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Review Article

# Identification of relevant performance indicators for district healthcare systems in Ethiopia: a systematic review and expert opinion

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Received 8 October 2019; Editorial Decision 29 January 2020; Accepted 17 February 2020

## Abstract

**Purpose:** To identify potential performance indicators relevant for district healthcare systems of Ethiopia.

**Data sources:** Public Library of Medicine and Agency for Healthcare Research and Quality of the United States of America, Organization for Economic Cooperation and Development Library and Google Scholar were searched.

**Study selection:** Expert opinions, policy documents, literature reviews, process evaluations and observational studies published between 1990 and 2015 were considered for inclusion. Participants were national- and local-healthcare systems. The phenomenon of interest was the performance of healthcare systems. The Joanna Briggs Institute tools were adapted and used for critical appraisal of records.

**Data extraction:** Indicators of performance were extracted from included records and summarized in a narrative form. Then, experts rated the relevance of the indicators. Relevance of an indicator is its agreement with priority health objectives at the national and district level in Ethiopia.

**Results of data synthesis:** A total of 11 206 titles were identified. Finally, 22 full text records were qualitatively synthesized. Experts rated 39 out of 152 (25.7%) performance indicators identified from the literature to be relevant for district healthcare systems in Ethiopia. For example, access to primary healthcare, tuberculosis (TB) treatment rate and infant mortality rate were found to be relevant.

**Conclusion:** Decision-makers in Ethiopia and potentially in other low-income countries can use multiple relevant indicators to measure the performance of district healthcare systems. Further research is needed to test the validity of the indicators.

**Key words:** performance, healthcare system, indicators, Ethiopia, narrative review

## Introduction

Health systems contribute to improving health and well-being of populations. Strengthening the resources of health systems is therefore a meaningful step toward better health outcomes. Nevertheless, there is much variation of desirable outcomes across health systems, which cannot be explained merely by resource investment and use. Systems differ across countries regarding structure and management.

Numerous attempts have been made to establish frameworks for the measurement of health system performance; examples include the European Community Health Promotion Indicator Development Model [1], the Health Indicators Framework of Canada [2] and the Organization for Economic Cooperation and Development's (OECD) Project of Health Care Quality Indicator [3]. All of these attempts resulted in a performance framework that comprises individual, social and environmental determinants of health as a common thread [1–3]. Many of these frameworks are comprehensive sources for multiple indicators.

In low- and middle-income countries' setting, District League Tables, the Balanced Score Card and health system governance framework were applied in Uganda, Afghanistan and Pakistan, respectively [4–6].

The two main shortcomings of performance frameworks are either they tend to provide lists of partially overlapping indicators or they propose indicators that are easily available from the system and therefore replicate the operational status quo [7].

Some of the main challenges in performance measurement include differences in perspectives on what to measure, setting-out criteria, 'conflicts between financial and quality goals and developing information systems' [8].

In Ethiopia, several main challenges for performance measurement in a low-income setting have been identified: information is not collected comprehensively and systematically, and therefore, data on frequency and distribution of disease and risk factors are lacking [9].

The Ministry of Health of Ethiopia initiated a Health Sector Transformation Plan that aims to improve the systems for routine monitoring of health care performance [9]. Consequently, a national health information system called District Health Information System (DHIS) with 122 specific indicators was implemented. However, these indicators predominantly focus on processes of service delivery, e.g. rates of antenatal care (ANC) utilization, with scant capacity and outcome indicators. Moreover, relevance and feasibility of the indicators are not clear. While process measures can be useful at a certain stage to establish procedures, indicators are needed which have the potential to improve the outcome-based quality of care. A potential applicability of such indicators on a micro-level, i.e. at the level of district health institutions, should be considered an asset.

The objective of this study is therefore to systematically review and analyze the performance indicators of healthcare systems that are relevant to district healthcare systems in Ethiopia.

## Organization of health system in Ethiopia

Ethiopia is a federal republic with nine national regional states—namely Tigray; Afar; Amhara; Oromia; Somali; Southern Nations, Nationalities and Peoples Region; Harari; Gambela and Benishangul Gumuz. It also has two city states—Addis Abeba and Dire Dawa. There is a ministry of health at national-level making policies and coordinating the health efforts of the nation. Each region has its own health office tasked with fulfilling the conditions for the provision of health services, such as for the prevention and control of

human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome, regulation of health and related services, development and management of health human resources, and procurement of health supplies [10].

