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Measuring management practices in India's district public health bureaucracy

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Keywords

India; management practices; district health system; measurement; reliability; validity; psychometric properties.

Highlights

- We developed a tool to measure management in India's district health bureaucracy
- We evaluated process-orientated management practices in 34 districts of Maharashtra
- The tool was feasible to implement, with few missing data and high response rates
- Psychometric performance of the tool was reasonably strong
- Reliability and validity was commensurate with other management tools

Abstract

Weak management is widely recognised as a key impediment to scaling-up coverage of health interventions and ensuring health systems are responsive to population needs. Yet there is scant evidence linking management practices in the public administration to effective health service delivery. We report on the development of a tool to measure management practices in India's district health bureaucracy. We first developed a conceptual framework based on a review of the literature and qualitative interviews with district public health managers. Across 16 management practices, we then drafted and piloted questions to be used with a scoring grid to evaluate process-orientated management practices. We implemented the tool in 34 districts of Maharashtra between April and July 2016, interviewing up to three district public health managers per district (n=99). Using rigorous psychometric methods, we assessed the acceptability, reliability and validity of the tool. We present three key findings. First, the tool was feasible to implement, response rates were high, and there were no missing data. Second, internal consistency of the tool was high and test-retest reliability was comparable with other management tools used in the literature. Third, there was evidence of validity. The number of staff with a management qualification was positively associated with better management practices. Factor analysis showed that one principal component loaded positively on all the management practices although there was little support for management sub-scales. These findings provide novel evidence on the psychometric properties of a tool designed to measure management practices in the public administration of a developing country. Our framework and tool provide the basis to examine associations between district health management practices and health service delivery, and test the effectiveness of management strengthening interventions in India's public health sector.

1. Introduction

Weak public service delivery has long been regarded as a key obstacle to ensuring widespread coverage of essential health interventions (Travis et al., 2004). Nowhere is the issue more salient than India, where the state has struggled to deliver basic public services to its population, despite the presence of elite national institutions and a highly educated top brass of public administrators (Pritchett, 2009). This is perhaps best reflected in the absenteeism of frontline health workers in the public sector, estimated at 40 percent (Muralidharan et al., 2011).

One reason for the current situation is possibly poor managerial quality in the public administration. Weak management is widely recognised as a key impediment to scaling-up coverage of health interventions (Mangham et al., 2010) and ensuring health systems are responsive to population needs (de Savigny et al., 2009). Yet there is a dearth of evidence linking practices in the public administration to effective service delivery and outcomes (Goldfinch et al., 2012). With a few exceptions (Rasul et al., 2018), much of the literature on management has focused on private firms or service delivery organisations, such as hospitals, schools and universities (Bloom et al., 2014; Bloom et al., 2007; McCormack et al., 2014).

In health systems and policy research, management has received little attention. Management is almost absent in commonly used frameworks on health system performance, falling under broader notions of “stewardship” and “governance” (WHO, 2007b). Most research on health systems is framed around the “hardware”, with limited attention given to management and other health system “software” that shape the delivery of health services (Sheikh et al., 2011). One notable exception is recent qualitative research on the everyday resilience of district health systems and managerial responses to challenges (Gilson et al., 2017).

We embarked on a project that aimed to study the relationship between management practices in the district health bureaucracy and the delivery of health services in India. As part of the research, we developed a tool to quantitatively measure management practices across the district health offices of Maharashtra. In this paper, we present a detailed account of how the tool was developed and report on its reliability and validity. These methodological details are important because of the inherent challenge of assessing a multidimensional concept such as management in complex public sector organisations. We focused on the district because it is the primary unit entrusted with implementing policy and ensuring effective primary care service delivery in India.

