



Out of the
Institute for Medical Data Processing, Biometry and Epidemiology

**Developing and Validating a Multi-Dimensional Instrument for
Measuring the Performance of District Health Systems in a National
Region in Ethiopia**

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Abstract

Background: Despite being the main vehicles of primary healthcare provision in Ethiopia, district health systems lack comprehensive set of valid performance indicators that are both process and outcome oriented. Therefore, we aimed to develop and validate a set of performance indicators for district health systems of Oromia Region, Ethiopia.

Methods: We used a sequential mixed-methods design. During development stage, we employed a qualitative interview study in Oromia Region, Ethiopia. We transcribed, did in vivo coding and inductive analysis of the interviews. Moreover, we conducted a narrative systematic review. Records on performance of health systems were appraised and synthesized. Then, during the validation stage, we supplied the indicators generated from the previous two studies to experts in the field of health systems as part of a Delphi study. In the Delphi study, experts voted on the inclusion- or exclusion- of indicators in three stages.

Results: Eleven functions of district health systems emerged from the interviews including: creating capacity of health centers for the provision of health care; and provision of comprehensive health care for communicable diseases and maternal health conditions, among others. Furthermore, 59 out of 238 indicators generated by the interviews and the systematic review were found to be valid by experts. Among these, 40 were found to be able to be drawn from the information systems in the districts. The indicators addressed multiple dimensions of performance of district health systems, such as capacity,

quality, and outcomes. Among valid and feasible indicators were rate of utilization of family planning methods, and tuberculosis cases per 1000 people.

Conclusion: Policy makers can use the valid indicators to monitor national policy priority areas like the expansion of family planning services. Moreover, the indicators can be used in the districts for local decision making, for example, to identify poorly performing functions and take corrective action.

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Acronyms and Abbreviations

AIDS: Acquired Immuno-Deficiency Syndrome

ANC: Antenatal Care

DAAD: German Academic Exchange Service

EAY: Elias Ali Yesuf

HEWs: Health Extension Workers

HIV: Human Immune-Deficiency Virus

HRPGC: Health Research and Postgraduate Council

IMPH: International Master of Public Health

LMICs: Low- and Middle-Income Countries

OECD: Organization for Economic Cooperation and Development

PhD: Doctor of Philosophy

TB: Tuberculosis

WHO: World Health Organization

YLL: Years of Life Lost

1. Introduction

1.1. Rationale

All individuals and organizations whose primary aim is to improve or maintain the health of individuals and populations form health systems (1). According to van Olmen et al., health systems have 10 related elements, “1) goals and outcomes; 2) values and principles; 3) service delivery; 4) the population; 5) the context; 6) leadership and governance; and 7-10) the organization of resources (finances, human resources, infrastructure and supplies, knowledge and information)”(2). Healthcare systems are more narrow with fewer elements (3). Health service delivery is the core of both health systems and healthcare systems.

District health systems are sub-national health systems with direct contact with populations (4). Typically, in low-income countries they provide the primary healthcare (5) locally and in a cost-efficient way.

Due to various reasons, but mainly their location in the periphery of a country, district health systems face challenges including poor quality health care (6). In Low-and Middle-Income Countries (LMICs), poor quality health care is estimated to be responsible for five million annual deaths (7). It also contributes to under-utilization of health care (8). Consequently, 3.6 million annual deaths occur due to non-utilization of health care (7).

Depending on the local situation, district health systems suffer from poor access to health care (9), shortage of electricity and water supply, inadequate human resources, inadequate medical equipment and drug, incomplete and patchy information systems (10), poor demand for healthcare, and poor skills in tracking functions and measuring the performance of the system and its elements.

Therefore, the measurement of performance of district health systems represents a means of health system strengthening. Performance management helps to improve quality and utilization of health care if appropriate and valid measures are used. For example, in Rwanda the number of mothers who used health centers to give birth increased after the implementation of performance measures and incentives for health centers tied with better performance (11).

Typically, performance measures are derived from the respective functions of health systems (12). Efforts were made in the Americas, Eastern Mediterranean Region, and Western Pacific Region of the World Health Organization (WHO) to formally describe functions of health systems (13–15).

There have been several attempts to also establish performance measurement of health systems in low-income countries. For example, District League Tables, the Balanced Score Card, and the set of National Indicators have been applied in Uganda, Afghanistan, and Ethiopia, respectively (16–18).

As a limitation, performance measures tend to be process oriented like in Ethiopia (e.g. number of deliveries in health facilities) with little or no focus on the outcomes of the processes (18). Moreover, the validity of the performance measures has not been tested in the Ethiopian example to this point.

Therefore, we set out to develop and validate a set of relevant performance indicators for district health systems taking Oromia Region, Ethiopia, as a case in point.

1.2. Description of the District Health System in Ethiopia

Service delivery in the targeted district—commonly called *woreda* in Ethiopia—health system encompasses networks of district health offices, health centers, health posts, and community health volunteers. Women development teams in Ethiopia are community health volunteers formed by women of child bearing age. They are trained by Health Extension Workers (HEWs). These are health workers who completed grade 10 in the Ethiopian education system and received an additional one year training on the Health Extension Program which includes environmental as well as maternal and child health components. Women development teams meet every week and discuss health issues of their members and benefit from mutual peer support. They refer health issues beyond their capacity to HEWs. ‘One-to-five formations’ are organized under women development teams.

One-to-five formations are teams with five women members with one team leader. They are in charge of supporting each other in utilizing family planning methods, educating each other on maternal and child health issues, and hygiene of their neighborhood.

We have developed a model of district health systems in Ethiopia based on documents from Oromia Region and the Federal Ministry of Health of Ethiopia (19,20). See figure 1.1 for a model of district health systems in Ethiopia.

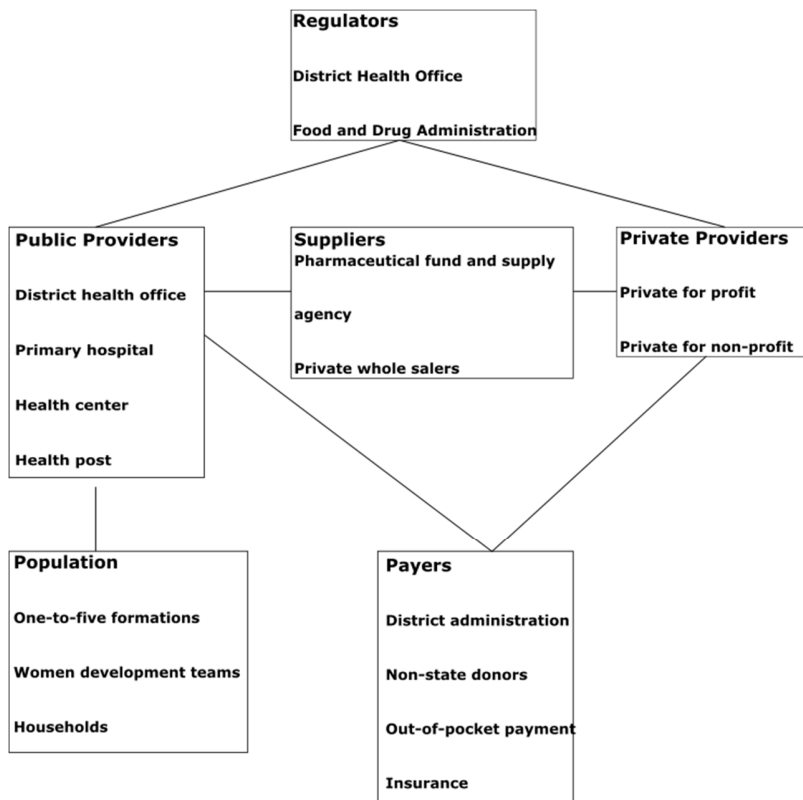


Figure 1.1: A model of district health systems in Ethiopia

1.3. Performance of Health Systems

Performance of health systems is the attainment of multiple goals under consideration of available resources and the distribution of those goals among different socioeconomic groups (1). It has access, capacity and quality dimensions that lead to better outcomes and equity (21,22). Outcomes are affected by health services, demographic, social, and life style factors. See figure 1.2 for a model of dimensions of health system performance we developed building on the concepts of the WHO and Organization for Economic Cooperation and Development (OECD).

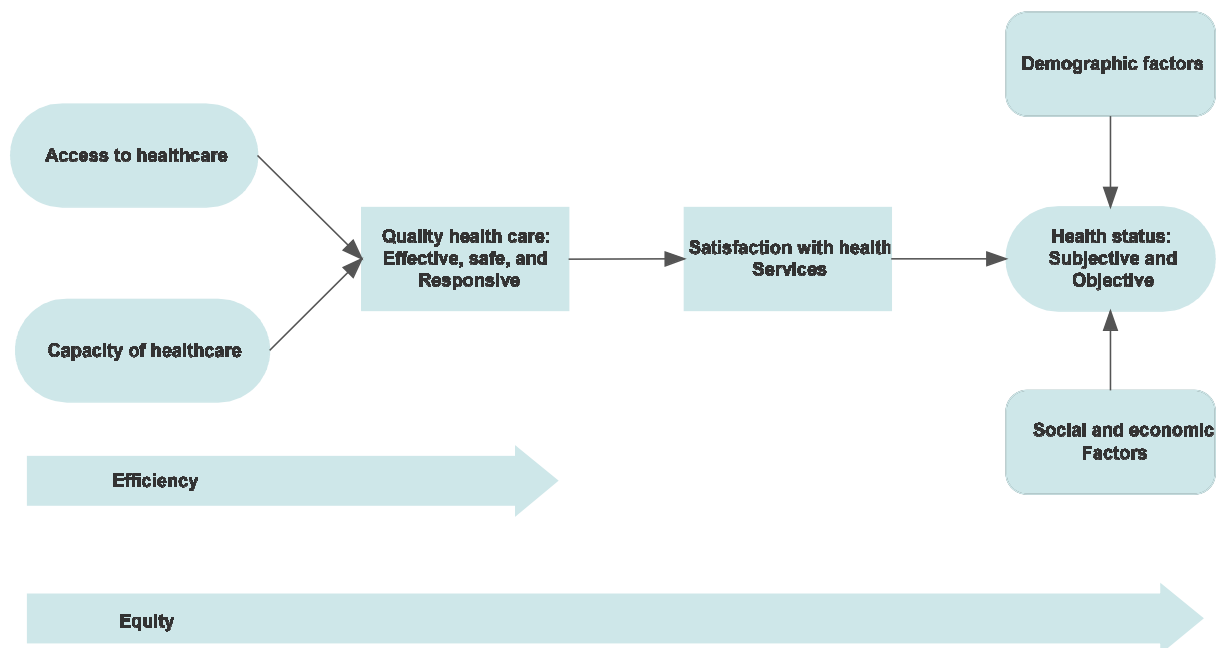


Figure 1.2: Dimensions of health system performance (21,22)

2. Research Objectives and Purpose

2.1. Research Objectives

The objectives of the Doctor of Philosophy (PhD) project were

- To identify essential functions of public district health systems in Ethiopia (23);
- To identify relevant indicators for measuring the performance of public district health systems in Ethiopia;
- To determine face and content validity of the prospective performance measurement instrument for public district health systems (24); and
- To explore the feasibility of deriving indicators from the elements of public district health systems, and other sources.

