Outcomes (our main outcome of interest is mortality)	Secondary outcomes	Number of participants included in study	Results: Outcome 1 (mortality) (e.g. 100/200 in private and 150/200 in public died or relative effects)	Results: Outcome 2 (other)	Results: Outcome 3 (other)	Results: Outcome 4 (all other outcomes)
Sogayar, 2008	Mortality rate		524 (pvt 196; pub 328)	Death (pvt: 0.491*328); pub: 0.367*196)			
Solomon, 2005	People with a disability from rheumat-oid arthritis as defined by using HAQ-DI index	Swollen joints; joint deformities	359 (196 pub; 163 pvt)		Disability among Africans: pub vs pvt (OR[9]: 3.09 95% CI[10] 1.62-5.91);	Disability among Caucasians: pub vs pvt (OR[9]: 2.7 95% CI[10] 1.31-5.57)	
Tavares, 2004	Mortality rate adjusted for age		203 (98 pub, 105 pvt)	Age-adjusted mortality rate (pvt 2.94; pub 5.23); (2.94/100) /(5.23/100) and SE: sqrt(1/5.23+ 1/2.94)			
Tayyem, 2008	Severe malnour-ishment	Severe malnutrition	181; 106 pub; 75 pvt		Severe malnutrition 8.5% pub; 1.4% pvt		
Wilks, 2000		Blood pressure (BP) control with medication	545		BP control: BP ≥160/95 while on treatment: pvt: 41/110; pub: 233/435	BP control: BP ≥140/90 while on treatment: pvt: 88/110; pub: 356/435	

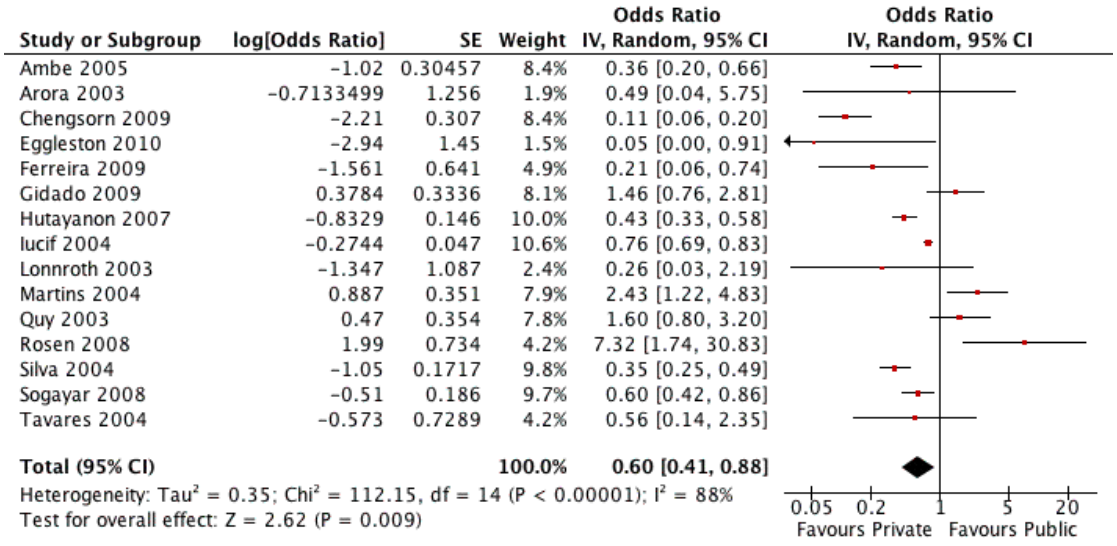
1. Tx= treatment
2. Successful = cured or tx completed
3. Unsuccessful = failed, defaulted, died or transferred
4. RNTCP—Revised National Tuberculosis Control Programme
5. AMI—Acute Myocardial Infarction
6. ART—Antiretroviral Therapy
7. ESRD-Ends Stage Renal Disease
8. SE-Standard Error
9. OR-Odds Ratio
10. CI-Confidence Interval

Appendix 4.1: Forest Plots

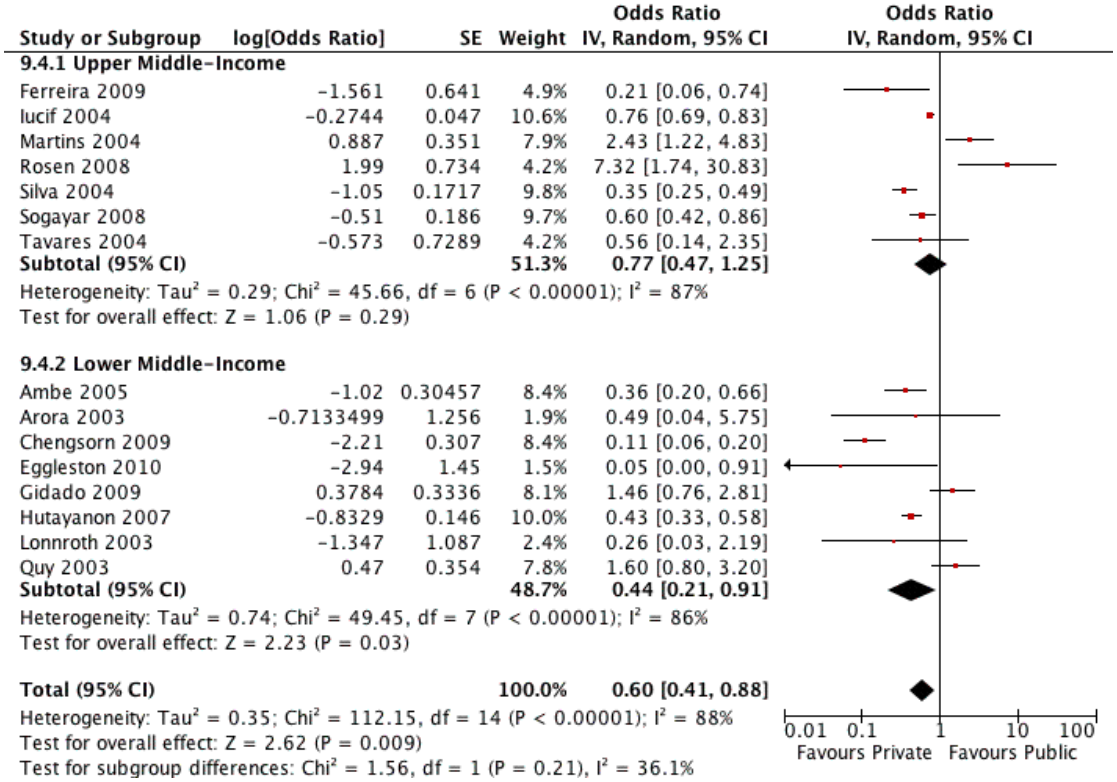
The following key applies to all of the forest plots:
■ = Weighted effect estimates from individual studies.
◆ = Subtotal and total summary estimates.