Ethiopia has a total of 770 districts [11]. The usual health facilities in districts are health centers. Health officers, nurses and midwives are the main health professionals. The usual activities are provision of health promotion and preventive interventions. Moreover, curative health care is largely provided on communicable diseases as well as maternal, neonatal and child health conditions in the districts.

## Definition of important terms used in this study

### District healthcare system

District healthcare systems are networks of facilities with a primary aim of providing health promotion, prevention and treatment of diseases, and rehabilitation services to a defined population living in a delineated administrative area.

### Performance of healthcare system

Well-performing healthcare systems should build their capacity for the provision of quality healthcare which is accessible, equitable and efficient with the goal of improving health status outcomes [12–15].

### Access

'Delivering healthcare that is within reasonable geographic reach and available when needed' [16].

### Capacity

Capacity refers to 'skills, tools and processes' that need to be in place in a functioning system [17].

### Quality

Quality is the extent to which healthcare is effective, safe and patient centered [13].

### Equity

Absence of variations in the utilization of healthcare or outcomes of care based on ethnicity, income, education, social structure and belief, but not need for healthcare [18, 19].

### Technical efficiency

'Delivering a given health service for least cost' [14].

### Outcomes

Incidence and prevalence of conditions and diseases, and their risk factors as well as subjective- and objective-health status are reported as outcomes.

## Methods

### Protocol and registration

The protocol was registered with the International Prospective Register of Systematic Reviews, The University of York, UK (registration number: CRD42016033347). The protocol is available

at: [http://www.crd.york.ac.uk/PROSPERO/display\\_record.asp?ID=CRD42016033347](http://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42016033347).

### Screening criteria

The following records were sought.

- (i) Research design: Case studies, process evaluation, surveys and economic evaluations of effectiveness and efficiency.
  - (ii) Expert opinions: Debate, commentary and opinion papers.
- (a) Reports and policy documents from organizations working to improve the performance of healthcare systems, such as Agency for Healthcare Research and Quality (AHRQ) of United States of America (USA), Ministry of Health of Ethiopia, OECD and the World Health Organization.

Articles and reports published in English between 1 January 1990 and 31 December 2015 were considered for inclusion. This period was chosen because it covers the timeline of the Millennium Development Goals when a lot of effort went into tackling major health problems in developing countries.

### Data sources and search strategy

Databases that were used for the final search include PubMed, AHRQ, OECD library and Google Scholar. The search was independently undertaken by Y.E.A. and W.M., who also undertook joint critical appraisals. In situations in which there was disagreement between the two reviewers, the argument was solved through discussion. There were no instances where an arbiter was required. Extraction was completed by Y.E.A. and all authors participated in synthesis. Electronic search of records was undertaken during February 2016. An initial search was made in PubMed to identify key terms related with performance. A final search strategy was built for each database based on these key terms. For PubMed, the Medical Subject Headings terms 'Community Health Services' AND 'Organization and Administration' AND 'Outcome and Process Assessment' AND 'Quality Indicators, Health care' were used. This strategy was adapted for AHRQ and OECD library. In addition, gray literature was searched in Google Scholar. The extracting author searched the reference lists of the retrieved publications to identify other relevant records that may have been omitted from the initial search.

### Critical appraisal and study selection based on eligibility

The inclusion criteria of the records were the provision of potential performance indicators that might be relevant for district healthcare systems in Ethiopia.

Appraisal was aided by tools from Joanna Briggs Institute (JBI), University of Adelaide, Australia ([Supplementary File 1](#)). We used this appraisal tool which was intended for opinions for most of retrieved full text records given the fact that most of the retrieved full text records were expert opinion or narrative. It addresses the credibility of the opinion source, and the focus of the opinion on the interest of patients. Moreover, we considered whether the record had an indicator potentially relevant to healthcare system of Ethiopia. A record which fulfilled 60% of the appraisal criteria and that has an indicator potentially relevant to district healthcare systems in Ethiopia passed the critical appraisal based on eligibility criteria.

We also used JBI Appraisal tools for cross-sectional, cohort and quasi-experimental studies. All tools are available from The JBI of University of Adelaide, Australia at <http://joannabriggs.org/research/critical-appraisal-tools.html>.

Frameworks, methods, results, arguments and annexes of full text records were read. Extraction of indicators was completed using a tool in [Supplementary File 2](#). Extraction was done by reading the full text of records and by finding data items relevant to the review objective. Extracted indicators were organized using the performance elements defined in the Background section of this review.

### Risk of bias in individual studies and across studies

Risk of bias was planned to be assessed using checklist on the systematic error in the design, execution and analysis of quantitative studies and the trustworthiness of qualitative studies. However, risk of bias analysis was not feasible due to the large diversity of the included studies. This is explained more in detail in the Results section.