2.2. Purpose

The purpose of the PhD project was to provide an instrument for performance monitoring of district health systems to identify and maintain strengths, and document and improve weaknesses.

3. Methods

We used a sequential mixed-methods design. A qualitative interview study and narrative systematic review followed by quantitative Delphi method were employed.

The target population of the project was public sector health service providers and a section of users in district health systems of Oromia Region, Ethiopia, which is the largest region by geographic and population size in Ethiopia. They were targeted because of their abundance and proximity to the functions of primary care delivery.

The project was executed in two phases. Phase one and two were development phase and validation phase, respectively and are described in Publication I (Yesuf, E. A., Grill, E., Fröschl, G., Koller, D., & Haile-Mariam, D. (2019). Administrators , health service providers , and consumers perspectives of functions of district health - care systems in Oromia region , Ethiopia : A qualitative study. *International Journal of Health Planning and Management*, 34, 836–850. <https://doi.org/10.1002/hpm.2742>) and Publication II (Yesuf, E. A., Grill, E., Fröschl, G., Haile-mariam, D., & Koller, D. (2019). Face and Content Validity of a Prospective Multi-dimensional Performance Instrument for Service Delivery in District Health Systems in Low-income Countries : A Delphi Study. *International Health*, Volume 12, Issue 3, May 2020, Pages 184–191, <https://doi.org/10.1093/inthealth/ihz064>)

3.1. Methods Used in Publication I

The first publication was about the development of a prospective instrument. It was marked by identification of the functions of district health systems and potential performance indicators for those functions.

Two research designs, namely, a qualitative interview study and a narrative systematic review were employed during the development of the prospective instrument. The qualitative interview study was implemented according to the processes for grounded theory as stipulated by Rance (25).

District administrators, health service providers, and consumers in Oromia Region of Ethiopia were the study population of the qualitative interview study.

Participants of the qualitative interview study were sampled from agrarian, semi-agrarian, and pastoral areas of Oromia Region. Administrators (district administrators, and heads of district health offices); health service providers (chief executive officers of primary hospitals, heads of health centers, health officers, nurses, midwives, and health extension workers); and women development team leaders as one of service recipients – because they consume health promotion from HEWs and use maternal and child health services of health posts and centers – were purposively selected. The criterion for purposive selection was the assumption that they will be knowledgeable on functions and performance measures of public district health systems because of their workplace proximity.

Data for the qualitative interview study were collected using open ended questions in an in-depth interview guide informed by Essential Public Health Functions of the Pan-American Health Organization (13). Moreover, a desk review of documents was done to supplement the in-depth interview findings.

Qualitative interview study data were collected using face-to-face interviews. Moreover, data were extracted from documents. Activities of elements of service providers in district health systems were extracted from documents in a form of text (19,26,27).

An inductive analysis of the interviews was executed. Elias Ali Yesuf (EAY) did in-vivo coding of interview data. First activities were identified. Then, related activities were grouped together into categories and that a group of categories formed functions of district health systems. Moreover, indicators were abstracted from interviews and documents.

Databases searched for the systematic review included the Public Library of Medicine of the United States of America, Agency for Healthcare Research and Quality of the same country, OECD's Library, and Google scholar.

Evaluation studies, observational studies, case studies, and reports of organizations published between 1990 and 2015 were the records sought for the systematic review.

Observational studies were assessed for selection bias, confounding, and publication bias. Case studies and reports were assessed for the credibility of their source, logic of the arguments, and support of the opinion by literature, among others.

Data were extracted from studies which passed the appraisal. The extracted data were performance indicators potentially relevant for district health systems in low-income settings like Ethiopia.

Extracted data were synthesized in a narrative text.

3.2. Methods Used in Publication II

Publication II is about validation of the prospective instrument. Indicators derived from the qualitative interview study and the systematic review were used to formulate a background paper which was used as a basis for the Delphi method. This method is a consensus method with commonly two or more stages and is applied to research questions which are relatively new (28). It can either be face-to-face, mail based, or online based on the cost of the study (for example, face-to-face Delphi studies tend to be costly) and the requirement for anonymity of opinions (28).

A panel of experts was selected purposively to participate in the Delphi method. They were recruited via email. An expert was a person who either authored a paper on performance of district health systems in LMICs, worked in those systems, or was referred by another expert. We did not calculate panel size given that the target population of experts from which a panel was going to be drawn was unknown.

Three stages of the Delphi method were employed. In stage one experts voted (yes vs. no) whether an indicator falls into a broader construct of performance of district health system.

Both during stage one and two, participants were asked to suggest indicators and comment on individual indicators.

Indicators retained during stage one and two, and suggested in the process were rated during stage three on a five point Likert scale. Moreover, the panel also rated on the overall completeness of the set of indicators as measurement of performance of district health systems.

During stage one, indicators which scored more than 75% of the votes were included for stage three. Indicators which scored at least 40% of the votes and at most 75% of the votes underwent a revote in stage two. Indicators with less than 40% of the votes were excluded (29).

During stage two, indicators which scored at least 50% of the votes were retained (29).

Indicators which scored a weighted mean of at least 3.8 (30) during stage three were retained.

Comments from each stage were addressed based on their relevance for the research question.

The feasibility of the final list of indicators found to be valid was then tested in one of the districts in Oromia Region. Interviews with heads of district health office, head of health center and HEWs were done in Jimma zone of Oromia region in Dedo District, Sheki Health Center, and Waro Kolobo Health Post, respectively, all located in Ethiopia.

3.3. Ethical considerations

The project was approved by the Ethics Commission of Ludwig-Maximilians-Universität München (Projekt Nr: 708-16) and Institutional Review Board of Jimma University (HRPGC/40130/2016). Participants provided informed written consent. Data were presented in an aggregate form and identity of participants was converted into codes to anonymize data.

4. Results

4.1. Results of Publication I

The qualitative interview study highlighted functions of public service providers in district health systems. We identified 11 functions of public service providers of district health systems. These were “...creating capacity of health centers and health professionals for the provision of health care; creating access for the provision of health care; ensuring equitable access to health care; regulation of private healthcare providers; disaster preparedness; monitoring risk factors and diseases in the district; provision of health promotive, preventive, and curative health care for communicable diseases and maternal health conditions; monitoring intermediate outcomes of care; developing capacity of health post and villagers toward demand creation for health care; provision of maternal and child health services; and helping health posts in reaching mothers and sick individuals.”

The functions were the basis for developing performance measures. Then, the systematic review together with the qualitative interview study produced 238 performance indicators which were used as a starting point for the Delphi study.

4.2. Results of Publication II

The Delphi study highlighted the face and content validity of the performance measures which were mostly related to capacity-, quality-, and outcome-dimensions of performance. 59 out of 238 indicators were found to have face value by Delphi study participants.

Feasibility of drawing valid performance indicators was also checked (to date not yet published). 40 out of 59 valid indicators were found to be feasible. Five out of 10 valid indicators of district health offices can be drawn directly from information systems in the district. 21 out of 31 indicators could be drawn from information systems or logbooks in health centers. Two out of four indicators could be drawn from health post records. Nine out of 14 outcome indicators could be drawn from district records.

Examples of indicators related to creating capacity were percentage of health centers provided with essential drugs and percentage of health centers which received supervision. Examples of indicators related to provision of promotive, preventive and curative services were the percentage of women receiving family planning services and percentage of pregnant women attending antenatal care.

See table 4.1 for relevant, valid, and feasible performance measures related with the functions of creating capacity, provision of quality health care, and monitoring diseases and risk factors organized by level of service providers in district health systems.

Table 4.1: List of relevant, valid, and feasible indicators for measuring the performance of service delivery in district health systems by function and data sources of Oromia Region, Ethiopia, 2019

Functions	Indicators	Data source	Level
Creating capacity of health centers and health professionals for the provision of health care	Making available of essential drugs such as for the treatment of malaria	Key performance indicators of the district	District health office
	Percentage of health centers which received support including training and supervision	District management standard	
Creating access for the provision of health care	Health officer density per 1000 population	Human resource information system	
Provision of health promotive, preventive, and curative health care for communicable diseases	Percentage of households in high risk communities sprayed with Indoor Residential Spraying	Malaria routine report database	
Monitoring risk factors and diseases in the district	Annual tuberculosis detection rate in the district	District Health Information System	
Creating capacity of health centers and health professionals for the provision of health care	Health center developed checklist to assess services quality	Key performance indicators	Health center
Provision of health promotive, preventive, and curative health care for communicable diseases	Percentage of non-pregnant women who needed family planning services and taking at least one method	District Health Information System	
	Percentage of pregnant women with at least one antenatal care check-up during the last pregnancy	District Health Information System	
	Percentage of pregnant women screened for iron deficiency anemia during the last pregnancy	Health center laboratory logbook	
	Percentage of pregnant women with HIV/ AIDS who received treatment	District Health Information System	
	Percentage of children who completed by age 2 of pentavalent vaccine –combination of diphtheria, pertussis, tetanus, hemophilus influenza type B, and hepatitis B	Expanded program of immunization registration	
Creating capacity of health centers and health professionals for the provision of health care	Percentage of pregnant women in a village registered by health post	Pregnant women registration book	Health post
	Percentage of households in a village which received education on bed net utilization	Health extension worker field book	

Examples of district health system outcome indicators applicable to all levels of health service delivery were rate of consistent toilet utilization and tuberculosis cases per 1000 people. See table 4.2.

Table 4.2: List of relevant, valid, and feasible indicators on outcomes of service delivery in district health systems and other social systems and data sources in Oromia Region, Ethiopia, 2019

Outcome indicator	Data source
Rate of consistent toilet utilization	Routine environmental health report
Regular bed net utilization rate	Malaria routine report
Measles cases per 100,000 population	Public health emergency management report
Tuberculosis cases per 1000 population	District Health Information System
Perinatal mortality rate	District Health Information System
Rate of still births	District Health Information System
Neonatal mortality rate	District Health Information System
Maternal Mortality Ratio	Maternal Death Surveillance Report
Percentage of pregnant women who received antenatal care: Urban vs. rural	Further analysis in District Health Information System

5. Discussion

We synthesized eleven functions of district health systems in Oromia Region of Ethiopia including creating capacity for the provision of health care, provision of quality health services, and monitoring risks and diseases. We also identified 40 relevant, valid, and feasible performance indicators related with the functions. Most of the indicators, such as antenatal care utilization and monitoring tuberculosis are in line with the WHO reference lists of 100 core indicators (31).