Mortality

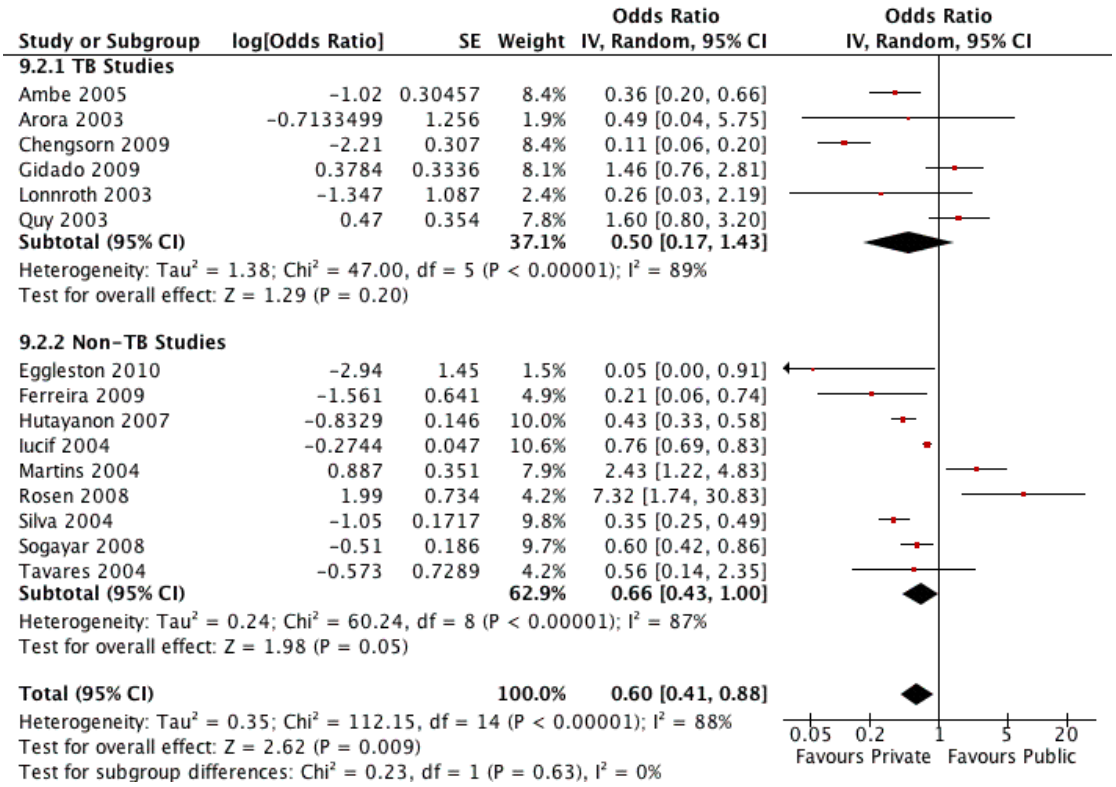
1. Forest plot of comparison: public versus private, outcome: mortality



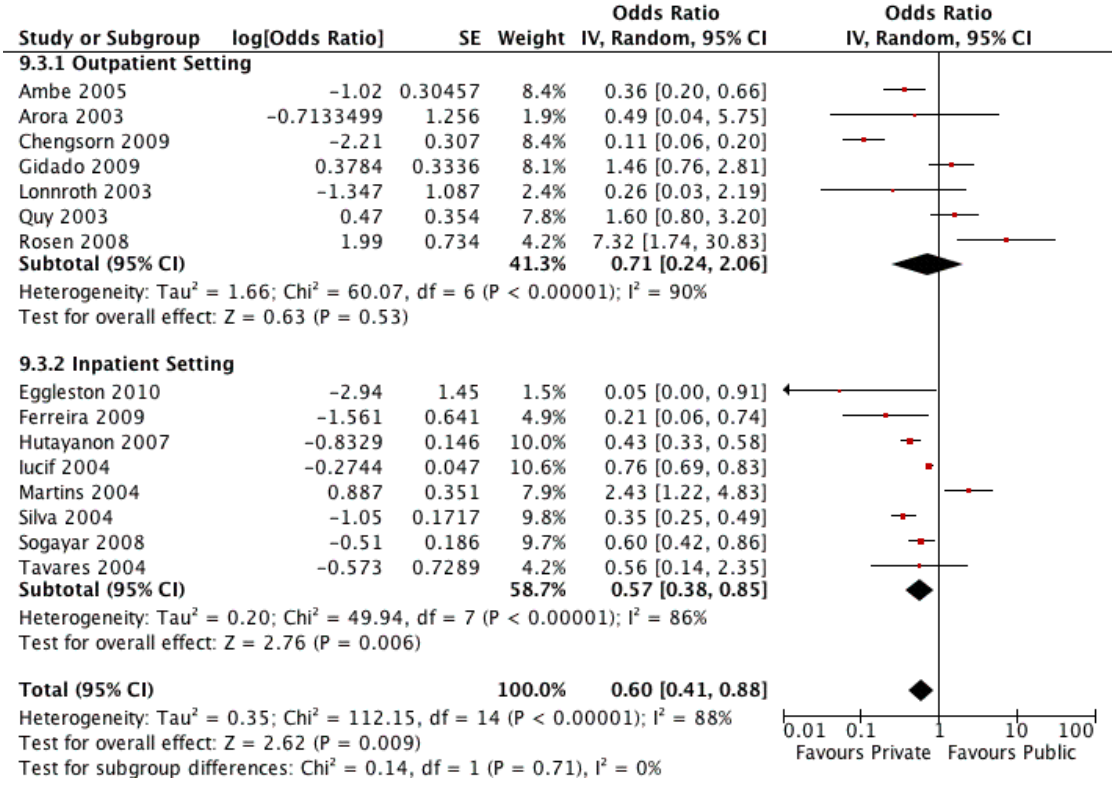
2. Forest plot of comparison: public versus private, outcome: mortality (upper-middle vs lower-middle income)



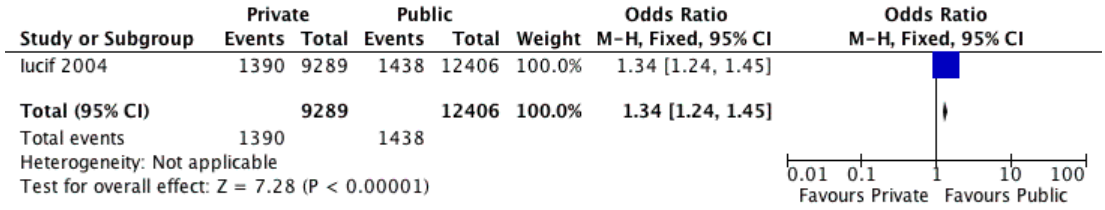
3. Forest plot of comparison: public versus private, outcome: mortality (TB vs Non-TB studies)



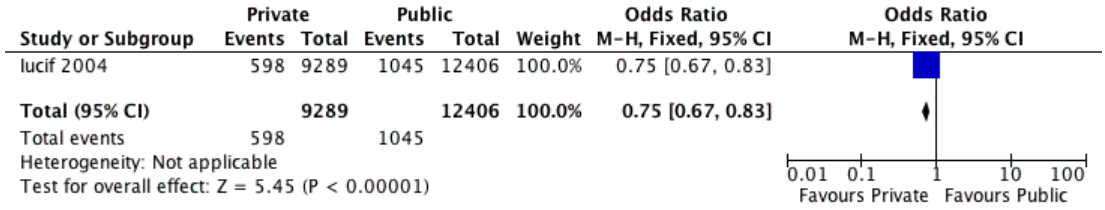
4. Forest plot of comparison: public versus private, outcome: mortality (outpatient vs inpatient settings)