2. Literature on management

2.1 Defining management

There are various bodies of the literature that speak to the question of how to conceptualise management. The first body of literature presents various frameworks of how to classify management functions in the health sector. A useful starting point is the definition given by Vriesendorp et al (2010) in which health management is described as continuously developing the potential of an organisation to transform human and financial resources and other inputs into improved services and better health. The literature consistently emphasises two dimensions: managing (planning and using resources efficiently to produce intended results) and leading (mobilising others to envision and realize a better future) (Daire et al., 2014; Vriesendorp et al., 2010). Management practices are the set of processes of planning, budgeting, organising, staffing, controlling and problem solving (Dorros, 2006; Kotter, 2001), in relation to the management of governance, human resources, financial resources, supplies and medicines, and information (Vriesendorp et al., 2010). The World Health Organisation delineates four dimensions of good leadership and management (number of well-trained managers, competencies, support systems, enabling work environment), making a distinction between managers and management practices (Egger et al., 2005; WHO, 2007a).

Of particular relevance to our study on district management is the idea of decision space, developed by Bossert (1998) in the context of decentralisation. The decision space approach provides a useful mapping of the functions and degrees of choice that might be transferred to local officials in the process of decentralisation. Functions include financing, service organisation, human resources, targeting and governance. A distinction is made between decision space that is governed by laws and regulations and actual or informal decision space that is defined by lack of enforcement such that officials can bend the rules or operate outside the limits of their authorised decision space.

A second body of empirical research is relevant because of the conceptualisation of management underpinning the measurement tools. The World Management Survey (WMS) represents the first systematic effort to collect data on representative samples of organisations and firms. The survey methodology, pioneered by Bloom and Van Reenen (2007), seeks to measure management in three broad areas – monitoring, targets, and incentives – with a focus on process-orientated practices that are universally considered “good”. The conceptualisation of management in this way has been influenced by notions of lean manufacturing techniques, key performance indicators, and best practice relating to promotion decisions. Some of the practices share similarities with other tools used to evaluate human resource management practices (MSH, 2012).

The WMS methodology provided the starting point for a recent study of management practices in the Nigerian civil service (Rasul et al., 2018). Adaptation of the assessment tool from private to public organisations took into account long-held perspectives on the importance of autonomy and delegation in public administration (Rose-Ackerman, 1986) as well as insights from ‘new performance management’, ‘new public management’ and ‘good governance’ agendas (Goldfinch et al., 2012; Mills et al., 2001; Minogue et al., 2000). The public administration literature highlights two broad dimensions: autonomy of middle and lower tier

bureaucrats; and performance based incentives. Extensions of the tool to cover management practices relevant to public sector management included adding additional questions on capacity building, flexibility, roles and delegation. This idea of autonomy – capturing the extent to which civil servants input into policy development and implementation processes – is closely related to Bossert's (1998) concept of decision space.

A third set of studies evaluating management interventions in health care provide some insights on how management has been conceptualised. An early study in the Gambia sought to strengthen district management by improving skills and resource management through better planning and coordination (Conn et al., 1996). An important insight was that effectiveness of the intervention was limited by the degree to which decision making was centralised. More recent studies have been conducted in Kenya (Seims et al., 2012) and Zambia (Mutale et al., 2017). These interventions drew heavily on the guidance given in Vriesendorp et al (2010), focusing on both leadership and management.

As a final remark, it is worth recognising that there is a broader literature on organisational performance that emphasises the importance of values and organisational culture (Gilson et al., 2004). In fact, much empirical work has been done in the measurement of organisational culture in health care, with a systematic review identifying thirteen instruments that have been used, typically in high-income settings (Scott et al., 2003).

2.2 Measuring management

The WMS tool has been used to collect data on management practices in firms worldwide (Bloom et al., 2014). The initial focus was on private manufacturing firms but the tool has subsequently been adapted to the measurement of management in hospitals, schools, universities, and the retail sector. Most recently, it has also been adapted to measure management practices of frontline service providers (Lemos et al., 2016) and civil service

organisations in developing countries (Rasul et al., 2018). Other management measurement tools have been used in various LMICs (McKenzie et al., 2016; Seims et al., 2012).

Survey methods used to measure management vary in terms of the type of interview, the nature of the questions and the scoring method. The standard WMS method is to interview respondents over the phone (Bloom et al., 2007). The benefit of this method is that it is possible to blind the interviewees to the fact that they are being assessed and to blind the interviewer to the characteristics of the organisation. In certain contexts, telephone interviews are challenging and face-to-face interviews are preferable, as has been done when the WMS tool has been applied in LMICs to the public sector (Lemos et al., 2016) and small firms (McKenzie et al., 2016). We are aware of one study that mailed the questionnaire to respondents for self-completion (Bloom et al., 2016a). Most studies interview an individual respondent, although group face-to-face interviews were used in the study of civil servants in Nigeria (Rasul et al., 2018).