The indicators are important in helping to solve challenges faced by district health offices and health centers in improving capacity for health service delivery and meeting quality expectations. They can also be used as a vehicle to implement national health policies of Ethiopia because they are instruments for performance monitoring and improvement. Moreover, they could help to track diseases with high burden in Ethiopia.

In accordance with findings from other studies, the lack of essential drugs (32) and low capacity to provide health services (33) were two of the major challenges faced by health centers also in our study. District health offices can use indicators from our study related to availing essential drugs and support of health facilities to tackle these challenges.

Quality indicators identified by our study, such as women needing family planning services and taking at least one method (24) can be a vehicle to monitor the implementation of national policy of expanding family planning services in districts. Furthermore, maternal health service utilization

indicators like antenatal care utilization may also be a vehicle for monitoring implementation of maternal and child health policy which prescribes improving maternal health care utilization as an intervention to reduce maternal mortality (6).

Children could also potentially benefit from the indicators identified by our study. For example through the indicator “percentage of children who completed pentavalent vaccination” (24) as vaccines are effective in preventing major childhood illnesses.

Based on expert opinion, registration of pregnant women by HEWs emerged as a valid and feasible indicator in our study. It is related with one of the woreda transformation agenda which is using data for decision making (6).

Lastly, outcome indicators such as consistent toilet utilization, tuberculosis cases per 1000 people, and perinatal mortality rate are related to the disease burden in Ethiopia. According to the Global Burden of Disease study, diarrhea and tuberculosis respectively are the second and the fourth leading causes of Potential Years of Life Lost (YLL) (34). A third of diarrhea cases could be prevented by hand washing promotion with provision of soap including during before and after toilet utilization (35). Moreover, fifth, sixth, and eighth leading causes of YLL in Ethiopia are due to preterm birth, encephalitis, and sepsis (34) that occur during the perinatal period.

Nevertheless, drawing the indicators from existing data sources may be constrained by the limited accuracy and timeliness of the data collected (36).

Using a range of methods and data sources are the strengths of our study. Furthermore, the inclusion of both process and outcome measures of performance of district health systems corroborates our conclusions.

Our study is limited by the fact that we measured face and content value of the indicators, not criterion validity. Criterion validity measures the importance of an indicator e.g. in predicting mortality in populations. Moreover, our study is limited by the low response rate of the Delphi study which is less than the expected response rate in Delphi studies of about 30% (37).

6. Conclusion

Policy makers and managers can use the eleven functions of district health systems and the related 40 performance indicators for continuous assessment of performance of district health systems on national and sub-national priority areas like expansion of family planning services. Moreover, the indicators can be a useful tool for decision makers at the district level to identify and improve weak functions by using performance measures. The indicators should be used together with improving data timeliness and accuracy.

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8. Annex

8.1. List of Publication

Publication I: Yesuf, E. A., Grill, E., Fröschl, G., Koller, D., & Haile-Mariam, D. (2019). Administrators , health service providers , and consumers perspectives of functions of district health - care systems in Oromia region , Ethiopia : A qualitative study. *International Journal of Health Planning and Management*, 34, 836–850. <https://doi.org/10.1002/hpm.2742>

Publication II: Yesuf, E. A., Grill, E., Fröschl, G., Haile-mariam, D., & Koller, D. (2019). Face and Content Validity of a Prospective Multi-dimensional Performance Instrument for Service Delivery in District Health Systems in Low-income Countries : A Delphi Study. *International Health, Volume 12, Issue 3, May 2020, Pages 184–191*, <https://doi.org/10.1093/inthealth/ihz064>

8.2. Statement on Pre-release and Contribution

In the qualitative interview study (publication I)

I was responsible for the conception of the study, designed data collection tools, participated in data collection, did coding and analysis of data, drafted the manuscript, and was in charge of correspondence with the journals and reviewers.

In the Delphi study (publication II)

I was responsible for the conception of the study, designed data collection tools, designed online survey platform, did data analysis, drafted the manuscript, and was in charge of correspondence with the reviewers.

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RESEARCH ARTICLE

Administrators, health service providers, and consumers perspectives of functions of district health-care systems in Oromia region, Ethiopia: A qualitative study

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Summary

The practice of functions of district health-care systems in Ethiopia is not clear. The aim of this study was to investigate the perspectives of administrators, health service providers, and health-care consumers regarding functions of district health-care systems as currently practiced.

Grounded theory approach was applied using interviews and desk review of documents. This study was set up in Oromia National Regional State, Ethiopia. Inductive analysis of interviews was done. Interviews and document reviews were mirrored.

Eleven functions of district health-care systems emerged in this study organized by level with relationships and commonality of few activities. The 11 functions of district health-care systems were creating capacity of health centers and health professionals for the provision of health care; creating access for the provision of health care; ensuring equitable access to health care; regulation of private health-care providers; disaster preparedness; monitoring risk factors and diseases in the district; provision of health promotive, preventive, and curative health care for communicable diseases and maternal health conditions; monitoring intermediate outcomes of care; developing capacity of health post and village health workers toward demand creation for health care; provision of maternal and child health services; and helping health posts in reaching mothers and sick individuals.

KEYWORDS

district, Ethiopia, function, health-care system, perspectives

1 | BACKGROUND

Understanding district health-care system, health service providers' perspectives of their public health and clinical functions is important to clarify roles, to identify areas of strength and improvement, and to measure performance of the functions.

By the end of the 20th century and the beginning of 21st century, there was a movement in the Americas to transform public health. The Institute of Medicine (IOM) of the United States of America (USA) defined three core functions of public health: assessment, policy development, and assurance.¹ Subsequently, in Latin America and the Caribbean Essential Public Health Functions (EPHFs) were described by the Pan-American Health Organization (PAHO).² This trend continued in other areas of the world.

Different regions of the World Health Organization tried to conceptualize public health functions. In the Eastern Mediterranean Region of the World Health Organization, efforts to understand the public health function of health systems at the national level were undertaken. Eight essential public health functions were identified, namely governance, workforce, communication, research, surveillance, preparedness, protection, and promotion.³ Moreover, countries in the Western Pacific Region, such as Fiji, Malaysia, and Vietnam, made effort to define essential public health functions.⁴ However, efforts on understanding perspectives of workers in district health systems regarding function are rare.

A study from Nepal used in-depth interviews and focus groups to explore key functions of district health systems and identified that planning takes place in district health offices, public health centers do health education, and provision of immunization and sexual and reproductive health services. But, district health offices have no adequate incentives for health professionals, and health centers do not have the capacity for provision of noncommunicable disease services.⁵

Top-down approaches to define functions of health systems were commonly applied. IOM's core functions of public health and PAHO's EPHFs were defined by expert panels with little input from local providers and consumers.^{1,2} This may reduce successful implementation of key interventions at the local level.⁶ On the other hand, bottom-up approaches based on needs of communities and providers were reported to improve effectiveness of care.⁷

Ethiopia envisions providing universal health care by 2035.⁸ District health-care systems are at the center of this drive. The functions of the different elements of district health-care systems are defined.⁹ However, there is no study on health worker perspectives and practices on their functions, how the functions are overlapped and interrelated.

This study is part of a larger project aimed at developing and validating a set of performance indicators for district health-care systems in Ethiopia. The aim of this study was to investigate the needs, views, and opinions of health-care administrators, providers, and consumers, regarding functions of district health-care systems as currently practiced.

1.1 | Organization of the district health-care system in Ethiopia

The elements of district health-care system in Ethiopia include regulators, suppliers, public providers mainly health centers and health posts, private providers, payers, and population. The district health office directly controls the public providers (for example, health centers and health posts) and regulates both public and private providers. Moreover, it pays for health care of the persons in the district who are not able to pay. These are persons whose income is

entirely spent for buying food for themselves and their families, if they have one, and persons with no income at all and no one to support them.

Ethiopia introduced a Health Extension Program (HEP), which comprises 16 packages including family planning, maternal health, and environmental health, among others.¹⁰ Various stakeholders are positioned to take part in the implementation of the packages in kebeles, the lowest administrative unit in the state's hierarchical structure. Health posts are health facilities that are the first point of contact between district health-care system and the population and placed in a kebele. In each of the health posts, two women who completed at least 10 years of formal schooling are installed as health extension workers (HEWs) after receiving a 1 year training on HEP. These HEWs, who are selected among the kebele population, are in charge of the implementation of the HEP in their kebeles. They are supposed to organize and assist women development teams and one-to-five formations in the kebele. The one-to-five formations are groups formed by five women living in adjacent households to deal with such health issues as maternal health, child care, sanitation, and the like in their households and neighborhood. A women development team is formed by a constellation of leaders of one-to-five formations. Families in a kebele who successfully implemented the HEP packages graduate as model families.

See Figure 1 for diagrammatic presentation of the district health-care system in Ethiopia.

2 | METHODS

2.1 | Theoretical approach

Grounded theory was used in health-care settings to develop concepts about a phenomena.¹¹ It was used in Ethiopia to explore barriers and facilitators of adherence to antiretroviral therapy (ART), barriers to follow-up of rheumatic heart diseases, and how the health system responded to a shortage of physicians.¹¹⁻¹³

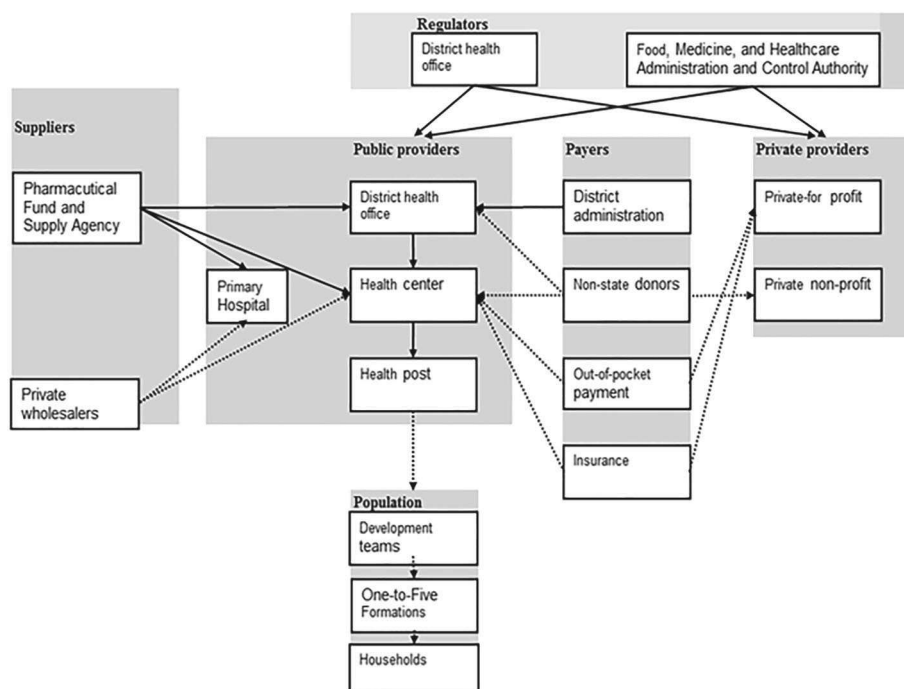


FIGURE 1 Organization of district health-care systems in Ethiopia

This study was based on a grounded theory as used by Rance.¹⁴ It captured the perceptions on their activities of multiple levels of district health-care system and consumers to come up with functions of district health-care systems. No priori conceptual framework was used because the functions were sought to emerge from the data provided by the participants.