### Relevance rating of indicators

Indicators extracted from the records were then tested for relevance based on rating by experts. An indicator was deemed relevant when it was concordant with the national- and district-level priority health objectives of Ethiopia as suggested by Travis and colleagues [20]. National-level priority objectives were identified from the health policy of Ethiopia [21] (see [Supplementary File 3](#)).

An expert was defined as either a person who authored a paper on healthcare system performance issues in Ethiopia, a person who held a position in monitoring and evaluation at national or district level, or referred by the previous two. Experts were contacted face-to-face and provided with the indicators identified from the systematic review.

Experts voted (yes vs. no) whether an indicator was relevant for either national- or district-level priority health objectives of Ethiopia. First, an indicator was voted yes if it is related with national-level priority health objectives. Second, an indicator was voted yes if it is related with district-level priority health objectives. An indicator which scored simple majority, more than 50% of the votes, for national-level relevance and absolute majority, more than 75% of the votes, for district-level relevance was retained. Decision thresholds were defined following an established procedure for consensus groups. Moreover, to get an idea about feasibility, we asked selected district health officers to comment on the possibility of deriving the indicators from information systems of the district.

Finally, indicators were organized based on their relevance as macro- (national), meso- (regional) and micro- (district) level based on national policy [21] and roles of the different levels of organization in the health system which were already described in the Introduction section.