There is variation in the nature of the questions used to elicit information on management practices in organisations (Bloom et al., 2016b). The WMS methodology uses mostly open ended questions whose answers provide the basis with which to evaluate the management practice (Bloom et al., 2007). The open-ended approach helps deal with the fact that some of the concepts are complex and require discussion and examples, but it does place more of a burden on the interviewer in terms of interpreting the responses. Other studies have used closed ended questions with answers recorded with categorical response options (Bloom et al., 2016a; McKenzie et al., 2016).

Converting responses from interviewees to a score is an important aspect of the methods. In the WMS methodology, the interviewer uses a scoring grid containing descriptors for each score to evaluate management practices (Bloom et al., 2007). In the adaptation of the WMS tool to the public sector of developing countries, a similar method is used except that two

interviewers score the management practices after the end of the interview based on their notes and reconcile any differences (Lemos et al., 2016). Studies that have used closed-ended questions must rank the responses from worst to best and then assign a value to each response. Finally, some studies have used subjective Likert scales to score responses (Bruhn et al., 2018). The standard approach to generating an overall score or index of management is to take an unweighted average of each item.

Tools used to measure management have not been well validated. The test-retest reliability of the WMS tools has been assessed in some studies, although imperfectly (Bloom et al., 2010a). Second interviews have been conducted with different managers within the same organisation but by different interviewers. Results from telephone interviews have been compared with those from face-to-face interviews of other managers within the same organisation (Grous, 2011). As a form of validation, numerous studies have examined associations between management practices and performance of the organisation.

3. Methods

3.1 Study setting

The study was conducted in the state of Maharashtra, India's second most populous state with 112 million people, of which 12.4 million live in Mumbai, according to the Indian Census 2011 (Office of the Registrar General & Census Commissioner, 2013). The state is divided into 6 divisions and 35 districts. GDP per capita in the state is 134,081 Rs (USD \$2,090) compared with the country average of 86,879 Rs (USD \$1354), making it one of the richer states in India. Under-five mortality is 29 deaths per 1,000 live births and maternal mortality is 68 deaths per 100,000 live births (International Institute for Population Sciences (IIPS) et al., 2016; Office of the Registrar General, 2016).

The Government of Maharashtra has adopted a decentralised structure similar to most other Indian states. Even though health is a state subject, most states follow a similar pattern of health care administration and management. This is largely because of a common planning framework, which is governed by the Planning Commission and the National Development Council, as well as the legacy of a common history of British colonial rule that laid the foundations of the health service bureaucracy. Further, the fiscal devolution of resources is determined by the central government and this is done through programmes, which are usually uniform across states.

The Ministry of Health and Family Welfare (MoHFW) in Maharashtra is divided into two departments, the Public Health Department and the Department of Medical Education and Drugs (see Appendix 1) [INSERT LINK TO ONLINE FILE]. Both these departments have a separate Minister and Minister of State and their Secretariat, as well as technical wings called Directorates. The district plays a key role in overseeing the delivery of rural health services and the implementation of health programmes.

The district health office is run by the District Health Officer (DHO) and a team comprising the Additional DHO, District Program Manager (DPM), district level programme managers and various support staff who administer the primary health care system of primary health centres and sub-centres.

The study received ethical approval from the Institutional Ethics Committee of the Indian Institute of Public Health in Gandhinagar (ref: TRC-IEC No. 31/2014) and the London School of Hygiene and Tropical Medicine, UK (ref: 8784).