2.2 | Setting

This study was set up in Oromia region of Ethiopia. According to the Central Intelligence Agency (USA), the population of Ethiopia is approximately 105 million.¹⁵ Oromia region accounts for 34.4% of Ethiopia's population.¹⁵ Afaan Oromoo is the official language of the region. The region has agrarian, agro-pastoral and pastoral communities. The main economic activities of the region are cash crop, coffee, and livestock production. Administratively, the region has 18 zones and 307 districts.

2.3 | Study population

This study was targeted for public providers of district health-care systems. The population of this study were all elements of public district health-care systems in Ethiopia, which are under the direct control of—and are accountable—to district administration. For the interviews, these included consumers (households, one-to-five formations, and women development teams); health-care providers in health posts and health centers; and controllers, regulators, and payers at district health offices.

The population for the document review were laws, regulations, and national standards for health-care providers, business process reengineering implementation guidelines, and health facility handbooks.

2.4 | Sampling

The sampling for interviews was encompassing communities of Oromia region and elements of district health-care system in order to represent all actors at the district level. Accordingly, four out of 18 zones in Oromia region were purposively selected: Jimma (agrarian), Arsi (agrarian), West Harerge (agro-pastoral), and Borena (pastoral). See image 1 on the sampled study sites.

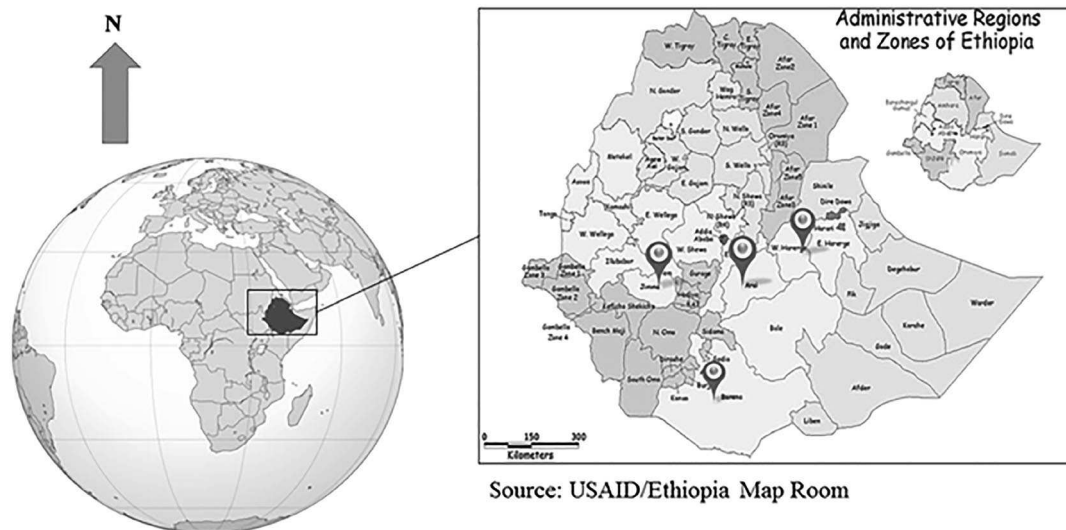
One district administrator, one district health office head, one chief executive of primary hospital, three health professionals (one from each of health officer, nurse, and midwife), one head of health center, one HEW, and one leader of women development team were purposively selected from each of the four included zones resulting in a total of 36 interview participants. The criteria for purposive selection was knowledge of a participant on the activities in district health-care systems based on their experience working in the system.

In the review part, documents were included, which were published in Ethiopia in English, Afaan Oromoo, and Amharic languages between 2001 and 2016, which describe roles or functions of any of the elements of district health-care systems.

We analyzed a total of four documents. These are business process reengineering guidelines for functions of district health offices, health post standard for health post functions, health center standard for health center functions, and federal ministry of health evaluation manuals for women one-to-five functions. See Table 1.

2.5 | Data collection

Interviews were completed face-to-face during March and April 2016 in four districts, one from each of the four zones mentioned above in sampling section: Seka, Edosa, Hirna, and Yavello from Jimma-, Arsi-, West Harerge-, and Borena-zone, respectively.



Source: <http://dic.academic.ru/dic.nsf/ruwiki/1515>

IMAGE 1 Sampled study sites [Colour figure can be viewed at wileyonlinelibrary.com]

TABLE 1 Characteristics of reviewed documents

Source	Title	Author	Year	Setting	Population	Language	Reference
Oromia Health Bureau, Ethiopia, 2009	Business process reengineering	Oromia Health Bureau, Ethiopia	2009	Sub-national health-care system	Providers	Afaan Oromo	9
Ethiopian Standard Agency, 2012a	Ethiopian Standard ES 3611:2012 Health Center—Requirements	Ethiopian standard Agency, Ethiopia	2012	Health center	Providers	English	16
Ethiopian Standard Agency, 2012b	Ethiopian Standard ES 3612:2012 Health Post—Requirements	Ethiopian standard Agency, Ethiopia	2012	Health post	Providers	English	17
Federal Ministry of Health, Ethiopia, 2015a	Evaluation manual: Family/women, one-to-five formation, women development team on health extension package implementation	Federal Ministry of Health, Ethiopia	2015	Family/women, one-to-five formation, women development team, health extension workers	Providers and population/customers	Afaan Oromo	18

Open-ended questions on activities or services provided by the different elements of public district health-care systems were asked. Moreover, closed-ended questions were asked about gender, age, position, and years of experience of participants. The in-depth interview guide was informed by the EPHFs of PAHO.² Moreover, the interview guide included questions on the services provided by health centers and health posts because EPHFs are intended for local health authorities (district health offices in Ethiopia), but not providers at the local level (health centers and health posts in Ethiopia). Moreover, EPHFs did not address the unique context in Ethiopia, which is the direct

involvement of one-to-five formations and women development teams in the district on health action. The participants were asked about their views on actual services. See Box 2 for the in-depth interview guide.

Document review was completed between April and May of 2017 by Yesuf E.A. Documents were read in full and scanned for relevant information. Information was then extracted in a form of text using a semi-structured tool, which included questions on activities of elements of district health-care systems.

2.6 | Interview context and relationships

Three interviewers with a position of lecturer from three different universities in Ethiopia and one interviewer with a title of supervisor from one zonal health department conducted the interviews. The interviewers did not report to have relationship with the participants. During five out of 27 interviews, additional persons who were the co-workers of the participants were present. Yesuf E.A. assisted during interviews done in Western Harerge. All interviews were conducted at office of the participants except three interviews, which were conducted at home of the participants.

2.7 | Analysis of data

An inductive analysis was done. Interviews were recorded, transcribed verbatim in the interview language (Amharic and Afan Oromo), and then the transcripts were translated into English. Yesuf E.A. did in vivo coding of the transcripts using MAXQDA 12.0 (see Table S1). During initial coding, activities were identified. Second stage coding was done to establish relationship between the activities and the level at which they occurred and their integration. Furthermore, activities common to all levels were defined by analyzing commonalities as suggested by Ellingson.¹⁹ Finally, we sought quotations as evidence for functions that emerged. Activities were used as findings, which were then grouped into categories, sub-functions. A group of categories was coded into themes or functions. Functions mostly emerged from interviews. However, some functions were predefined by the questions in the interview guide, such as ensuring equity and disaster preparedness by district health-care systems.

The texts extracted from documents were organized into functions for the different elements of district health-care systems. Integration of interviews and desk review was done at the analysis stage and representation of findings stage. Results from interviews were merged and mirrored with the results from the document review. Analysis of interviews was completed and then documents were used to verify or refute interview findings based on the postpositivist tradition.²⁰ Interviews showed the practical aspects while the desk review highlighted the expected situation.

BOX 2 In-depth interview guide

Guiding questions

- Q1. What *services* are provided by the district health-care system in your locality? (district health office, health canter, health posts, and women development teams)
- Q2. Which services would you like to be *added*? Give examples and suggest how often you would like those services to be provided by elements of district health-care system?
- Q3. What should be the role of district health offices and health facilities in *risk factor and disease monitoring*?
- Q4. What should be the role of district health office in *emergency situations*, such as natural disaster, such as flooding, drought or refugee crisis?
- Q5. How do you feel about the role of elements of district health offices in *coordination* with other sectors?
- Q6. How do you feel about the role of district health office in population health risks such as removal of waste nuisance (liquid or solid), noise nuisance, etc?
- Q7. How do you feel about the role of district health offices and others in ensuring better health status and health *equity*?
- Q8. How do you feel about the role of district health office in *Regulation* of health facilities, ensuring standards for health centers, private clinics, drug vendors, etc?
- Q9. What special services are provided by district health-care systems in areas dominated by pastoral communities?

2.8 | Availability of data

All transcripts of interviews and extracted texts from documents on which the research was based can be accessed from the first author on request.

2.9 | Ethics

Ethical approval for this study was obtained from the institutional review board of Jimma University Institute of Health (opinion number HRPGC/40130/2016). Participants provided informed written consent to be interviewed and recorded.

3 | RESULTS

Out of 36 planned interviews, 27 were completed corresponding with a response rate of 75%. The completed interviews were with district administrator (one), heads of district health departments (four), chief executive officers (CEOs) of primary hospitals (two), heads of health center (three), health extension workers (four), women development team leaders (two), health officers (four), nurses (three), and midwives (four). Three district administrators, two CEOs of primary hospitals, one head of a health center, one nurse, and two women development team leaders could not be reached after two visits when the data collectors were in the respective districts for interviews.