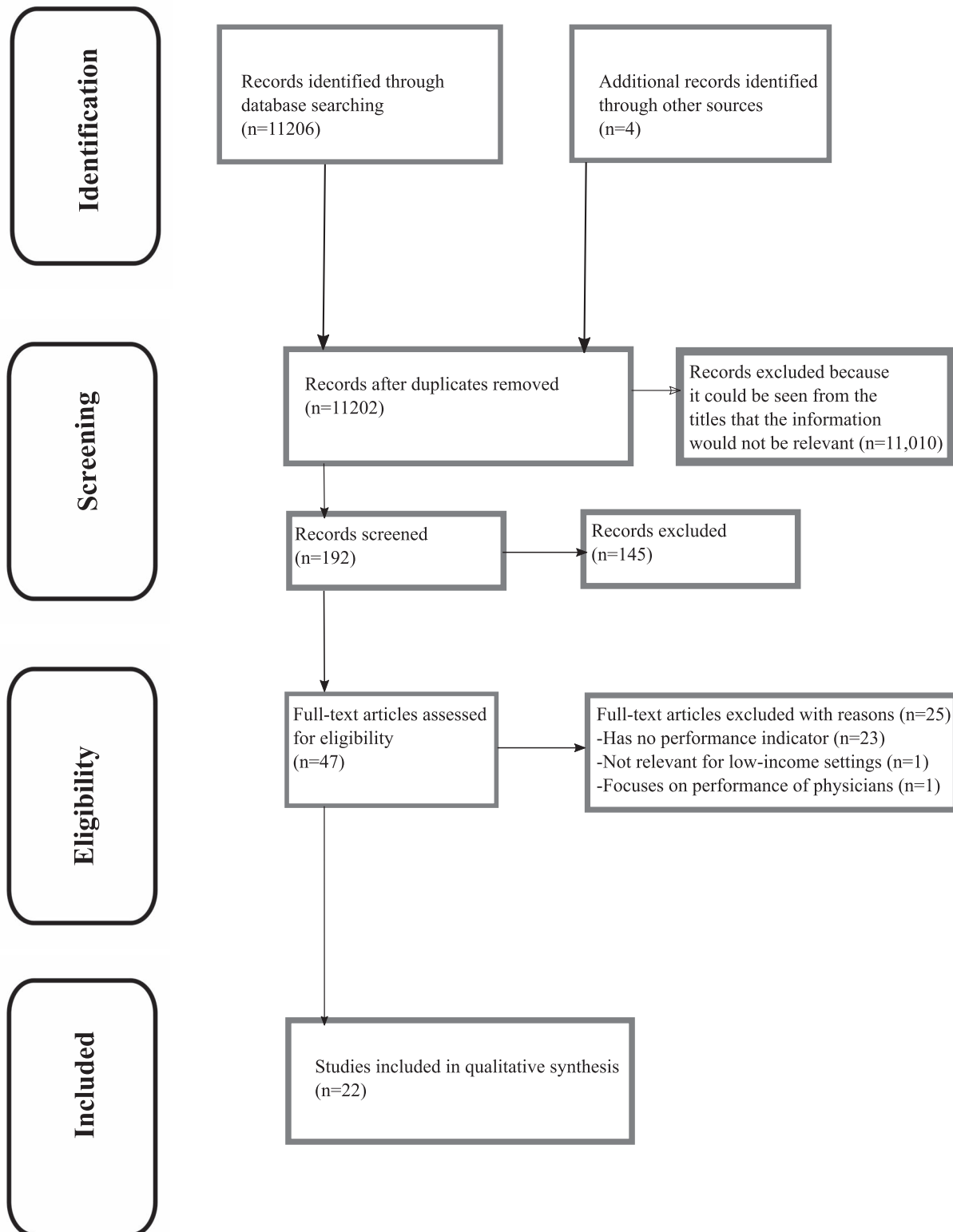
### Ethics statement

The methods and procedures of this review were approved by the Institutional Review Board of Jimma University (HRPGC/40130-/2016) and the Ethics Commission of Ludwig-Maximilians-Universität München (Projekt No: 708-16). Participants in the experts' opinion provided written informed consent.

## Results

### Characteristics of included studies

The search strategy returned 11 206 titles from PubMed (141), AHRQ (1080), OECD Library (6665) and Google scholar (3320).



**Figure 1** District indicators PRISMA flow diagram.

From these, 200 records were selected based on their titles. Eight were duplicates. One hundred ninety-two abstracts were assessed based on screening criteria. From these, 43 records were selected. Four records were identified from the reference lists of the full texts of records.

Finally, a total of 47 full text records were assessed based on the eligibility criteria (see [Supplementary File 4](#)). Twenty two out of 47 records passed the critical appraisal based on eligibility criteria. Thus, they were retained for full text extraction ([Fig. 1](#)). However, retrieved

**Table 1** Characteristics of Included Studies

No	Source [Author Year]	Publication title	Population	Setting	Gender	Age	Design	Country	Reference
1	[AHRQ 2009]	Recommended Initial Core Set of Children's Healthcare Quality Measures for Voluntary Use by Medicaid and CHIP Programs National Healthcare Quality Report 2011	Children health services	Medicaid for poor and CHIP <sup>a</sup>	All	Children	Expert panel	USA	[30]
2	[AHRQ 2012]	National Healthcare Quality Report 2011	Healthcare system	National, national-level comparison	All	All ages	Mixed: Literature review, secondary data analysis, conferences and meetings Literature review	USA	[31]
3	[AHRQ 2014]	The Guide to Clinical Preventive Services 2014	Primary care subsystem	National, national-level comparison	All	Adult	Literature review	USA	[32]
4	[Bar-Zeev 2012]	From hospital to home: The quality and safety of a postnatal discharge system used for remote dwelling Aboriginal mothers and infants in the top end of Australia	Mothers, managers of health center/hospital, hostel manager, travel officer, liaison officer	regional hospital and health centers	Women	Reproductive age	Mixed: Retrospective cohort, key informant interview and participant observation	Australia	[33]
5	[Buckley <i>et al.</i> 2013]	Clinical-Community Relationships Evaluation Roadmap	Primary care subsystem	National, national-level comparison	All	All ages	Mixed: Environmental scan of measures, literature review and expert panel	USA	[34]
6	[Crofts <i>et al.</i> 2014]	Adaptation and implementation of local maternity dashboards in a Zimbabwean hospital to drive clinical improvement	Mothers, neonates	tertiary referral hospital	Women	Reproductive age	Before-after evaluation expert panel	Zimbabwe	[35]
7	[Farrel 1957]	The Measurement of Productive Efficiency	Production units	Organization	All	All	Expert panel	USA	[23]
8	[Handler <i>et al.</i> 2002]	Assessing Capacity and Measuring Performance in Maternal and Child Health	Mothers, children	state and local health agencies	All	Children, adult	Desk review of measures	USA	[36]
9	[Jee and Or 1999]	Health Outcomes in OECD Countries: A Framework of Health Indicators for Outcome-Oriented Policymaking	Health system	National, national-level comparison	All	All ages	Mixed: Expert panel and literature review	OECD Countries	[37]
10	[Jurgutis and Vaimiomaki 2011]	Operational System of Evidence Based and Widely Recognized Quality Indicators for PHC <sup>b</sup> performance Proposal document for discussions with stakeholders	Professionals in primary care	National, national-level comparison	All	All ages	Expert panel	Belarus, Estonia, Latvia, Lithuania, Kaliningrad region of Russia	[38]

Continued

Table 1 Continued.