3.2 Tool development

3.2.1 Conceptualising good management

Developing a tool to measure management requires having an idea of what good management looks like. Informed by the literature review, a number of principles guided our conceptualisation of management. First, we focused on management practices, rather than managers. While there is a literature on measuring leadership (Bandiera et al., 2017), we were primarily interested in organisational processes. Hence we did not attempt to capture what personality traits or qualities, such as inspirational leadership, constitute a good manager (Sharma et al., 2018). This was also for the pragmatic reason that information on processes and systems should be possible to capture given that there is an established literature on measuring management. Second, we gave priority to management practices for which there was some consensus on what constitutes good and bad management. In other words, we sought to evaluate, and not simply describe, the management practices in place. There is of course scope for legitimate debate on individual practices. The evidence is mixed, for example, on whether targets are motivating or demotivating and whether they encourage gaming behaviours that are detrimental to organisational performance (Cleary et al., 2013; Hood, 2006).

We were cognisant of the need to have a thorough understanding of the district public health bureaucracy in India, particularly its organisational structure, appointment processes, and culture (Purohit et al., 2016a; Purohit et al., 2016b; Purohit et al., 2014). To inform our thinking during this formative phase, we conducted qualitative interviews with district public health managers. Previous studies on management practices provided the starting point for developing a topic guide that explored the relevance of different dimensions of management, the language used by public health managers to describe their duties and roles, and the management systems of government. We conducted 12 in-depth interviews with public health managers in four districts in Maharashtra. Understanding of government systems and

processes was critical. To give one example, each health facility has a patient welfare committee, known as rogi kalyan samite (RKS), which is permitted to generate and manage funds locally. Frequent use of RKS funds for the local procurement of drugs is indicative of a poorly managed district drug supply chain.

These in-depth interviews as well as tools used previously in the literature informed the development of a first version of the management survey tool that contained questions on management practices structured around five broader dimensions of management found to be relevant: operations; performance monitoring; targets; people management; and autonomy. Multiple iterations of the tool were piloted with district public health managers in five districts of Gujarat to scrutinise further the relevance of each management practice, refine language, and develop a set of probing questions.

3.2.2 Management practices and scoring grid

The tool defined sixteen management practices, grouped into the five management dimensions, as shown in Figure 1. The complete tool is available in Appendix 2 [INSERT LINK TO ONLINE FILE]. The general approach of the tool followed Bloom et al (2007). Under each management practice, we asked a series of open-ended questions that required the respondent to elaborate beyond a simple yes or no answer, making the interview feel more like a conversation and helping respondents to be more at ease. Responses to the open ended questions provided the basis to quantitatively score the management practice between 1 (worst) and 5 (best). We evaluated each management practice with three questions such that a total of 48 responses were scored across the sixteen management practices. Table A1 [INSERT LINK TO ONLINE FILE] illustrates with six example management practices what the tool was seeking to test and the questions asked in interview.

The scoring options were defined using descriptors to guide interviewers towards an objective assessment of the management practice (see Appendix 2) [INSERT LINK TO ONLINE FILE].

This was one area in which the tailoring of the tool to the study setting was crucial. The definition of best practice needed to be applicable to district health administration in India and it had to be plausibly obtainable. We were concerned that had we used international norms of best practice in private sector firms, we would have recorded low scores with little or no variation in the quality of management across districts.

3.3 Data collection

3.3.1 Type of interview and respondents

We considered gathering data in a group interview with several managers in an organisation but dismissed this option because of the strong hierarchical relationships in the Indian government and the reluctance of junior staff to speak up in the presence of more senior colleagues. Instead we conducted face-to-face interviews with individuals. These were undertaken in private and respondents were assured of confidentiality of their responses through the informed consent procedure. Our judgement was that telephone interviews were not a viable option – they would have resulted in refusals and inaccurate responses.

The study was conducted in 34 districts of Maharashtra between April and July 2016. We did not include Mumbai which is the state capital. We sought to interview up to three different managers within each district office. Interviewing different respondents within each district office allowed us to capture information from someone junior enough to know actual day-to-day practices and someone senior enough to know and understand the broader context. Our piloting suggested that it was important to capture information from managers with different perspectives afforded by their roles since some managers were more or less informed about specific management practices.

Respondents were eligible for interview if they had been employed in the present post (either permanent or acting) for at least three months prior to interview. We approached the following

district public health managers, in order of priority: Chief District Health Officer (DHO); Assistant District Health Officer (ADHO); District Program Manager (DPM); Reproductive and Child health Officer (RCHO); and Quality Medical Officer (QMO). If any of the first three were not available for interview, we approached the fourth or fifth on the list.