Nine out of 27 (33.3%) participants were women. Age of the participants ranged from 19 to 40 years. Mean age of the participants was 30 years with a standard deviation of 4.5 years. Years of experience of the participants ranged from one to 19. See Table 3 for description of participants.

3.1 | Functions of district health-care systems

Eleven functions of district health-care systems emerged from interviews organized by level of district health-care system with common activities across levels and relationships between activities during the provision of health care.

TABLE 3 Description of participants

Participant code	Gender	Age, Years	Years of Experience	Participant Code	Gender	Age, Years	Years of Experience
111	Man	- ^a	-	219	Man	[25, 29]	[1, 5]
112	Man	[30, 34]	[6, 10]	312	Man	[30, 34]	[1, 5]
113	Man	[25, 29]	[1, 5]	315	Woman	[19, 24]	-
114	Man	[30, 34]	[1, 5]	316	Woman	[30, 34]	-
115	Woman	[19, 24]	[6, 10]	317	Man	[35, 39]	[16, 20]
116	Woman	[35, 39]	[1, 5]	318	Woman	≥40	[16, 20]
117	Man	[30, 34]	[6, 10]	319	Woman	[25, 29]	[1, 5]
119	Woman	[25, 29]	[1, 5]	412	Man	[35, 39]	[6, 10]
212	Man	[30, 34]	[6, 10]	414	Man	[30, 34]	[6, 10]
213	Man	[25, 29]	[6, 10]	415	Woman	[30, 34]	[11, 15]
214	Man	[25, 29]	[6, 10]	417	Man	[25, 29]	[1, 5]
215	-	-	-	418	Man	[25, 29]	[6, 10]
217	Man	[30, 34]	[6, 10]	419	Woman	-	[6, 10]
218	Man	[25, 29]	-				

^aInformation not provided.

The 11 functions of district health-care systems occurred by level. Six out of 11 functions were undertaken by district health offices including creating capacity of health centers and health professionals for the provision of health care, creating access for the provision of health care, ensuring equitable access to health care, regulation of private health-care providers, disaster preparedness, and monitoring risk factors and diseases in the district. Two out of 11 functions: provision of health promotive, preventive, and curative health care for communicable diseases and maternal health conditions, and monitoring intermediate outcomes of care occurred in health centers. Two out of 11 functions: developing capacity of health post and villagers toward demand creation for health care, and provision of maternal and child health services occurred in health posts. Lastly, one out of the eleven functions—helping health posts in reaching mothers and sick individuals—was undertaken by women development teams.

The activities that led to the 11 functions of district health-care systems emerged either from document reviews, interviews, or both.

Examples of activities of capacity creation that were found only during document review were estimating need for psychotropic drugs and surveillance of safety of drugs.⁹

Capacity creation activities, such as making sure health centers and health posts possess lighting and water sources, in-service training of health professionals, and coordination with other sectors, emerged both during document review and interview.

Advanced degree opportunity for health professionals as an activity of capacity creation was emerged only during interview. A participant stated that

The other thing is the issue of education opportunity. As a zone, it is believed that if two or three persons get an education opportunity, it is considered as more than enough. But, everyone needs change, promotion, need to have hope. When you see education sector, every year seven or eight teachers get education opportunity from one school. But, for health professionals there is no such opportunity. [Participant 212]

Activities related with the function of creating access included access to ambulance services and financial access to health care. As one participant stated

What is the fate of a person who has no money, education and etc? This is a problem. It must be the question of everybody. For this kind of problem health insurance is very interesting [critical]. But, I don't think the government [district health office] is working with full dedication. [Participant 213]

According to interviews, the function called ensuring equity entailed activities, such as availing adequate drugs and health professionals in rural areas, and waiving the cost of health care for the poor. One participant stated that

Health services given in rural health center are given by diploma holders. Therefore, rural communities are not getting equal service compared to the urban area.... Therefore, our people are not getting equal services due to geographic difference. Sometimes those living at the peripheral area get lower standard service. [Participant 219]

Management of disasters as a function emerged during the interviews. Management of disasters was described as involving a budget and a committee at district level. As one participant put it,

There is a committee that has been established at district level. The committee is chaired by the woreda administrator. The sectors participating in the committee are education, agriculture and health. There will be big and bad consequences if a disaster strikes. It may lead to communicable disease outbreak. The roles of woreda health office are assessing the nature of the disaster and problem identification, and identification of impact of the disaster on the health of children and women. Based on the identified problems, provision of necessary services for the community is the responsibility of a woreda health office. [Participant 112]

However, a leader of women development team claimed that there was no such arrangement for disasters. She said,

We didn't face similar cases [disasters]. If it happens, we will pray to God. [Participant 116]

The function of providing health promotive-, preventive-, and curative-health care for communicable diseases and maternal health conditions involved activities related with provision of health care on areas of general medicine, minor surgery, emergency, maternal and child health (MCH), and health promotion.¹⁶ For example, document review and interview revealed that health centers provided curative health care for communicable diseases, such as malaria, tuberculosis (TB), HIV voluntary counseling and testing (VCT), ART, and sexually transmitted disease (STD), among others.¹⁶ One interview participant stated that

For TB [tuberculosis], bacteriological confirmation, and for HIV, CD4 count, viral load measurement, and pre-ART are done [Participant 414]

A few activities related with the provision of health care in areas of general medical services and youth services lacked in a pastoral district. Participants from a pastoral district mentioned what were lacking in that district.

Some services are not found in our woreda. These are services like voluntary counseling and testing, ART [Anti-Retroviral Treatment] service, and youth services. [Participant 217]

Furthermore, maternal health services emerged prominently both during interview and document review as an activity of health centers. For example, antenatal care and delivery care were provided in health centers. However, certain conflicting messages were retrieved, for example, one head of health center claimed that they were providing full delivery services in the health center, while a leader of an associated women development team said that the provided services were not comprehensive. She stated that

What we need is that there should be delivery services conducted by knowledgeable health professionals in our residential area. For example, last week my daughter in-law suffered from prolonged labor and was referred and I was sad with the conditions. [Participant 316]

Patient satisfaction was monitored as a measure of outcome of health care by health centers. One participant stated

Moreover, when a person gets ill he goes early to medical services. We ask the person the type of service he received and his satisfaction with the service after he completed receiving the services and exits [health facility]. [Participant 117]

A few activities of health centers emerged only during document review. Examples of this are basic rehabilitative services, such as contracture and foot ulcer prevention.¹⁶ Moreover, minor surgery (for example: lipoma excision and circumcision), handling of regional anesthesia, and pain management were stated as activities of health centers as indicated by a document¹⁷ but were not practiced by the health centers interviewed for this study.

According to document review and interview, collaboration with organizations in the health sector and other sectors for health promotion was an activity related with health promotion done by health centers. Document review revealed that a "health center shall have a planned approach to collaborate with other health service levels and other institutions and sectors on an ongoing basis".¹⁶ As one participant put it,

Our health center has good integration with other sectors. For example, with the women and child affair office, since 70% of the general population are women and children we are working with them from the very beginning of the planning. We have also been evaluating performances together. [Participant 114]

The function of developing capacity of health post and villagers toward demand creation for health care and provision of a few maternal and child health services took place in health posts. The activities of health

posts ranged from registration of residents of the village to health promotion as well as provision of preventive services like childhood immunizations and curative services like integrated management of childhood illnesses (IMCIs).

Both document review¹⁷ and interviews suggested that the activity of baseline survey of the population of a kebele was done by health posts. One of the reviewed documents states that

*Health extension workers shall conduct a baseline survey of the kebele when they first arrive. This shall cover the number of households, the resident population by gender and age.*¹⁷

Regarding health information, health posts were expected to maintain family folders on the health-related issues of families in a village.

Both document review¹⁷ and interviews revealed that health posts performed childhood immunizations like pentavalent vaccine and oral polio vaccine.

Curative services like IMCI did not emerge from the document review but were indicated by interview participants as an activity of health posts. A participant suggested

With regards to curative services, as I mentioned earlier, we give this service for under five children to treat or prevent problems like pneumonia, diarrhea, fever and others. [Participant 315]

The function of helping health posts in reaching mothers and sick individuals was undertaken by women development teams.

This was in line with what was expected from women development teams, which is to identify pregnant women in their village and report to HEWs.¹⁸ As one participant stated

One-to-five formations and women development teams have one hour discussion for two days on toilet digging, immunization, and bed net utilization, sending pregnant women to health facility, identifying people with cough of two or more weeks and sending them to health posts for testing. [34 year old male district health officer during pretesting]

The document review revealed that women development teams were expected to participate in the elimination of open defecation and abolition of home delivery in their village.¹⁸ Moreover, they were expected to provide support to one-to-five formations that are part of women development teams.¹⁸

One-to-five formations support their members so that the later scored high during annual evaluations of performance. According to the HEW guideline,¹⁸ members should be evaluated based on utilization of family planning methods; breast feeding practices; utilization of MCH services; and self-, household-, and environmental-care practices related to health.

Finally, commonality of functions by the different levels of the district health-care system were also observed. A few services were common between the different elements of the district health-care system. Women, one-to-five formations, and development teams were expected to participate in environmental hygiene activities like drainage of stagnant water to prevent malaria.¹⁸ Both health centers and health posts were expected to report diseases under national surveillance to district health office.¹⁷ Another example of an activity common to health centers and health posts was provision of family planning and maternal health services.

Provision of information, education, communication (IEC) and behavior change communication (BCC) on prevailing health issues were found to be activities of district health offices, health centers, and health posts.^{9,17}

There was integration of activities across different levels of the district health-care system. For example, women development teams identified persons with cough lasting for two or more weeks. On the next level, health posts assessed symptoms among persons with cough lasting for two or more weeks and referred them to the nearest health center. The health centers did laboratory diagnosis of persons with cough with acid-fast bacilli test of the sputum. Health centers also administered anti-TB treatment. Lastly, the district health office did compile TB incidence and prevalence data, and reported to all stakeholders.

4 | DISCUSSION

Based on needs, views, and opinions of health-care consumers, providers, regulators, and administrators, we were able to identify a set of 11 functions of district health-care systems in Oromia region in Ethiopia, which would be transferable to other regions of Ethiopia through interviewing health-care administrators, providers, and consumers in the other regions to confirm or refute the findings.

Functions are organized by level in district health-care systems with commonality of few activities. Activities mentioned in documents, but not practiced, emerged during interviews. Few activities were not stated in documents but emerged during interviews.