No	Source [Author Year]	Publication title	Population	Setting	Gender	Age	Design	Country	Reference
11	[Kanani 1998]	Toward Quality of Care in Child Health Programmes: A Challenge for the Partnership in Health and Social Sciences	Primary healthcare	state, Madhya Pradesh	All	Children	Participatory research	India	[39]
12	[Mayberry <i>et al.</i> 2006]	Improving quality and reducing inequities: a challenge in achieving best care	Healthcare system	state, non-profit	All	All	Expert panel	USA	[18]
13	[McGlynn 2008]	Identifying, Categorizing, and Evaluating Health Care Efficiency Measures.	Healthcare system	hospital, nursing home, primary care	All	All ages	Literature review	USA	[40]
14	[OECD 2013]	Health at a Glance 2013: OECD Indicators	Health system	National, national-level comparison	All	All	Literature review	OECD Countries, BRIICS <sup>c</sup>	[41]
15	[OECD 2015]	Health at a Glance 2015: OECD Indicators	Health system	National, national-level comparison	All	All	Literature review	OECD Countries, BRIICS	[15]
16	[Schoen <i>et al.</i> 2006]	U.S. Health System Performance: A National Scorecard	Health system	National, national-level comparison	All	All	Scorecard	USA	[22]
17	[Slater 1999]	Outcomes Research and Community Health Information Systems	Subsystem of health system	Province-level information system	All	All	Conceptual framework	Canada	[42]
18	[Stewart <i>et al.</i> 2007]	Interpersonal Processes of Care Survey: Patient-Reported Measures for Diverse Groups	Adult	General medicine	All	Adult	Cross-sectional study	USA	[43]
19	[Stocking 1991]	Patient's Charter	Healthcare system	Any level of care	All	All	Patient charter	England, Scotland, Wales	[44]
20	[Tarimo 1991]	Toward a Healthy District: Organizing and Managing District Health Systems Based on Primary HealthCare	Subsystem of health system	District	All	All	Book	Low and middle income setting. Formerly developing nations.	[45]
21	[Tollen <i>et al.</i> 2011]	Tracking: A Framework for Understanding Change	Subsystem of health system, organization of physicians	Health management organization, accountable care organization, patient medical home	All	All	Conceptual framework	USA	[17]
22	[WHO 2000]	The World Health Report 2000 Health Systems: Improving Performance	Healthcare system	National, national-level comparison	All	All	Conceptual framework	No specific country/countries	[46]

<sup>a</sup>CHIP, Children's Health Insurance Programs

<sup>b</sup>PHC, Primary health care

<sup>c</sup>BRIICS, Brazil, Russia, India, Indonesia, China, South Africa

**Table 2** Healthcare access and capacity indicators relevant for district healthcare systems in Ethiopia

#	Source [Author year]	Indicator	Description	Level	Information system	Reference
<b>Access indicators</b>						
1	[Schoen <i>et al.</i> 2006]	Access to primary care	Percentage of adults (ages 19–64) with accessible primary care provider (usual source of care for preventive services, new problems, ongoing problems and referral) including during after-hour or weekend access in person, via telephone or email	Regional	Cannot be drawn	[22]
2	[Tarimo 1991]	Availability of primary healthcare	Population per health center	Regional	Regional key performance indicators	[45]
3	[Handler <i>et al.</i> 2002]	Health insurance coverage for children	'Percentage of children without health insurance'	National	Ethiopian Health Insurance Agency	[36]
4	[OECD 2013]	Nurses density	Number of nurses per 1000 population stratified by urban, rural and intermediate regions	National/ Regional	Human resource information system	[41]
<b>Capacity indicators</b>						
1	[Kanani 1998]	Availing essential supplies	Availing adequate essential supplies in primary health facilities according to client flow all the time. Essential supplies include supplies for essential services on reproductive, maternal, neonatal, and child health, tuberculosis treatment, HIV treatment, blood pressure monitoring, plasma glucose monitoring, and cervical cancer screening [47].	Regional	Regional key performance indicators	[39]
2	[Tollen <i>et al.</i> 2011]	Use of peer review and teams	Percentage of health facilities which use peer reviews and teams	District	District key performance indicators	[17]
3	[Kanani 1998]	Support of health facilities	Percentage of health facilities which received support including training and supervision	District	District key performance indicators	[39]
4	[Jurgutis and Vainiomaki 2011]	Satisfaction of professionals	Percentage of health professionals satisfied with their job	Regional	Cannot be drawn	[38]
5	[Tarimo 1991]	Inter-sectoral coordination	Existence of inter-sectoral coordinating bodies in Ministry of Health or Regional Health Offices or District Health Offices	National/ Regional/District	Cannot be drawn	[45]

records were too diverse to allow for a systematic assessment of bias. Thus, the retained records did not undergo risk of bias assessment.