We obtained the permission and support of the State Principal Secretary of Health to carry out the study. She provided a letter of support which was shown to each respondent when introducing the study. Teams were given standard guidance in how to schedule interviews and conduct them. In advance of arriving in the district, researchers contacted eligible respondents to schedule interviews. All interviews were voluntary and had a duration of about one hour. The most challenging aspect of obtaining interviews was securing the availability of the eligible respondent. Most were very busy but once they had committed to being interviewed the interviews ran smoothly.

3.3.2 Interview procedures

Interviews were conducted by field teams composed of two members, a primary interviewer in charge of leading the interview and asking questions, and a second interviewer instructed to take detailed notes throughout the conversation. Interviewers prepared all necessary materials to administer the survey before entering the location of the interview. The primary interviewer explained the purpose of the study and sought consent. The introduction to the study emphasised: confidentiality of the information provided, focus of the interview on actual practices and not on general functioning of government systems, request for honest and frank responses, and encouragement to discuss challenges and experiences faced by respondents.

The interview followed the sequence of questions in the survey tool. The scoring grid allowed the interviewer to score each management practice question on a scale from 1 (worst) to 5 (best). There was no scope for providing “don’t know” responses. The range of 1 to 5 was not intended to be a subjective scale; the scoring guidance provided an objective description of

what scores of 1, 3 or 5 meant. Although the guidance did not provide a description for score 2 and 4, interviewers were free to give any score on the 1 to 5 scale according to their best judgment of managers' responses. Interviewers were instructed to avoid using a score of 3 as a default in case they experienced difficulties in assigning a score. Instead, they were provided with instructions to probe respondents to get enough information to score practices.

In order to facilitate the scoring process, there were two versions of the tool. The first was the tool used during interview that contained a list of questions and a space for notes for each management practice; the second was a scoring version that was used by interviewers to score answers immediately after the end of the interview. This scoring version was kept hidden from the respondent for the duration of the interview. Both team members were responsible for scoring management practices at the end of the interview. The scoring guidelines were used to discuss and find agreement on scoring. In the early stage of the fieldwork, teams were sometimes assisted by a researcher, responsible for taking extensive notes, helping with facilitation, and advising interviewers if inaccurate scoring was identified.

3.3.3 Limiting survey bias

We employed a number of well-tested strategies to limit survey bias during data collection (Bloom et al., 2010b). On the respondent side, we interviewed up to three respondents per district, to limit the influence of any single respondent and reduce the amount of noise in the district level measure of management. Respondents were blinded to the scoring to limit bias that might arise if they had the impression they were being assessed. They were not informed their responses would be scored and the scoring was done confidentially out of sight.

Piloting of the tool suggested that respondents, particularly those in the most senior position, had a tendency to describe government management systems and policies that existed on paper when it was actual practices that we were after. This is similar to what has been referred to as the "public" and "private" face of individuals – the former representing how

people present their views to strangers, the latter representing what people divulge to trusted friends (Goffman, 1959). To get beyond the public face, interviewers were trained to use techniques to obtain more detail on actual experiences and practices in instances where the original questions did not elicit the necessary information. These included probing, asking for examples, and asking for direct personal experience to steer the conversation towards actual practices and strategies adopted (see Appendix 4) [INSERT LINK TO ONLINE FILE].

To limit interviewer bias, the scoring of management practices was based on exact descriptors across the range of scores in order to reduce the role for subjective interpretation. We hired interviewers with good knowledge of management in the district health administration and conducted intense training and mock interviews over a one week period to calibrate scores between different interviewers as a means to improve consistency. Finally, both interviewers were responsible for scoring. After the interview had been completed, the interviewers would refer to their notes and agree on a score for each question. Where an individual score could not be agreed, further input was sought from a member of the core research team.

3.4 Psychometric performance

We undertook a range of approaches to assess the acceptability, reliability and validity of the management measurement tool. We were guided by the framework presented in Smith et al (2005) that recommends a number of commonly used psychometric tests to determine whether a measurement tool provides scientifically credible information. Tests were performed on individual items as well as the summary score, calculated as an unweighted average of the responses to all the questions, hence scaled between 1 and 5. Assessment of the psychometric performance of the tool was done ex post, not to inform the development of the scale.