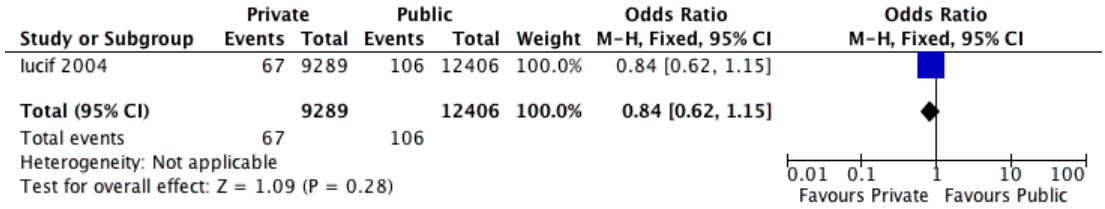
5. Forest plot of comparison: public versus private, outcome: mortality (adjusted by Charlson comorbidity index=0)



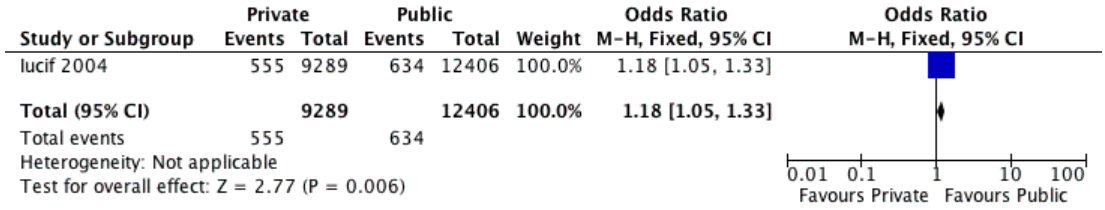
6. Forest plot of comparison: public versus private, outcome: mortality (adjusted by Charlson comorbidity index=1 to 3)



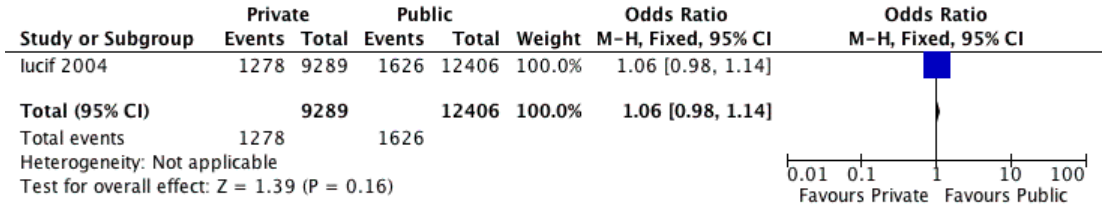
7. Forest plot of comparison: public versus private, outcome: mortality (adjusted by Charlson comorbidity index=4 or more)



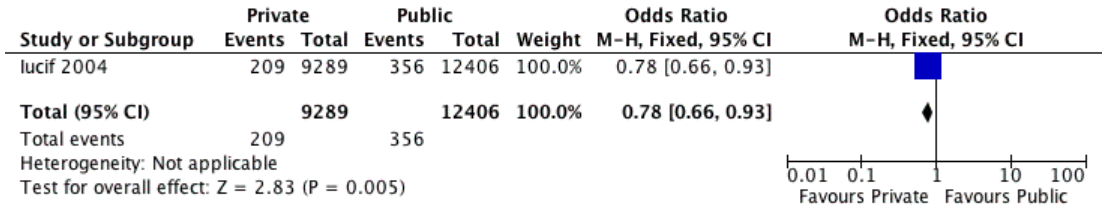
8. Forest plot of comparison: public versus private, outcome: mortality (age-adjusted by Charlson comorbidity index=1 to 2)



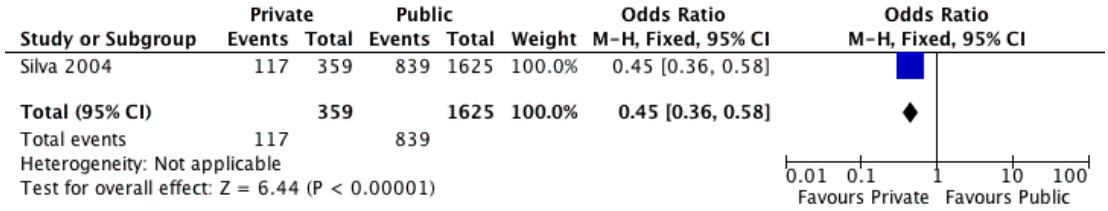
9. Forest plot of comparison: public versus private, outcome: mortality (age-adjusted by Charlson comorbidity index=3 to 5)



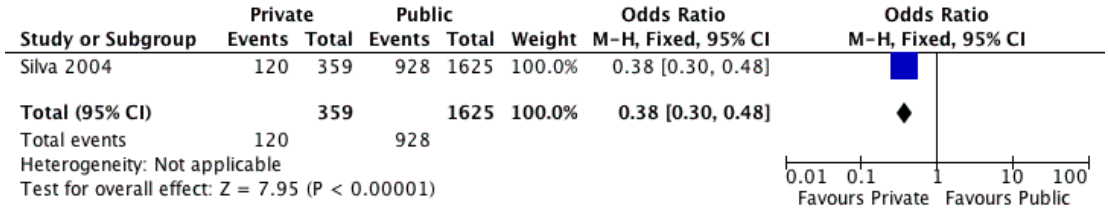
10. Forest plot of comparison: public versus private, outcome: mortality (age-adjusted by Charlson comorbidity index=6 or more)



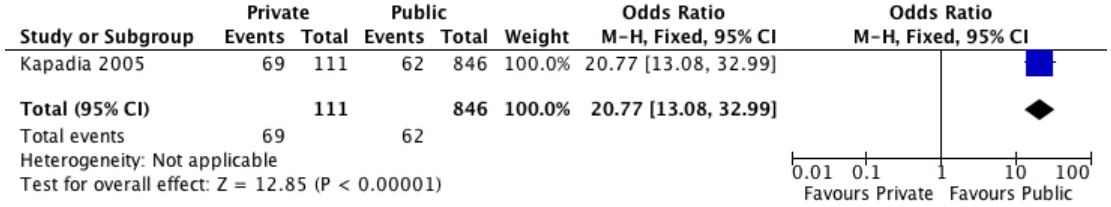
11. Forest plot of comparison: public versus private, outcome: severe septic mortality