Among the 22 records extracted for synthesis, four were literature reviews, four expert panels, three conceptual frameworks and four mixed formats (a combination of two or more of the aforementioned methods or types) (Table 1).

### Characteristics of experts

Nine experts rated the indicators from the review including seven male and whose age ranging from 28 to 43 (average age of 35.4 years). All of the experts are from public sector, six from academia and three from district health departments. The experts had year of work experience ranging from 4 to 21 (average of 11.7 years).

### Data items extracted from records

We extracted healthcare system indicators of access, capacity, quality, equity, efficiency and outcomes.

### Indicators of performance of healthcare systems

We identified 152 indicators of the elements of the performance of healthcare systems that are potentially relevant at the district level for Ethiopia.

Experts rated 39 (26%) of the initially retrieved indicators as relevant, among these four of 14 for access, five of 16 for capacity, 13 of 56 for quality, two of 11 for equity, one of 10 for efficiency and 14 of 45 for outcomes.

Access indicators mainly referred to access to primary health care, e.g. to the number of adults that have access to primary care. Capacity indicators referred to support given to a health center, e.g. availability of supplies according to client flow all the time for essential services (e.g. reproductive, maternal, neonatal, child health, TB, HIV treatment, etc.). Some of access indicators such as access to primary care cannot be drawn from existing information systems in the district (Table 2).

Quality indicators relevant for groups with different healthcare needs according to age and sex were identified. Among these were the vaccination of children, HIV treatment among adults and ANC

**Table 3** Healthcare quality indicators relevant for district healthcare systems in Ethiopia which are applicable at the district level of the health system

#	Source [Author year]	Indicator	Element of quality of healthcare system	Age <sup>a</sup>	Description	Information system	Reference
1	[AHRQ 2012]	Rate of completion of recommended vaccinations	Effectiveness	Children	Completion rate of 'diphtheria-tetanus-pertussis vaccine, polio vaccine, measles-mumps-rubella vaccine, Haemophilus influenza type B vaccine, hepatitis B vaccine, varicella vaccine, and pneumococcal conjugate vaccine' by age 19–35 months	Expanded program of immunization registration	[31]
2	[AHRQ 2012]	HIV-positive individuals receiving HAART	Effectiveness	Adults	Percentage of HIV positive adults receiving HAART	Tuberculosis registration book	[31]
3	[Jurgutis and Vaimiomaki 2011]	Tuberculosis (TB) treatment rate	Effectiveness	Children and adults	Percentage of patients with TB on anti-TB treatment of Directly Observed Therapy	Tuberculosis registration book	[38]
4	[AHRQ 2012]	Rate of completion of TB therapy	Effectiveness	Children and adults	Percentage of patients on TB treatment who completed treatment	Tuberculosis registration book	[31]
5	[AHRQ 2014]	High Blood Pressure screening	Effectiveness	Adults	Percentage of adults screened for high blood pressure	Cannot be drawn	[32]
6	[AHRQ 2014]	Diabetes mellitus screening	Effectiveness	Adults	Percentage of adults screened for diabetes mellitus	Cannot be drawn	[32]
7	[Jurgutis and Vaimiomaki 2011, Tarimo 1991]	Rate of ANC checkup	Effectiveness	Pregnant women	Percentage of pregnant women with at least one ANC checkup during the last pregnancy	DHIS	[38, 45]
8	[AHRQ 2009]	Average frequency of ANC	Effectiveness	Pregnant women	Average frequency of ANC checkup among women who received at least one ANC check up	DHIS	[30]
9	[AHRQ 2014]	Rate of HIV infection screening	Effectiveness	Pregnant women	Percentage of pregnant women screened for HIV during ANC	DHIS	[32]
10	[AHRQ 2014]	Rate of gestational diabetes mellitus screening	Effectiveness	Pregnant women	Percentage of pregnant women screened for gestational diabetes mellitus	Cannot be drawn	[32]
11	[Tarimo 1991]	Percentage of women with skilled delivery care	Effectiveness	Pregnant women	Percentage of pregnant women who received skilled delivery care during the last pregnancy	DHIS	[45]
12	[Crofts <i>et al.</i> 2014, AHRQ 2012]	Rate of third or fourth degree perineal tear	Safety	Postpartum women	'Percentage of women with a third or fourth degree perineal tear' after delivery	Cannot be drawn	[31, 35]
13	[Smith 2009, WHO 2000, AHRQ 2012]	Rate of report of good communication with providers	Patient centeredness	All	Percentage of patients who reported that doctor-always listened, explained, showed respect, and spent enough time	Cannot be drawn	[19, 31, 46]