First, we carried out item analysis tests and assessed acceptability of the tool. Item analysis identifies questions (items) that have weak psychometric performance based on the following tests: unrotated principal component factor analysis to determine whether items are measuring a single factor; the extent of missing data; maximum endorsement frequencies as indicated by the proportion of respondents endorsing each response category; floor and ceiling effects as indicated by the proportion of respondents endorsing the maximum and minimum response categories; the extent of item redundancy as indicated by inter-item correlations; and internal consistency as measured by item-total correlations. Acceptability refers to the quality of the data in terms of completeness and score distributions. We examined the extent of missing data as well as ceiling and floor effects in the summary score. Table 2 summarises the tests and criteria used.

Second, we examined the reliability of the tool. Reliability concerns the internal consistency and test-retest reliability of the data. We assessed the former – the extent to which items comprising a scale measure the same construct – using Cronbach’s alpha. We assessed the latter by measuring the within district variation between respondents with the intraclass correlation. An analysis of variance model is used to estimate the intraclass correlation. Because this test is performed on data from *different* respondents within the same district, it is not intended as a pure test-retest reliability measure. However, it remains highly informative given that the purpose of the tool was to capture management practices at the district level.

We further investigated the reliability of the tool by examining whether there were systematic differences in the overall management score between respondents within the same district. Specifically, we analysed whether characteristics of the respondent were associated with the overall management score using a linear mixed effects model that allowed for district random effects. Characteristics included were the job title of the respondent, whether the position was permanent, whether the appointment was through an internal promotion or external process,

gender, tenure in the current post (years), and tenure working for the government in the district (years).

Third, we present evidence on the construct validity of the tool. We examined whether management practices were correlated with the number of staff in the district health office with a management qualification. We defined a management qualification as either a Master of Business Administration (MBA) or a Post Graduate Diploma in Public Health Management (PGDPHM). We hypothesised that, conditional on the total number of staff, districts with a higher number of staff with a management qualification would have better management scores. Using the same linear mixed effects model as previous, we ran a regression of the summary management score on the number of district staff with a management qualification and the total number of district staff. We included controls for characteristics of the respondent. We also conducted exploratory factor analysis on the 16 management practices to assess the importance of individual practices and to determine the extent of support for subscales.

It is important to note that we used responses to all the questions when generating an overall measure of management. In other words, the item analysis tests described previously were used to make an assessment of the psychometric performance of individual items, not to eliminate items in the development of the overall score. We do, however, examine the sensitivity of our results to using an overall management score that is based only on those questions that performed strongly in the item analysis.

4. Results

4.1 Descriptive statistics

We conducted 99 interviews in the 34 study districts. We interviewed the target number of three respondents in 31 (91%) districts, and two respondents in 3 (9%) districts. Table 1

shows the characteristics of the respondents. They were on average 40 years of age and had been in post for three years while working in the district government for almost five years. Most respondents (87%) were men. The majority of interviews were with the three most senior managers in each district; in six districts the Chief District Health Officer was not available for interview.

Almost two-fifths of respondents (39%) were in a permanent position, with the remaining 60% of respondents temporarily covering a position higher than their current grade (acting) or working in their position under a fixed term contract. Most appointments (78%) were made directly, which means that officials were recruited through an external process to fill a specific position rather than being promoted internally based on seniority and eligibility by the Departmental Promotion Committee (DPC). The most common highest qualification was Doctor of Medicine (MD), followed by Master of Business Administration (MBA) and Diploma in Public Health (DPH).

The mean overall management score was 3.1. Districts scored highest on monitoring (3.6), followed by operations (3.5), autonomy (3.0), people (2.5) and targets (2.2), providing an indication of the better performing dimensions of management. The distribution in the overall summary score was reasonably narrow (standard deviation 0.36), with few scores below 2.5 (5 respondents) and above 4.0 (3 respondents).

4.2 Item analysis and acceptability

Table 2 presents the results of the psychometric tests. The first set of results under item analysis identifies questions with poor psychometric performance. The loadings on the first principal component analysis factor ranged from 0.004 to 0.70. Of the 48 items, 16 items failed to load more than 0.3 on the first principal component analysis factor. The inter-item correlation was less than 0.75 for all items such that no item failed the item redundancy test.