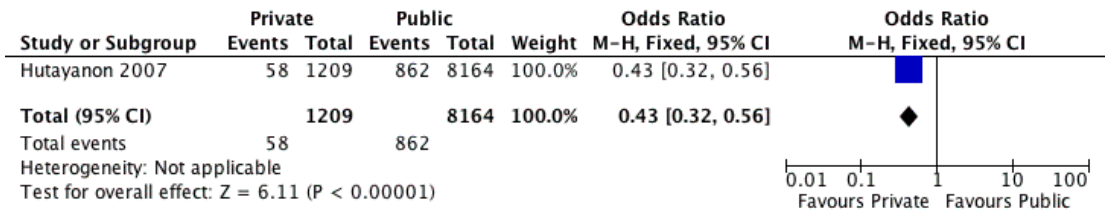
12. Forest plot of comparison: public versus private, outcome: septic shock mortality



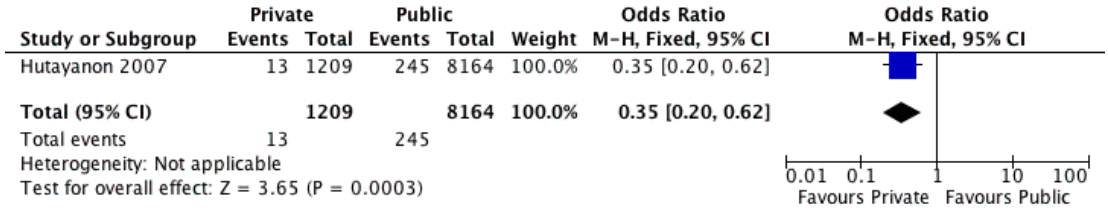
13. Forest plot of comparison: public versus private, outcome: death in ICU among all hospitalized



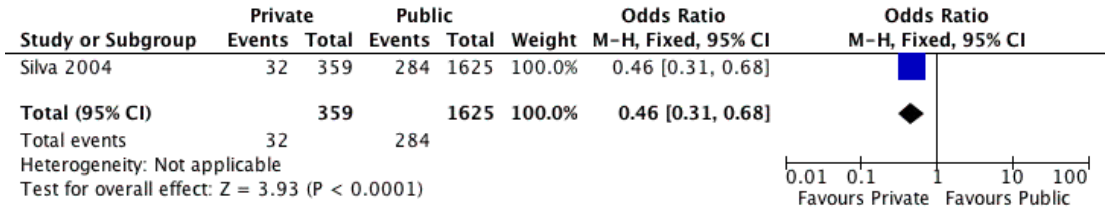
14. Forest plot of comparison: public versus private, outcome: cardiac-specific death (adjusted)



15. Forest plot of comparison: public versus private, outcome: non-cardiac death (adjusted)

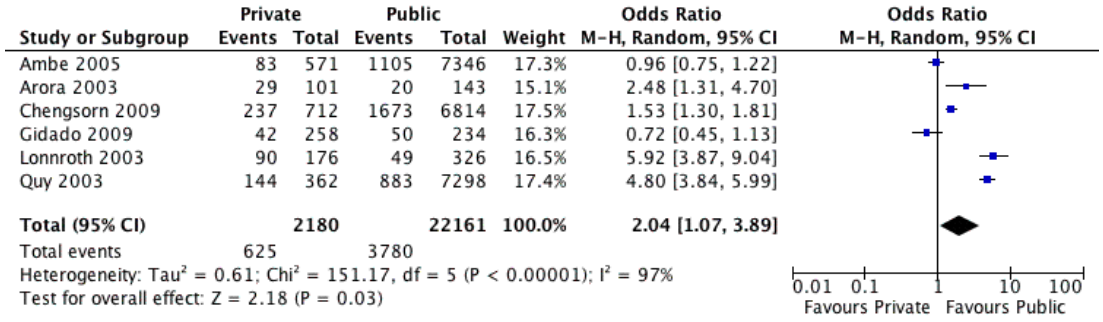


16. Forest plot of comparison: public versus private, outcome: SIRS-related mortality at 28 days



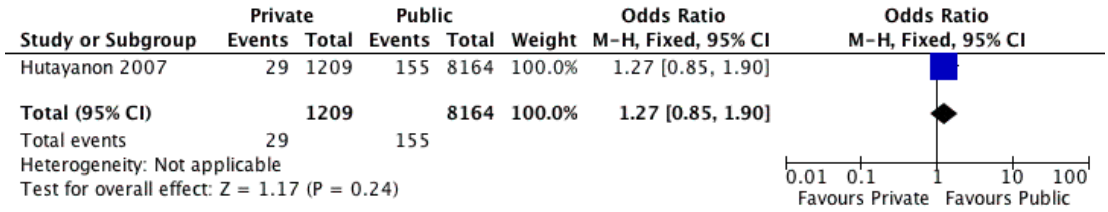
Tuberculosis outcomes

17. Forest plot of comparison: public versus private, outcome: unsuccessful TB treatment

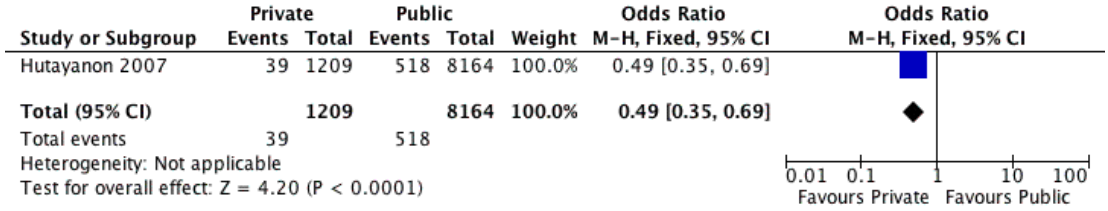


Non-death cardiovascular outcomes

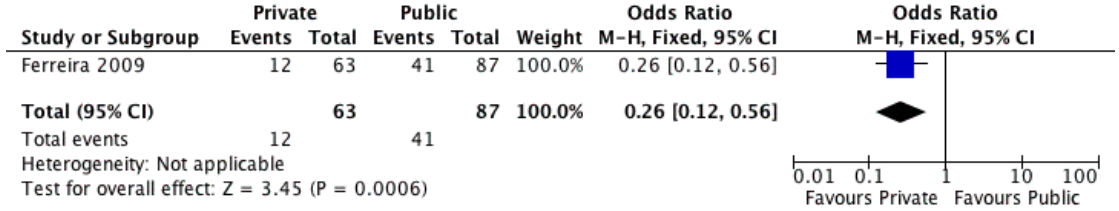
18. Forest plot of comparison: public versus private, outcome: cerebrovascular accident (adjusted)



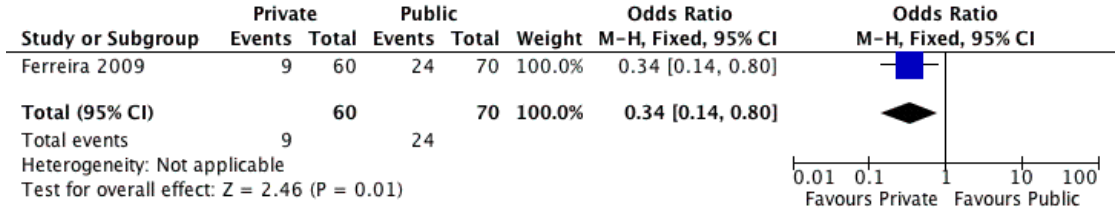
19. Forest plot of comparison: public versus private, outcome: major bleeding (adjusted)