<sup>a</sup> Infant = 0–1 year olds, children = 1–12 year olds, adolescent = 13–17 year olds, teenagers = 15–17 year olds



**Table 4** Health system outcome indicators relevant for district healthcare systems in Ethiopia

#	Source [Author year]	Indicator	Description	Level	Information system	Reference
1	[AHRQ 2009, OECD 2002, Handler <i>et al.</i> 2002]	Teenage pregnancy	Rate of birth for teenagers, 15–17 year old	District	Cannot be drawn	[12, 30, 36]
2	[Handler <i>et al.</i> 2002]	Rate of very low birth weight	Percentage of live births weighing < 1500 grams	District	Cannot be drawn	[36]
3	[Crofts <i>et al.</i> 2014]	Rate of post-partum hemorrhage	Percentage of women with bleeding after birth of > 500 mL	District	Cannot be drawn	[35]
4	[Jee and Or 1999, Kanani 1998]	Acute watery diarrhea	Annual incidence of diarrhea in children	National/Regional/ District	DHIS	[37, 39]
5	[Jee and Or 1999, Kanani 1998]	Malnutrition	Annual incidence of wasting in children	National/Regional/ District	DHIS	[37, 39]
6	[Kanani 1998]	Micronutrient (iodine, iron, vitamin A) deficiency	Average of the deficiency rates of iodine, iron, and vitamin A in children	National/Regional/ District	Cannot be drawn	[39]
7	[Smith 2009]	Incidence of measles	New cases of measles per 100 000 population	National/Regional/ District	Public health emergency management report	[19]
8	[Tarimo 1991]	Annual incidence of tuberculosis in all ages	New cases of tuberculosis per 1000 population	National/Regional/ District	DHIS	[45]
9	[AHRQ 2012, Jee and Or 1999, Tarimo 1991]	Maternal Mortality Ratio (MMR)	Maternal deaths per 100, 000 live births	National/Regional/ District	Maternal Death Surveillance Report	[31, 37, 45]
10	[Jurgutis and Väimiomaki 2011, OECD 2002]	Rate of stillbirths	Percentage of still births among total births	National/Regional/ District	DHIS	[12, 38]
11	[Handler <i>et al.</i> 2002]	Neonatal mortality rate	Deaths from birth to 28 days of life per 1000 live births	National/Regional/ District	DHIS	[36]
12	[Handler <i>et al.</i> 2002]	Post-neonatal mortality rate	Deaths after 28 days of life and before one year per 1000 live births	National/Regional/ District	Cannot be drawn	[36]
13	[Handler <i>et al.</i> 2002]	Perinatal mortality rates	Deaths from 28 weeks of gestation to 7 days of neonatal life per 1000 live births	National/Regional/ District	DHIS	[36]
14	[AHRQ 2012, Jee and Or 1999, Kanani 1998, OECD 2002, Smith 2009, Handler <i>et al.</i> 2002, Tarimo 1991]	Infant mortality rate	Deaths from birth to 1 year of life per 1000 live births	National/Regional/ District	Cannot be drawn	[12, 19, 31, 36, 37, 39, 45]

among women. Even though most of the quality indicators could be drawn from DHIS, a few indicators such as the percentage of adults screened for hypertension could not be drawn from the information systems in districts (Table 3).

Two equity and one efficiency indicators were found to be relevant. The relevant equity indicators were equity in health status [12, 15] and inequity in infant mortality [22], and technical efficiency was the relevant efficiency indicator [23].

Few indicators of health system outcomes were found to be relevant for district healthcare system in Ethiopia. Half of these outcome indicators could be drawn from the existing information systems in districts. For example, information on percentage of children who are wasted can be drawn from DHIS (Table 4).

## Discussion

Based on a systematic review and expert opinion, we could retrieve 39 performance indicators relevant for district healthcare systems in Ethiopia. Arguably, this is the first time that a comprehensive attempt was made to identify a pragmatic set of indicators that would work in a low-income healthcare setting.

Most of the identified indicators were related to the quality and outcomes of healthcare. This is in line with current literature. For example, Ham and others [24] identified mainly the quality indicators of performance for local health systems in the UK.