Other qualitative studies in district health-care systems in low-income countries explored the attitude of mothers' toward utilization of maternal health services, decision-making process, and data platforms for decision-making.²¹⁻²³

According to this study, functions of district health office are creating capacity of health centers and health professionals for the provision of health care, creating access for the provision of health care, ensuring equitable access to health care, regulation of private health-care providers, disaster preparedness, and monitoring risk factors and diseases in the district. For example, they are expected to make sure that health facilities have water and electricity, motivate health professionals, provide essential drugs to health facilities, allocate health budget for the poorest, and put ambulance especially for pastoral communities. However, the overlapping roles of health-care provision and regulation may create a conflict of interest and reduce the possibility for impartiality in assessing public and private providers.²⁴

Major functions of health centers are provision of health promotive, preventive, and curative health care for communicable diseases and maternal health conditions, and monitoring of intermediate outcomes of care. A focus of health centers on communicable disease control and prevention is hardly surprising since lower respiratory infection, diarrhea, and HIV/AIDS are the top three causes of years of life lost (YLL) in Ethiopia.²⁵

Our study revealed that health posts mostly do fulfill functions of surveillance, health promotion, and social participation in health. They register residents of the village, provide health education on prevailing health issues, do childhood immunization, IMCIs, and provide short-term contraceptives among other activities. One study from three districts in Oromia region showed that 45% of mothers seek care for diarrhea in children from health post and another 45% from health center.²⁶ This shows that health posts are instrumental in treating childhood illness as are health centers. However, utilization of management of childhood illnesses by health posts was hampered by absenteeism of HEWs from health posts.²⁷ HEWs in health posts train and work with one-to-five formations and women development teams.

Functions of one-to-five formations and women development teams are related with the function of surveillance. They participate in identification of pregnant women and referrals to health posts. This activity is documented by another study carried out in another national regional state in Ethiopia, called Tigray.²² This helps women to initiate antenatal care (ANC) early in pregnancy, which in turn contributes to reduce the maternal mortality in Ethiopia, which is still high standing at 412 per 100 000 live births²⁸ by increasing contact between communities and the district health-care system. The ability of one-to-five formations and women development teams in identification of risk factors and diseases in their neighborhoods is important to ensure continuity of care.

Activities have a hierarchy and continuity with increasing complexity as one goes from the lower level to the higher level of health-care providers in district health-care systems. The disease entity TB is a typical example in this regard. Our study showed that women development teams identify people with cough lasting two or more weeks and inform HEWs about them and help them to go to health post or health center. This is important for two reasons. First, TB is the fourth leading cause of YLL in Ethiopia.²⁵ Second, according to one study from rural Northwest Ethiopia, two-thirds of patients with active TB are not detected.²⁹ Given the burden of TB and detection rate in Ethiopia, women development teams help to increase the detection rate and facilitate contact of persons with TB symptoms with providers in the district health-care system, increasing the chances of diagnosis and treatment. Moreover,

increased detection rate means accurate reporting of the burden of TB in the district-by-district health offices. Nevertheless, hierarchy of activities is not always the case.

Overlap of activities is observed between two or more elements of district health-care systems. For example, both health posts and health centers report diseases under national surveillance to district health offices. BCC is provided by health posts, health centers, and district health offices, which may increase the reach of BCC.

A few activities are stated in documents but are not practiced. An activity under the function of surveillance is a good example here. Postmarketing surveillance of the safety of drugs is mentioned as an activity of district health offices in the document review but did not emerge during interviews. Guideline by FMHACA recommends reporting of adverse drug events and medication errors directly from health facility to FMHACA (Food, Medicine, and Healthcare Administration and Control Authority of Ethiopia, 2014).³⁰ If adverse events and medication errors are not well reported, then morbidity and mortality due to medication may go unnoticed leading to delay in taking action by practitioners and policy makers.³¹

Career opportunities for nurses and HEWs are also not given attention by district health offices according to interview participants. This might be one of the reasons for the low satisfaction index of HEWs.³²

A few activities are uniquely lacking in pastoralist areas, for example, youth services.

IMCIs merged as an activity of health posts during interviews but not in the documents review. This might be because of the recent expansion of these services to health posts.²⁷

Interview participants stated that district health offices should avail competent professionals and important drugs like uterotonics in rural areas, while both aspects are perceived as not adequately practiced. This affects the ability of the district health-care system, and by extension, the national health-care system in achieving the stated policy objective of reducing the gap in health-care utilization between urban and rural areas.⁸ In addition to equity measures, outcome measures are also rarely practiced.

Though intermediate outcome exists, health status outcome research is not adequately practiced except for measuring the incidence of acute respiratory infections. This is also the case for chronic diseases. Though health centers treated communicable diseases, treatment of chronic diseases is not often practiced by health centers. This might be contributing to the high age standardized mortality due to noncommunicable diseases in Ethiopia, which stands at 476 per 100 000 people, which is higher than mortality due to malaria, TB, and HIV/AIDS combined.⁸

The strengths of this study include the range of geographic areas addressed and stakeholders interviewed, multiple data sources used, and mirroring of interview and desk review. Moreover, peer briefing and debriefing were done with a faculty member of the College of Education and Behavioral Sciences, Jimma University, who carries a master's degree in Educational Leadership and Management. Because of these reasons the findings could be transferred to similar settings in Ethiopia and elsewhere.

The limitation of this study is the inability to fully capture the voice of the beneficiaries of health care, though partially captured through the interview of women development teams. Moreover, adults and patients with disabilities were not interviewed.

Presence during some interviews of other persons not involved in the research, the involvement of a district supervisor, and inability to check the findings with the participants because of the remote study setting may have limited the internal validity of the findings. Even though there were interruptions of few of the interviews by third party others, we believe that the responses were not affected because the interviews were stopped immediately when nonparticipants entered the interview locations and restarted when they left. According to Smith (1995), responses are affected by the presence of others when the questions are sensitive,³³ for example, questions on gender roles or political views are sensitive; this level of sensitivity was not reached in this study. Moreover, involvement of a district supervisor in a few instances may have created a conflict of interest. Its effect on responses is considered minimal as the level of involvement of a district supervisor is detached from the health facility level. A certain level of intimidation on the level of an interviewed individual can, however, not finally be ruled out.

5 | CONCLUSIONS

In the context of Oromia region of Ethiopia, there are 11 functions of district health-care systems. Elements of district health-care systems have specific functions, though a few activities like reporting of diseases under national surveillance overlap between two or more elements. District health offices have partially contradicting roles of both provider and regulator. Few activities mentioned in some regulatory documents are not practiced. On the other hand, some activities such as the implementation of the IMCIs are practiced by health posts, though not mentioned in regulatory documents. Contradicting and overlapping roles should be separated and further study should be done on why certain activities are not undertaken.

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CONFLICTS OF INTEREST

We declare that we have no conflict of interest.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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Face and content validity of a prospective multidimensional performance instrument for service delivery in district health systems in low-income countries: a Delphi study

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Background: Valid performance indicators help to track and improve health services. The aim of this study was to test the face and content validity of a set of performance indicators for service delivery in district health systems of low-income countries.

Methods: A Delphi method with three stages was used. A panel of experts voted (yes vs no) on the face value of performance indicators. Agreement on the inclusion of indicators was a score of >75% and ≥50% during stages one and two, respectively. During stage three, indicators with a mean score of ≥3.8 on a five-point scale were included. The panel also rated the content validity of the overall set of indicators.

Results: The panel agreed on the face value of 59 out of 238 performance indicators. Agreement on the content validity of the set of indicators reached 100%. Most of the retained indicators were related to the capacity of health facilities, the quality of maternal and child health services and HIV care and treatment.

Conclusions: Policymakers in low-income countries could use a set of performance indicators with modest face and high content validity, and mainly aspects of capacity and quality to improve health service delivery in districts.

Keywords: Delphi study, district, health systems, indicators, low-income country, validity

Introduction

According to the health systems dynamics framework, health systems have 10 elements that interact in a dynamic way. These are: (1) goals and outcomes, (2) values and principles, (3) service delivery, (4) the population, (5) the context, (6) leadership and governance and (7–10) the organization of resources (finances, human resources, infrastructure and supplies, knowledge and information).¹ At the core of a central axis of these elements is ‘organization and delivery of health care services’.¹ Even although health systems are broadly defined, a healthcare system is assumed to be a subsystem within the health system that has fewer elements.

According to Wendt, Frisina and Rothgang,² a healthcare system has elements of ‘financing, health service provision and

regulation’. Similar to the health system, health service provision is the key element of a healthcare system. This concept is generally applied to national healthcare systems. Nevertheless, it can also be applied to subnational health systems such as district healthcare systems, which are at the forefront of primary health service delivery.³

‘A district health system includes the interrelated elements in the district that contribute to health in homes, educational institutions, workplaces, public places and communities, as well as in the physical and psychosocial environment.’⁴

The district health systems of low-income countries commonly have elements of service delivery, regulators, suppliers and financiers. In this study we focused on service delivery because it is the core function of district health systems. Service delivery can be executed by private or public providers. Public

providers of health services are generally the major providers of health service in districts of low-income countries and commonly include health posts, health centres, district hospitals and district health offices, which are vertically integrated for planning and control.

The performance of a health system is the attainment of multiple goals and the distribution of the attainment of those multiple goals.⁵ It includes access to and capacity for the provision of quality healthcare as well as striving for better health status outcomes in an efficient and equitable manner.^{6–8}

Performance measures are important for service delivery in district health systems to capture areas of success that could be scaled up, and also to learn from failures.⁹ They also help decision-makers to use the results of performance measurement for decision-making at the local level.¹⁰ Moreover, they can be applied to elements in the district health system to improve quality outputs, such as growth monitoring and institutional delivery by attaching the results of performance measurement to incentives for staff.¹¹

District health systems in low-income countries face a myriad of challenges, including difficulty in integrating vertical programmes,¹² ambiguity regarding their administrative roles¹³ and poor performance monitoring.

In Uganda, a perceived lack of local decision space contributed to poor performance monitoring in district health systems.¹⁴ Poor performance monitoring of health service delivery leads to weak accountability for results and a decline in the quality of services. In low- and middle-income countries (LMICs), the poor quality of health services contributed to 5 million annual deaths.¹⁵ Past efforts at developing performance indicators for low-income country health systems were made by organizations such as the WHO¹⁶ and individuals such as Kruk and Freedman.¹⁷ However, the indicators are not validated for health systems of low-income countries.

Other indicators tend to be process oriented. For example, performance indicators used at the national and subnational level in a low-income country such as Ethiopia are process oriented, for instance, the number of deliveries in health institutions.¹⁸

Therefore, there is a need for a set of valid indicators for district health systems in low-income countries with both process and outcome attributes.