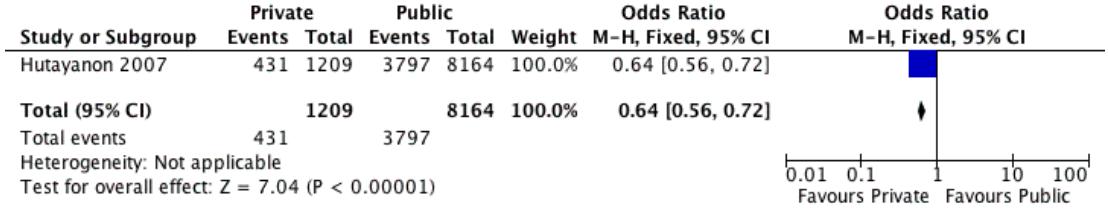
20. Forest plot of comparison: public versus private, outcome: severity of cardiac illness (Killip >1) or death



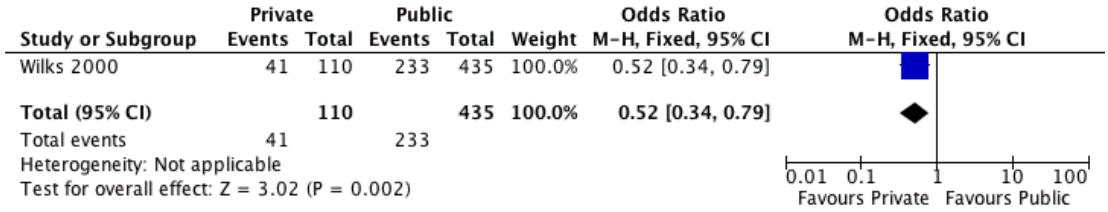
21. Forest plot of comparison: public versus private, outcome: severity of cardiac illness (Killip >1)



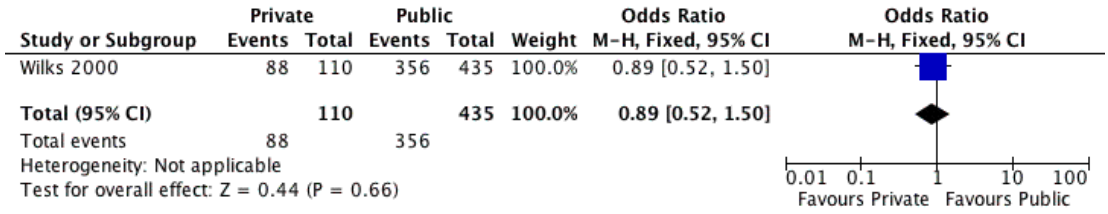
22. Forest plot of comparison: public versus private, outcome: congestive heart failure



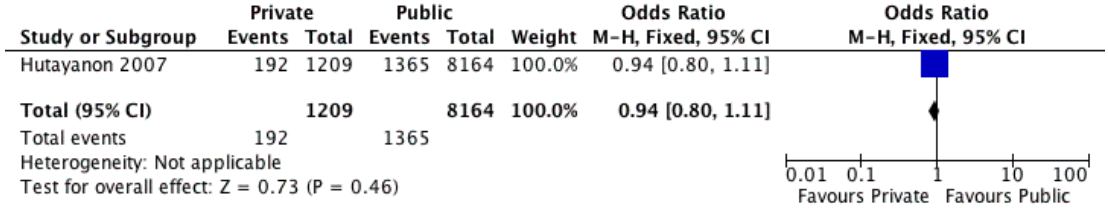
23. Forest plot of comparison: public versus private, outcome: blood pressure control (greater than or equal to 160/95)



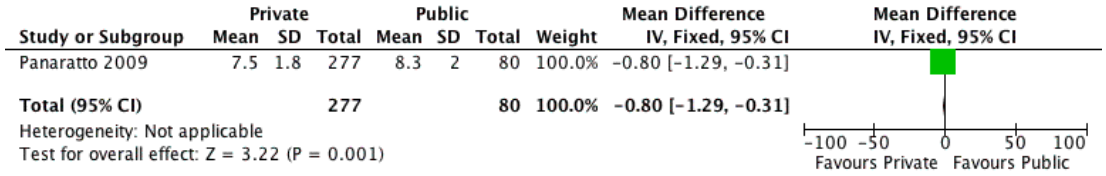
24. Forest plot of comparison: public versus private, outcome: blood pressure control (greater than or equal to 140/90)



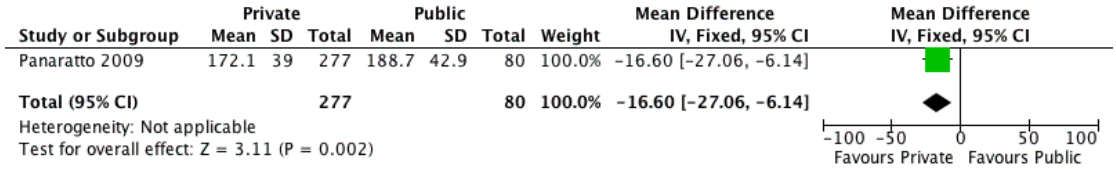
25. Forest plot of comparison: public versus private, outcome: cardiac arrhythmia (adjusted)



26. Forest plot of comparison: public versus private, outcome: A1C (glycemic control)

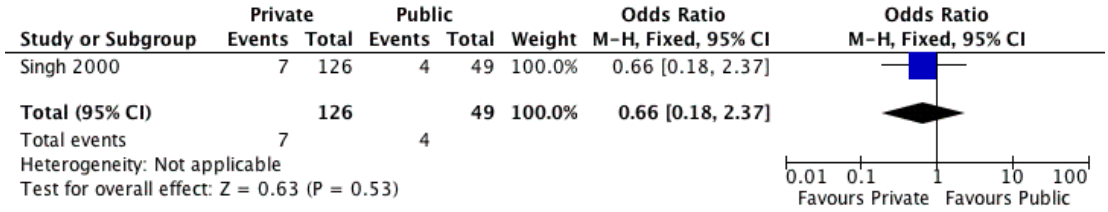


27. Forest plot of comparison: public versus private, outcome: cholesterol

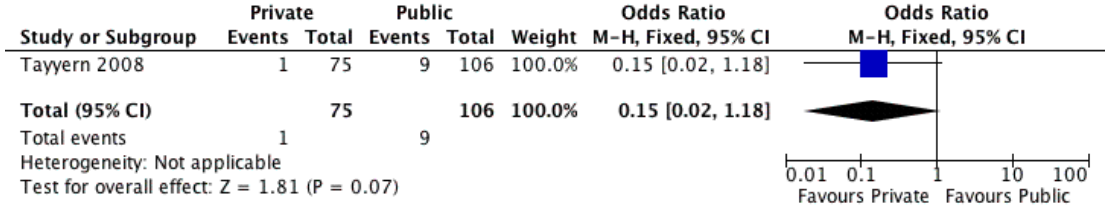


Other health outcomes

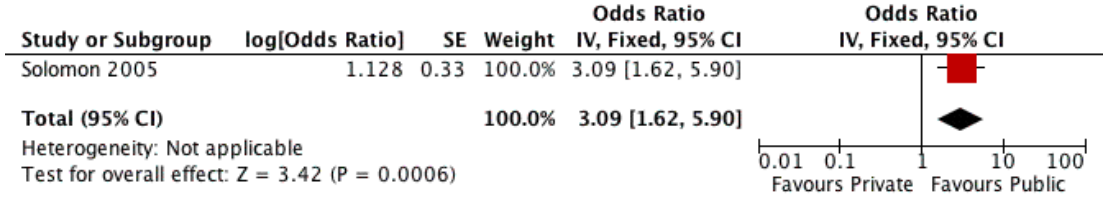
28. Forest plot of comparison: public versus private, outcome: remained blind after surgery