Among them, the indicators found to be relevant are access to primary healthcare, completion of recommended vaccinations, treatment of HIV and TB, screening of diabetes mellitus, malnutrition and infant mortality. These indicators are most relevant because of their relation with health policy priorities, magnitude of the problems addressed by the indicators, and the impact of the interventions to tackle them.

The retained indicators are highly related with national and district-level priority health objectives. For example, access indicators such as the density of nurses as well as outcome indicators such as rates of malnutrition align with national policy priorities of develop adequate human resources for health, and addressing malnutrition, respectively. Moreover, indicators including on the availability of primary care are related with regional roles of ensuring the provision of health services. Furthermore, districts are largely concerned with the direct provision of healthcare and that quality indicators such as percentage of HIV-positive individuals receiving highly active anti-retroviral therapy (HAART) are directly applicable as performance indicators in districts.

Access to primary healthcare is a relevant indicator because primary healthcare has constantly been identified as a major strategy toward universal healthcare [25]. Primary healthcare in Ethiopia is provided by health centers [26]. Thus, support of health facilities by district health offices as an indicator is essential.

Specifically for Ethiopia, but also for other low-income countries, completion of recommended vaccinations and treatment of HIV and TB are of utmost relevance. In Ethiopia, lower respiratory infection, diarrhea, HIV and TB infection are the main causes of years of life lost [27].

In Ethiopia, a third of the disease burden is due to non-communicable diseases, such as cardiovascular diseases, cancer, mental and substance use disorders, and diabetes which, respectively, are the second, sixth, seventh and ninth leading causes of premature death [28]. Therefore, indicators for screening for major non-communicable diseases could be used for monitoring the impact of complex public health interventions to disease control.

Malnutrition-related indicators are relevant for monitoring the major public health problem, malnutrition in Ethiopia. In Ethiopia, stunting affects 38% of under five children, and 57% of children age 6–59 months are anemic [29].

Likewise, inequity in infant mortality should be monitored because it is the most valid measure of the impact of district healthcare system and other systems on mortality.

Even though it is feasible to derive most of the indicators from the information systems in districts, there are also indicators which cannot be drawn. For example, outcome indicators such as infant mortality rate would not be derivable from existing information systems in districts. Thus, additional means of surveillance would be needed to establish these indicators.

The major strength of our study is the inclusion of local stakeholders for local relevance, yielding a small set of indicators useful in the Ethiopian context. Inclusion of different types of reports, ranging from conceptual frameworks to epidemiologic research, and data extraction carried out by two local health care research experts in the field are additional strengths of our review.

This review is limited insofar as only the qualitative relevance of the indicators for Ethiopia setting could be considered. Even though evidence for validity of the indicators for the health district setting in Ethiopia is lacking, we are confident that indicators that are published will have some kind of validity. We also trust in our experts' opinion. Another limitation may be that we only considered English language records. We may have missed relevant indicators published in other languages. However, based on current experience with published literature, the most relevant findings may indeed be available in English.

## Conclusions

Decision-makers in Ethiopia and elsewhere could measure the performance of healthcare systems with multiple relevant indicators including access to primary healthcare and infant mortality. Further empirical studies are needed on the validity of the performance indicators that were identified by this study for a low-income setting such as Ethiopia.

## Supplementary material

Supplementary material is available at *INTQHC Journal* online.

## Acknowledgements

We would like to acknowledge the German Ministry for Economic Cooperation and Development through the German Academic Exchange Service (DAAD) and its EXCEED program for providing travel grant and supporting EAY during his stay in Munich, Germany.

## Conflict of Interest

We declare that we have no financial or other conflict of interest with either individuals or organizations.

## Funding

This work was supported by Pears IMPH Seed-Grant Program to Promote Public Health Research which is the result of a continuing partnership between the Hebrew University of Jerusalem-Hadassah, Jerusalem, Israel and the Pears Foundation [grant number: not applicable].

## Authors' contributions

E.A.Y., D.H.M., D.K., G.F. and E.G. contributed for the initiation, design and execution of the study. M.W. contributed for the design and execution of the study. E.A.Y. drafted the manuscript. M.W., D.H.M., D.K., G.F. and E.G. contributed for the improvement of the draft. All authors read and approved the final draft.

## Availability of data and material

Critical appraisal of records and data extracted from records is available on request.

## Ethics approval and consent to participate

This study is approved by the Institutional Review Board (IRB) of Jimma University Institute of Health (formerly College of Health Sciences, Jimma University), Ethiopia and the Ethics Board of the Medical Center of Ludwig-Maximilians-Universität München (LMU), Germany.

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