The aim of this study is to test the face and content validity of a set of performance indicators for district health systems in low-income settings to help improve performance monitoring of service delivery towards the goal of better health and longevity.

Methods

Working definitions of performance dimensions of district health systems

The following are key terms and their definitions as used in this paper.

Service delivery has access, capacity and quality dimensions that partially lead to better outcomes in health status; these should be equitably distributed, and resources should be used efficiently to produce better health status.¹⁹

Access (to health services): 'the perceptions and experiences of people as to their ease in reaching health services or health facilities in terms of location, time, and ease of approach'.²⁰

Capacity refers to 'skills, tools and processes' that need to be in place in a functioning system.²¹

Quality: '[t]he correct provision of evidence-based healthcare services to all who could benefit, but not to those who would not benefit'.⁶

Outcomes: the incidence and prevalence of conditions and diseases and their risk factors as well as subjective health status and objective health status such as mortality.

Efficiency: the relationship between inputs and outputs of healthcare.⁶

Equity: '[t]he absence of systematic differences in one or more aspects of health status (or access) across socially, demographically or geographically defined population groups'.²⁰

Development of the prospective instrument

The dimensions of the performance of a health system can be measured by a set of indicators. For an indicator to be selected as a performance indicator the following criteria are commonly applied: importance, relevance, validity, reliability and feasibility.²² In 2016 and 2017, we used a narrative systematic review and qualitative interviews to identify relevant performance indicators for service delivery in district health systems of low-income countries. Those performance indicators that were identified were categorized into access, capacity, quality, outcomes, equity and efficiency dimensions of health system performance, and used as part of the prospective instrument for this study. The instrument was used as a background paper for voting and commenting on the Delphi method.

Study design

A Delphi method was chosen to overcome geographical and logistical difficulties since experts from many different countries were involved. In this situation the Delphi method was preferable to face-to-face discussions.²³

Setting

This study was set up in the district health systems of low-income countries.

Panel size and sampling of participants

Given that the target population of experts from which the panel was drawn was not known,²⁴ panel size was not calculated a priori. Even though there was no recommended sampling technique for Delphi method studies,²⁵ a panel of experts was selected using purposive sampling based on pre-set criteria. The criteria for an expert was somebody who (1) had published an article on the quality or performance of health systems in a low-income setting, (2) had experience working in a district health system (for example, as an administrator of a district health office) or (3) was recommended by either (1) or (2). Experts were recruited online via email. Experts acquired their experience in LMICs such as Afghanistan, Cameroon, Ethiopia, Ghana, India, Kenya, Nigeria, Pakistan, Rwanda, South Africa and Uganda.

Variables

Face validity was defined as the ability of a performance measure to fall into the broader construct of service delivery performance in district health systems in low-income settings. Content validity was defined as the completeness of an entire set of performance measures to represent the service delivery performance of district health systems in low-income settings.

Data collection and analysis

The email collector option of SurveyMonkey (One Curiosity Way, San Mateo, CA, USA) was used for data collection. Participants were provided with a background paper containing a set of relevant performance indicators of district health systems in low-income settings. They were asked to vote and comment on performance indicators over three stages.

During stage 1, participants were asked to vote (yes vs no) on each of the performance indicators regarding the ability of an indicator to fall under the broader construct of service delivery performance of district health systems in low-income countries and to rate the completeness of the entire set of performance indicators. Moreover, they were asked to comment on each of the performance indicators. Agreement on an indicator level was established when an indicator achieved >75% of the votes. An indicator polling 40–75% of the votes was considered equivocal and voted on again during stage 2. When an indicator only scored <40% of the votes it was considered to be excluded by the panel.

During stage 2, participants were given the set of performance indicators which took 40–75% of the votes during stage 1²⁶ and they were voted on again. Moreover, performance indicators that had been proposed during stage 1 were voted upon, and those which scored <50% were excluded. Stage 2 panellists were also asked to comment on the performance indicators.

During stage 3, participants were asked to rate those performance indicators which received either >75% during stage 1 or ≥50% of the votes during stage 2. Furthermore, performance indicators that had been proposed during stage 2 were also rated. The panel was asked to rate the indicators on a five-point scale (from 1=least well to 5=very well), and comment on them. Performance indicators which achieved a mean score of ≥3.8 were retained for the final set of validated indicators.²⁷

During each stage participants rated the prospective instrument on a four-point Likert scale (1=strongly disagree, 2=disagree, 3=agree and 4=strongly agree) to test its overall completeness.

The Delphi stages lasted an average of 5 weeks.

Results

Response rates and characteristics of the panellists

The overall median response rate was 9.8%. The ages of the panellists ranged from 33 to 58 y (mean=42.0, SD=9.8), 34 to 72 y (mean=51.6, SD=14.4) and 28 to 62 y (mean=39.2, SD=9.6) for stages 1, 2 and 3, respectively. Their work experience ranged from 10 to 35 y (mean=17.9, SD=9.3), 10 to 45 y (mean=27.4, SD=13.6) and 7 to 30 y (mean=15.3, SD=6.4) for stages 1, 2 and 3, respectively. Women represented 13, 30 and

14% of panellists during stages 1, 2 and 3, respectively. About 88, 50 and 78% of panellists were from Ethiopia during stages 1, 2 and 3, respectively. Workers in the government sector accounted for 50, 60 and 50% of panellists during stages 1, 2 and 3, respectively (Table 1).

Response rates varied by stage and dimension of district health system performance. During stage 1, response rates ranged from 8 out of 95 (8.4%) for the equity dimension to 17 out of 95 (17.9%) for the capacity dimension; the median response rate was 9.5%. The stage 2 response rate ranged from 8 out of 95 (8.4%) for the health status outcomes dimension to 14 out of 95 (14.7%) for the capacity dimension; the median response rate was 10.5%. The stage 3 response rate was 9.3%.

Findings of face validity

Panellists were provided with 238 indicators to vote upon during stage 1: 142 indicators (59.7%) were included, 88 (37.0%) were assigned to re-voting and 8 (3.4%) indicators were selected for exclusion. On the level of performance dimension, inclusion during stage 1 was highest for outcomes (79.6%) followed by equity (72.2%) and the lowest was for access (38.9%). In the re-voting category the highest was for capacity (53.1%) followed by access (50.0%) and the lowest was for outcomes (20.4%). See Table 2 for more information.

Comments by panellists during stage 1 were integrated with the findings of the votes. For example, a participant during stage 1 suggested that ‘the indicators should include indicators for the role of other stakeholders like non-governmental organizations and the indicators should focus on [the] healthcare system not the health system’. However, regarding the role of other stakeholders, it was noted that an indicator concerning the

Table 1. Characteristics of the panellists

Characteristics	Stage 1 (n=8) frequency (%)	Stage 2 (n=10) frequency (%)	Stage 3 frequency (%)
Gender			n=7
Male	7.0 (87.5)	7 (70.0)	6.0 (85.7)
Female	1.0 (12.5)	3 (30.0)	1.0 (14.3)
Country			n=9
Ethiopia	7 (87.5)	5 (50.0)	7.0 (77.8)
South Africa	1 (12.5)	2 (20.0)	0.0 (0.0)
USA	0 (0.0)	1 (10.0)	0.0 (0.0)
Canada	0 (0.0)	1 (10.0)	0.0 (0.0)
Belgium	0 (0.0)	1 (10.0)	1.0 (11.1)
Uganda	0 (0.0)	0 (0.0)	1.0 (11.1)
Sector			n=8
Government	4 (50.0)	6 (60.0)	4.0 (50.0)
Academia	2 (25.0)	3 (30.0)	2.0 (25.0)
Private for profit	0 (0.0)	0 (0.0)	1.0 (12.5)
Private non- profit	2 (25.0)	1 (10.0)	1.0 (12.5)

Table 2. Stage 1 indicators, inclusion and exclusion results

Performance domain	Number of indicators included (>75% of votes) frequency (%)	Number of indicators for re-vote (40–75% of votes) frequency (%)	Number of indicators excluded (<40% of votes) frequency (%)	Total
Capacity	14 (43.8)	17 (53.1)	1 (3.1)	32
Access	7 (38.9)	9 (50.0)	2 (11.1)	18
Quality	65 (56.5)	45 (39.1)	5 (4.4)	115
Outcomes	39 (79.6)	10 (20.4)	0 (0.0)	49
Efficiency	4 (66.7)	2 (33.3)	0 (0.0)	6
Equity	13 (72.2)	5 (27.8)	0 (0.0)	18
Total	142 (59.7)	88 (36.9)	8 (3.4)	238

existence of intersectoral coordinating bodies in the district health office already existed.

Stage 1 panellists also suggested including certain indicators, most of which were accepted, except when there was already an indicator in place. For example, an indicator called ‘the percentage of children who completed the pentavalent vaccine by the age of 1 y’ was included in stage 2. One panellist suggested removing indicators for vaccines which were not available in most low-income countries; for example, the measles–mumps–rubella vaccine was not available in district health systems in Ethiopia and thus was removed from the set of indicators. See Supplementary File 1 for the comments made and actions taken during stage 1.

During stage 2, 104 indicators were provided for panellists to vote upon, and it was agreed to include 99 (95.2%) of these. Performance dimension level agreement was 100% for access, outcomes, efficiency and equity dimensions of performance. Moreover, agreement was very high for capacity and quality dimensions (Table 3).

During stage 2 the panel also commented on the indicators, and suggested including, excluding or merging indicators. For example, an indicator concerning the existence of a quality committee in the district health office to address quality problems was added, and indicators regarding children without health insurance and underinsured adults were merged with the one for families without health insurance. See Supplementary File 2 for a detailed description of the comments made and actions that were taken.

The stage 3 panel was provided with descriptions of the functions of district health offices and public providers (health centres, health posts and women community health volunteers) in district health systems in Ethiopia.