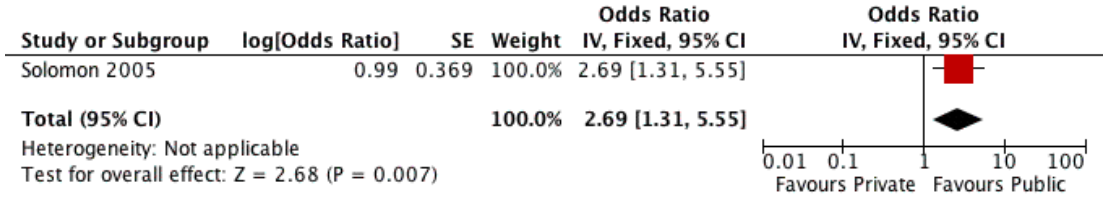
29. Forest plot of comparison: public versus private, outcome: severe malnutrition



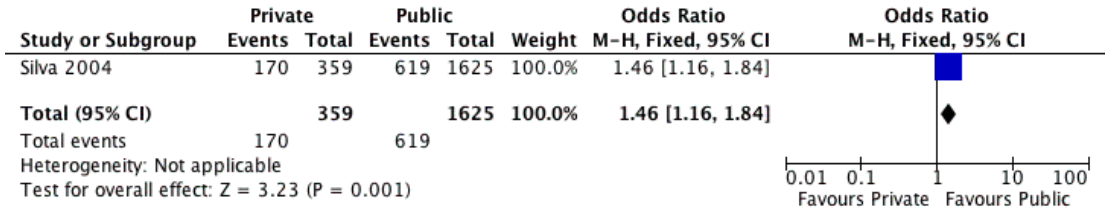
30. Forest plot of comparison: public versus private, outcome: rheumatoid arthritis disability among Africans



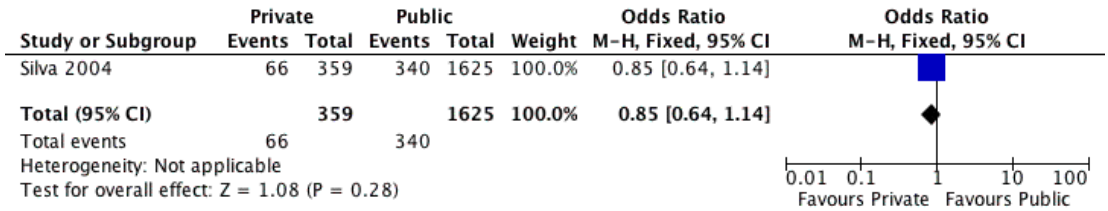
31. Forest plot of comparison: Public versus private, outcome: rheumatoid arthritis disability among Caucasians



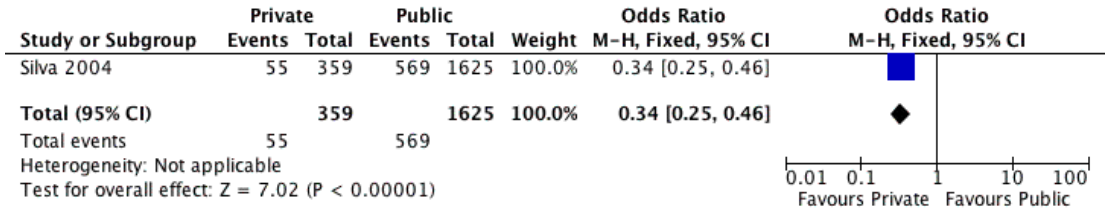
32. Forest plot of comparison: public versus private, outcome: SIRS



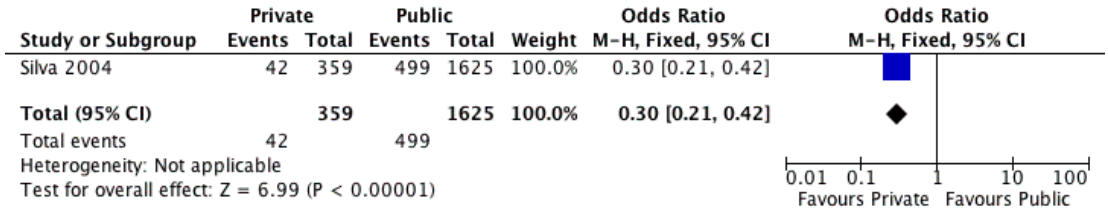
33. Forest plot of comparison: public versus private, outcome: sepsis



34. Forest plot of comparison: public versus private, outcome: severe sepsis



35. Forest plot of comparison: public versus private, outcome: septic shock



Appendix 4.2: GRADE summary of evidence

Outcomes	Illustrative comparative risks (95% CI)		Relative effect (95% CI)	No. of participants (studies)	Quality of the evidence (GRADE)[7]
	Assumed risk Public healthcare	Corresponding risk Private healthcare provision			
Mortality	109 per 1000[1]	68 per 1000 (48 to 97)[1]	OR 0.60 (0.41 to 0.88)	45,936 (15 studies)	⨁⊖⊖⊖ very low[2]
Mortality (adjusted by Charlson comorbidity index=0)	116 per 1000	150 per 1000 (140 to 160)	OR 1.34 (1.24 to 1.45)	21,695 (1 study)	⨁⨁⊖⊖ low
Mortality (adjusted by Charlson comorbidity index=1 to 3)	84 per 1000	64 per 1000 (58 to 71)	OR 0.75 (0.67 to 0.83)	21,695 (1 study)	⨁⨁⊖⊖ low
Mortality (adjusted by Charlson comorbidity index=4 or more)	9 per 1000	8 per 1000 (6 to 10)	OR 0.84 (0.62 to 1.15)	21,695 (1 study)	⨁⨁⊖⊖ low
Mortality (age-adjusted by Charlson comorbidity index=1 to 2)	51 per 1000	60 per 1000 (53 to 67)	OR 1.18 (1.05 to 1.33)	21,695 (1 study)	⨁⨁⊖⊖ low
Mortality (age-adjusted by Charlson comorbidity index=3 to 5)	131 per 1000	138 per 1000 (129 to 147)	OR 1.06 (0.98 to 1.14)	21,695 (1 study)	⨁⨁⊖⊖ low
Mortality (age-adjusted by Charlson comorbidity index=6 or more)	29 per 1000	23 per 1000 (19 to 27)	OR 0.78 (0.66 to 0.93)	21695 (1 study)	⨁⨁⊖⊖ low
Severe Septic Mortality	516 per 1000	324 per 1000 (277 to 382)	OR 0.45 (0.36 to 0.58)	1,984 (1 study)	⨁⨁⨁⊖ moderate[3]
Septic Shock Mortality	571 per 1000	336 per 1000 (285 to 390)	OR 0.38 (0.3 to 0.48)	1984 (1 study)	⨁⨁⨁⊖ moderate[3]
Death in ICU among all Hospitalized	73 per 1000	621 per 1000 (507 to 722)	OR 20.77 (13.08 to 32.99)	957 (1 study)	⨁⨁⨁⨁ high[4]
Cardiac-specific death (adjusted)	106 per 1000	49 per 1000 (37 to 62)	OR 0.43 (0.32 to 0.56)	9,373 (1 study)	⨁⨁⨁⊖ moderate[3]
Non-cardiac death (adjusted)	30 per 1000	11 per 1000 (6 to 19)	OR 0.35 (0.2 to 0.62)	9,373 (1 study)	⨁⨁⨁⊖ moderate[3]
Remained Blind After Surgery	82 per 1000	56 per 1000 (16 to 175)	OR 0.66 (0.18 to 2.37)	175 (1 study)	⨁⨁⊖⊖ low
Cerebrovascular Accident (adjusted)	19 per 1000	24 per 1000 (16 to 35)	OR 1.27 (0.85 to 1.9)	9,373 (1 study)	⨁⨁⊖⊖ low
Major Bleeding (adjusted)	63 per 1000	32 per 1000 (23 to 44)	OR 0.49 (0.35 to 0.69)	9,373 (1 study)	⨁⨁⨁⊖ moderate[3]
Severity of Cardiac Illness (Killip >1) or Death	471 per 1000	188 per 1000 (97 to 333)	OR 0.26 (0.12 to 0.56)	150 (1 study)	⨁⨁⨁⊖ moderate[3]
Severity of Cardiac Illness (Killip >1)	343 per 1000	151 per 1000 (68 to 295)	OR 0.34 (0.14 to 0.8)	130 (1 study)	⨁⨁⨁⊖ moderate[3]
Unsuccessful TB Treatment	171 per 1000[1]	296 per 1000 (181 to 445)[1]	OR 2.04 (1.07 to 3.89)	24,341 (6 studies)	⨁⨁⨁⊖ moderate[5,6]
Congestive Heart Failure	465 per 1000	357 per 1000 (327 to 385)	OR 0.64 (0.56 to 0.72)	9,373 (1 study)	⨁⨁⊖⊖ low
Severe Malnutrition	85 per 1000	14 per 1000 (2 to 99)	OR 0.15 (0.02 to 1.18)	181 (1 study)	⨁⨁⨁⨁ high[7]
Blood Pressure Control (Greater than or equal to 160/95)	536 per 1000	375 per 1000 (282 to 477)	OR 0.52 (0.34 to 0.79)	545 (1 study)	⨁⨁⊖⊖ low
Blood Pressure Control (Greater than or equal to 140/90)	818 per 1000	800 per 1000 (700 to 871)	OR 0.89 (0.52 to 1.5)	545 (1 study)	⨁⨁⊖⊖ low
Cardiac Arrhythmia	167 per 1000	159 per 1000	OR 0.94	9,373	⨁⨁⊖⊖

(adjusted)		(138 to 182)	(0.8 to 1.11)	(1 study)	**low**
A1C (glycemic control)		The mean A1C (glycemic control) in the intervention groups was **0.8 lower** (1.29 to 0.31 lower)		357 (1 study)	⨁⨁⊖⊖ **low**
Cholesterol		The mean Cholesterol in the intervention groups was **16.6 lower** (27.06 to 6.14 lower)		357 (1 study)	⨁⨁⊖⊖ **low**
SIRS	**381 per 1000**	**473 per 1000** (417 to 531)	**OR 1.46** (1.16 to 1.84)	1,984 (1 study)	⨁⨁⊖⊖ **low**
Sepsis	**209 per 1000**	**183 per 1000** (145 to 231)	**OR 0.85** (0.64 to 1.14)	1,984 (1 study)	⨁⨁⊖⊖ **low**
Severe Sepsis	**350 per 1000**	**155 per 1000** (119 to 199)	**OR 0.34** (0.25 to 0.46)	1,984 (1 study)	⨁⨁⨁⊖ **moderate**[3]
Septic Shock	**307 per 1000**	**117 per 1000** (85 to 157)	**OR 0.3** (0.21 to 0.42)	1,984 (1 study)	⨁⨁⨁⊖ **moderate**[3]
SIRS-Related Mortality at 28 days	**175 per 1000**	**89 per 1000** (62 to 126)	**OR 0.46** (0.31 to 0.68)	19,84 (1 study)	⨁⨁⨁⊖ **moderate**[3]
Disability Among Africans	**250 per 1000**	**507 per 1000** (351 to 663)	**OR 3.09** (1.62 to 5.9)	400 (1 study)	⨁⨁⨁⊖ **moderate**[4]
Disability Among Caucasians	**250 per 1000**	**473 per 1000** (304 to 649)	**OR 2.69** (1.31 to 5.55)	400 (1 study)	⨁⨁⨁⊖ **moderate**[4]

[1] Not all studies found similar results.
[2] Some study population sizes are estimated from the text. These estimates only affect the absolute effect measure.
[3] The relative effect is estimated to be less than 0.5.
[4] The relative effect is estimated to be more than 2.0.
[5] Large effect.
[6] The relative effect is estimated to be less than 0.2.
[7] The overall quality of evidence rating is assessed by the total of points 4 points, high quality; 3 points, moderate quality; 2 points, low quality; > 2 very low quality.

Appendix 4.3: GRADE evidence profiles

Quality assessment							Summary of findings				
							No of patients		Effect		Quality
No of studies	Design	Limitations	Inconsistency	Indirectness	Imprecision	Other consid-erations	Private Healthcare Provision	Public Healthcare	Relative (95% CI)	Absolute	
Mortality											
15	Observational studies	no serious limitations	serious[1]	no serious indirectness	no serious imprecision	none	1,088/ 12,132 (9%)[2]	3,681/ 33,804 (10.9%)[2]	OR 0.60 (0.41 to 0.88)	41 fewer per 1000 (from 12 fewer to 61 fewer)	VERY LOW
Mortality (adjusted by Charlson comorbidity index=0)											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	none	1,390/9,289 (15%)	1,438/ 12,406 (11.6%)	OR 1.34 (1.24 to 1.45)	34 more per 1000 (from 24 more to 44 more)	LOW
Mortality (adjusted by Charlson comorbidity index=1 to 3)											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	none	598/ 9,289 (6.4%)	1,045/ 12,406 (8.4%)	OR 0.75 (0.67 to 0.83)	20 fewer per 1000 (from 13 fewer to 26 fewer)	LOW
Mortality (adjusted by Charlson comorbidity index=4 or more)											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	none	67/9289 (0.7%)	106/12,406 (0.9%)	OR 0.84 (0.62 to 1.15)	1 fewer per 1000 (from 3 fewer to 1 more)	LOW
Mortality (age-adjusted by Charlson comorbidity index=1 to 2)											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	none	555/ 9,289 (6%)	634/12,406 (5.1%)	OR 1.18 (1.05 to 1.33)	9 more per 1000 (from 2 more to 16 more)	LOW
Mortality (age-adjusted by Charlson comorbidity index=3 to 5)											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	none	1,278/ 9,289 (13.8%)	1,626/ (13.1%)	OR 1.06 (0.98 to 1.14)	7 more per 1000 (from 2 fewer to 16 more)	LOW