The panel voted for 241 indicators to be included during stages 1 and 2. Fourteen indicators were either merged or removed based on comments made during either stage 1 or stage 2. Therefore, stage 3 started with 227 indicators, which were organized by elements of public provider of district health-care, and whole health system indicators on outcomes,

Table 3. Voting for indicators during stage 2

Performance domain	Number of indicators included ($\geq 50\%$ of votes) frequency (%)	Number of indicators excluded (<50% of votes) frequency (%)	Total
Capacity	20 (95.2)	1 (4.8)	21
Access	11 (100.0)	0 (0.0)	11
Quality	48 (92.3)	4 (7.7)	52
Outcomes	12 (100.0)	0 (0.0)	12
Efficiency	2 (100.0)	0 (0.0)	2
Equity	6 (100.0)	0 (0.0)	6
Total	99 (95.2)	5 (4.8)	104

Table 4. Results of ratings during stage 3

Element of district healthcare system	Number of indicators included (weighted mean score ≥ 3.8) frequency (%)	Number of indicators excluded (weighted mean score <3.8) frequency (%)	Total
District health office	10 (23.8)	32 (76.2)	42
Health centre	31 (26.5)	86 (73.5)	117
Health post	2 (28.6)	5 (71.4)	7
Women community health volunteers	2 (28.6)	5 (71.4)	7
Outcomes: the whole system	11 (25.6)	32 (74.4)	43
Efficiency: the whole system	0 (0.0)	3 (100.0)	3
Equity: the whole system	1 (12.5)	7 (87.5)	8
Total	57 (25.1)	170 (74.9)	227

efficiency and equity; 57 indicators (25.1%) with a weighted mean score of ≥ 3.8 were retained. Agreement regarding the percentage of indicators included for the level of each service provider in the district health system was consistent with agreement overall, each of which scored in the upper 20s, except for the efficiency and equity indicators for the whole system. Details of the indicators retained and excluded during stage 3 are provided in Table 4. There were no substantial comments made during stage 3 (Supplementary file 3).

Indicators retained at the end of stage 3 are listed in Table 5, ranked by a matrix of performance dimension and the element of each public service provider in the district health system. Outcome and equity indicators partially attributed to the entire district health system are described in Table 6.

Table 5. Final list of valid indicators by performance dimension and the element of public service providers of the district health system

District health office	Health centre	Health post
<p>Capacity indicators:</p> <p>Making available essential drugs, such as for the treatment of malaria</p> <p>Percentage of health centres which received support, including training and supervision</p> <p>Percentage of pregnant women who reached the receiving health facility among pregnant women referred by women development teams</p> <p>Percentage of sick children who reached the receiving health facility among sick children referred by women development teams</p> <p>Access indicators:</p> <p>Percentage of households within 30 min walking distance from a primary healthcare provider</p> <p>Percentage of children with geographic access to vaccination services</p> <p>Health officer density per 1000 population</p> <p>Proportion of households covered by community health workers through outreach activities</p> <p>Quality indicators:</p> <p>Percentage of households in high-risk communities sprayed with indoor residential spraying</p> <p>Annual TB detection rate in the district</p>	<p>Capacity indicators:</p> <p>Health centre-developed checklist to assess services quality</p> <p>Quality indicators:</p> <p>Percentage of non-pregnant women who needed family planning services and taking at least one method</p> <p>Percentage of pregnant women with at least one antenatal care check-up during the last pregnancy</p> <p>Percentage of pregnant women with ≥ 4 antenatal care check-ups during the last pregnancy</p> <p>Percentage of pregnant women counselled on danger signs of pregnancy during antenatal care of the last pregnancy</p> <p>Percentage of pregnant women screened for HIV during the last pregnancy</p> <p>Percentage of pregnant women screened for syphilis during the last pregnancy</p> <p>Percentage of pregnant women screened for gestational diabetes mellitus during the last pregnancy</p> <p>Percentage of pregnant women screened for hypertension during the last pregnancy</p> <p>Percentage of pregnant women tested for blood group and type during the last pregnancy</p> <p>Percentage of pregnant women screened for iron deficiency anaemia during the last pregnancy</p> <p>Percentage of pregnant women supplied with iron during the last pregnancy</p> <p>Percentage of pregnant women supplied with folic acid during the last pregnancy</p> <p>Percentage of pregnant women with HIV/AIDS who received treatment</p> <p>Percentage of women who gave birth in health centre during the most recent pregnancy</p> <p>Percentage of women enrolled in postnatal care services immediately after birth</p> <p>Percentage of children who initiated vaccination within 45 d after birth</p> <p>Percentage of children who completed polio vaccine by age 2 y</p> <p>Percentage of children who completed measles vaccine by age 2 y</p> <p>Percentage of children who completed pneumococcal conjugate vaccine by age 2 y</p> <p>Percentage of children who completed</p>	<p>Capacity indicators:</p> <p>Percentage of pregnant women in a village registered by health post</p> <p>Percentage of households in a village that received education on bednet utilization</p> <p>Women community health volunteers, capacity indicators:</p> <p>Percentage of pregnant women in a village detected by community health volunteers</p> <p>Percentage of pregnant women referred to health post or health centre among pregnant women detected by community health volunteers</p>

Continued

Table 5. *Continued*

District health office	Health centre	Health post
	<p>pentavalent vaccine – combination of diphtheria, pertussis, tetanus, haemophilus influenza type B and hepatitis B –by age 2 y</p> <p>Percentage of children aged 45 d to 2 y who underwent regular growth monitoring</p> <p>Percentage of children with diarrhoea who received treatment</p> <p>Percentage of children with respiratory tract infection who required treatment and received treatment</p> <p>Percentage of HIV-positive adults lost to follow-up after initial positive test and then located with tracking</p> <p>Percentage of HIV-positive adults receiving highly active antiretroviral therapy</p> <p>Percentage of HIV-positive adults screened for TB in the past year</p> <p>Percentage of HIV and TB coinfecting adults who received anti-TB treatment</p> <p>Percentage of TB patients counselled on transmission of the disease to others</p> <p>Percentage of newly diagnosed TB on anti-TB treatment of directly observed therapy</p> <p>Percentage of patients on TB treatment who completed treatment</p>	

Content validity

Six out of seven members of the panel agreed that the set of indicators in stage 1 reflected service delivery performance in district health systems. Seven out of eight agreed on the overall validity of the set of indicators during stage 2. During stage 3, all eight participants agreed that the final set of indicators reflected service delivery performance in district health systems in low-income countries.

Discussion

Average face validity increased from stage 1 to stage 2 and then decreased from stage 2 to stage 3. At the dimension level, agreement during stage 1 was highest for the outcome dimension followed by equity, with suggestions made for new quality indicators. During stage 2, agreement at the dimension level increased to 100% for all of the dimensions except for capacity and quality. During stage 3, about a quarter of the indicators from each dimension received a high rating, except for efficiency and equity.

During each subsequent stage there was an increase in consensus on content validity, indicating that the entire set of indicators represented the broader construct of service delivery performance in district health systems in low-income settings.

Finally, 59 indicators were retained. All performance dimensions were addressed except efficiency. A little more than half of the indicators concerned health centres, reflecting the core function they play in districts regarding service delivery of primary healthcare. The indicators are comparable with international norms such as 100 core health indicators²⁸ and WHO indicators for monitoring the six building blocks of health systems.¹⁶

This study found that access indicators commonly used by developing countries¹⁷, such as 1 physician per 1000 people of the population, were found to be valid; these are also suggested by WHO for monitoring the health workforce.¹⁶ WHO also suggest monitoring services such as antenatal care, delivery, HIV/AIDS and TB treatment, which were also found to be valid in this study. Outcome indicators, such as infant mortality and maternal mortality, which were found to be valid for low-income settings in this study, are also commonly used in developing countries.¹⁷

The panel selected several indicators related to the quality of healthcare. This is important with regard to health centres because they are the major providers of healthcare in districts and therefore should be monitored. Indicators related to antenatal care and child health were also selected. This is important because of high maternal and child health mortality in low-income countries.

Table 6. District healthcare system outcome and equity indicators

District healthcare system outcome indicators
Rate of consistent toilet utilization
Regular bednet utilization rate
Measles cases per 100 000 population
TB cases per 1000 population
Trachoma cases per 100 000 population
Onchocerciasis cases per 100 000 population
Perinatal mortality rate
Rate of stillbirths
Neonatal mortality rate
Percentage of deaths within 28 d of live births weighing <1500 g
Postneonatal mortality rate
Infant mortality rate
Maternal mortality ratio
District healthcare system equity indicator
Percentage of pregnant women who received antenatal care: urban vs rural

Even although district healthcare systems in low-income countries are affected by efficiency and equity problems, no efficiency indicator and most of the equity indicators did not make it into the final set of indicators.

Implementation of the indicators by districts may help to strengthen the capacity of district health systems and improve health service quality and utilization. Together with subsidies, the indicators can be used to improve utilization rates for healthcare services across districts. For example, quality indicators such as growth monitoring and institutional deliveries, which were found to be valid in this study, were used in Rwanda to increase the use of those services by subsidising health centres to provide better performance.¹¹ Moreover, quality indicators such as the percentage of TB patients who completed treatment could be a proxy for other aspects of the district health system, for example the capacity of the system to retain patients in treatment.¹⁹

Data availability might be a challenge in utilizing the indicators as most of the data collected in districts of low-income countries focus upon service delivery for mothers and children.²⁹ However, application of the indicators in the face of a shortage of data at the district level still helps, in two ways. First, it pressurizes districts to explore new ways of using locally generated data. Second, it encourages them to identify areas in which data are lacking, particularly regarding outcomes. These encourage district health systems towards better monitoring of service delivery performance by linking it to healthcare outcomes such as mortality.

The findings of this study are limited by the fact that agreement on face validity did not show a monotonic increase. Moreover, the response rate in this study was less than response rates that have been reported in Delphi studies (of around 30%).²⁴ This may have affected the inclusion or exclusion of some indicators through the effects of non-response bias. Hence, despite experts being invited from many LMICs, respondents were mostly from Ethiopia, South Africa and Uganda.

Thus the indicators selected as being valid by the participants might have been more applicable to health systems in low-income countries in eastern and southern Africa. Moreover, service delivery in district health systems is only partially responsible for morbidity and mortality outcomes. Therefore, outcome indicators are only partly attributed to service delivery in district health systems. Finally, due to the small sample size, the inability to aggregate the selected indicators by the gender of the panel, i.e. to estimate the effect of gender upon the selection of a group of indicators, may also have limited this study's findings.

Conclusions

Policymakers in low-income countries could use a set of performance indicators with modest face and high content validity, and mainly aspects of capacity and quality, to improve health service delivery in districts. Policymakers in national and local settings should pilot the indicators and document the challenges, including the availability of data at the local level, and work on mechanisms to secure additional data, particularly regarding outcomes. Outcome indicators found to be valid in this study should be used with caution by applying the proportion of outcomes attributed to the district health system and other social sectors, such as education and economic status. This can be achieved by using panel regression techniques to determine the adjusted coefficient of health services in the health production function by using infant mortality as a dependent variable, and health services, economic status and levels of education as predictors.

Supplementary data

Supplementary data are available at *International Health* online.

Authors' contributions: EAY conceived the study. EAY, DK, GF, DHM and EG contributed to the design, conduct and analysis stages of the study. EAY drafted the manuscript. EAY, DK, GF, DHM and EG contributed to subsequent versions of the manuscript and approved the final version. EAY and DK are the guarantors of this study.

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