Mortality (age-adjusted by Charlson comorbidity index=6 or more)											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	none	209/ 9,289 (2.2%)	356/12,406 (2.9%)	OR 0.78 (0.66 to 0.93)	6 fewer per 1000 (from 2 fewer to 10 fewer)	LOW
Severe Septic Mortality											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	strong association[3]	117/359 (32.6%)	839/1,625 (51.6%)	OR 0.45 (0.36 to 0.58)	192 fewer per 1000 (from 134 fewer to 239 fewer)	MODERATE
Septic Shock Mortality											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	strong association[3]	120/359 (33.4%)	928/1,625 (57.1%)	OR 0.38 (0.3 to 0.48)	235 fewer per 1000 (from 181 fewer to 286 fewer)	MODERATE
Death in ICU among all Hospitalized											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	serious imprecision	strong association[3]	69/111 (62.2%)	62/846 (7.3%)	OR 20.77 (13.08 to 32.99)	548 more per 1000 (from 435 more to 650 more)	MODERATE
Cardiac-specific death (adjusted)											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	strong association[3]	58/1209 (4.8%)	862/8,164 (10.6%)	OR 0.43 (0.32 to 0.56)	57 fewer per 1000 (from 44 fewer to 69 fewer)	MODERATE
Non-cardiac death (adjusted)											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	strong association[3]	13/1209 (1.1%)	245/8,164 (3%)	OR 0.35 (0.2 to 0.62)	19 fewer per 1000 (from 11 fewer to 24 fewer)	MODERATE
Remained Blind After Surgery											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	none	7/126 (5.6%)	4/49 (8.2%)	OR 0.66 (0.18 to 2.37)	26 fewer per 1000 (from 66 fewer to 92 more)	LOW
Cerebrovascular Accident (adjusted)											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	none	29/1,209 (2.4%)	155/8,164 (1.9%)	OR 1.27 (0.85 to 1.9)	5 more per 1000 (from 3 fewer to 16 more)	LOW

Major Bleeding (adjusted)											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	strong association[3]	39/1,209 (3.2%)	518/8,164 (6.3%)	OR 0.49 (0.35 to 0.69)	31 fewer per 1000 (from 19 fewer to 40 fewer)	MODERATE
Severity of Cardiac Illness (Killip >1) or Death											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	strong association[3]	12/63 (19%)	41/87 (47.1%)	OR 0.26 (0.12 to 0.56)	283 fewer per 1000 (from 138 fewer to 375 fewer)	MODERATE
Severity of Cardiac Illness (Killip >1)											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	strong association[3]	9/60 (15%)	24/70 (34.3%)	OR 0.34 (0.14 to 0.8)	192 fewer per 1000 (from 48 fewer to 275 fewer)	MODERATE
Unsuccessful TB Treatment											
6	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	strong association[5]	625/ 2,180 (28.7%)[2]	3,780/ 22,161 (17.1%)[2]	OR 2.04 (1.07 to 3.89)	125 more per 1000 (from 10 more to 274 more)	MODERATE
Congestive Heart Failure											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	none	431/ 1,209 (35.6%)	3,797/8,164 (46.5%)	OR 0.64 (0.56 to 0.72)	108 fewer per 1000 (from 80 fewer to 138 fewer)	LOW
Severe Malnutrition											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	very strong association[6]	1/75 (1.3%)	9/106 (8.5%)	OR 0.15 (0.02 to 1.18)	71 fewer per 1000 (from 83 fewer to 14 more)	HIGH
Blood Pressure Control (Greater than or equal to 160/95)											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	none	41/110 (37.3%)	233/435 (53.6%)	OR 0.52 (0.34 to 0.79)	161 fewer per 1000 (from 59 fewer to 254 fewer)	LOW
Blood Pressure Control (Greater than or equal to 140/90)											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	none	88/110 (80%)	356/435 (81.8%)	OR 0.89 (0.52 to 1.5)	18 fewer per 1000 (from 117 fewer to 53 more)	LOW

Cardiac Arrhythmia (adjusted)											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	none	192/ 1209 (15.9%)	1,365/8,164 (16.7%)	OR 0.94 (0.8 to 1.11)	8 fewer per 1000 (from 29 fewer to 15 more)	LOW
A1C (glycemic control) (Better indicated by lower values)											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	none	277	80	-	MD 0.8 lower (1.29 to 0.31 lower)	LOW
Cholesterol (Better indicated by lower values)											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	none	277	80	-	MD 16.6 lower (27.06 to 6.14 lower)	LOW
SIRS											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	none	170/359 (47.4%)	619/1,625 (38.1%)	OR 1.46 (1.16 to 1.84)	92 more per 1000 (from 36 more to 150 more)	LOW
Sepsis											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	none	66/359 (18.4%)	340/1,625 (20.9%)	OR 0.85 (0.64 to 1.14)	26 fewer per 1000 (from 64 fewer to 23 more)	LOW
Severe Sepsis											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	strong association[3]	55/359 (15.3%)	569/1,625 (35%)	OR 0.34 (0.25 to 0.46)	195 fewer per 1000 (from 152 fewer to 231 fewer)	MODERATE
Septic Shock											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	strong association[3]	42/359 (11.7%)	499/1,625 (30.7%)	OR 0.3 (0.21 to 0.42)	190 fewer per 1000 (from 150 fewer to 222 fewer)	MODERATE
SIRS-Related Mortality at 28 days											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	strong association[3]	32/359 (8.9%)	284/1,625 (17.5%)	OR 0.46 (0.31 to 0.68)	86 fewer per 1000 (from 49 fewer to 113 fewer)	MODERATE

Disability Among Africans											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	strong association[4]	100/200 (50%)	50/200 (25%)	OR 3.09 (1.62 to 5.9)	257 more per 1000 (from 101 more to 413 more)	MODERATE
Disability Among Caucasians											
1	Observational studies	no serious limitations	no serious inconsistency	no serious indirectness	no serious imprecision	strong association[4]	100/200 (50%)	50/200 (25%)	OR 2.69 (1.31 to 5.55)	223 more per 1000 (from 54 more to 399 more)	MODERATE

[1] Not all studies found similar results.
[2] Some study population sizes are estimated from the text. These estimates only affect the absolute effect measure.
[3] The relative effect is estimated to be less than 0.5.
[4] The relative effect is estimated to be more than 2.0.
[5] Large effect.
[6] The relative effect is estimated to be less than 0.2.

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