The item-total correlation was less than 0.25 for 15 out of 48 items. No item failed the maximum endorsement frequency test and no item had more than 5% missing data. There were no observations with missing data and there was a reasonably even distribution in the score. There were no floor or ceiling effects in that no observation had the minimum value of zero or the maximum value of five.

4.3 Reliability and within district variation

The summary management score showed good internal consistency. Cronbach's alpha for the overall score was 0.904, well above the standard threshold of 0.7. The district intraclass correlation was 0.52, indicating that more than 50% of the variation in management practices was between districts. This suggests reasonable agreement between respondents and test-retest reliability, and gives us confidence that the reported scores contain a strong signal of actual management practice. Measurement error is nonetheless an important issue. We presume that much of the 48% of the variation in management practices that is due to differences between respondents within the same districts reflects survey measurement error.

Table 3 reports the coefficients and residual intraclass correlations from three models examining how the overall score differed between respondents in the same district. In the first model, with district random effects only, the intraclass correlation was similar to what was reported previously. The second model included the position of the respondent as covariates and indicates systematic differences in management practices according to the position of the respondent. Management practice scores based on interviews with Chief DHOs were significantly higher (equivalent to 0.65 standard deviations) than those from interviews with Additional DHOs. The positions of other respondents were not associated with the management score. The third model included additional characteristics of the respondents and their job. The coefficient on Chief DHO remained positive and statistically significant. Whether the respondent had a permanent position and was appointed through the internal

promotions process were significantly associated with better reported management practices. Gender was also significant, with male respondents associated with worse reported management practices. Finally, tenure in the current post was associated with a higher management score. The results remained largely unchanged when we used an overall score of management based on the reduced set of 32 items that survived the item analysis tests (Table A2 to A4 in Appendix) [INSERT LINK TO ONLINE FILE] or an overall score based on the primary factor from factor analysis (Table A5 to A6 in Appendix) [INSERT LINK TO ONLINE FILE].

Given that our tool sought to measure management practices at the district level, the results in Table 3 suggest that some of the measurement error was systematic. As shown by the residual intraclass correlations, as we accounted for more respondent characteristics, the share of the variation in management practices driven by differences across respondents within districts decreased.

4.4 Validity

Table 4 reports the results showing that the number of staff with a management qualification was positively associated with better management practices. In the first model that allowed for random effects at the district level, adding one additional member of staff with a management qualification in the district health office was associated with an increase of 0.12 in the management score ($p=0.002$). In the second model, the coefficient on the number of staff with a management qualifications remains strongly positive and highly significant ($p<0.001$) when respondent characteristics are included. Similar results were obtained when used alternative approaches to the overall score of management (Table A2 to A6 in Appendix) [INSERT LINK TO ONLINE FILE].

Exploratory factor analysis on the 16 management practices showed that one principal component loaded positively on all the practices, explaining 36% of the variance (Table A7) [INSERT LINK TO ONLINE FILE]. This suggests that there is common factor of “good management” (Bloom et al., 2007). DHOs that perform well on one management practice tend to perform well on all management practices. A second principal component accounted for a further 10% of the variance, but the pattern in the factor loadings is difficult to interpret and conceptually unclear.

5. Discussion

In this paper we described the development of a tool to measure management practices in India's district public health administration. The process was systematic, informed by a conceptualisation of what good management looks like in this specific context, qualitative interviews with district health managers, and extensive piloting of the tool. We then collected data in every district of Maharashtra, interviewing up to three district health managers in each district. The data collection methods were carefully tailored to the study context and documented in detail. Finally, we assessed the acceptability, reliability and validity of the tool.

We discuss in turn a number of key findings. First, it was feasible to implement the tool. The response rate was very high and there was almost no missing data. However, this should not obscure the fact that such research, from a practical perspective, was challenging. It required close engagement with and considerable buy-in from government. Face-to-face interviews were the only feasible option and getting the time of busy public health managers required patience. Our experience also suggested that there is balance to be struck when hiring interviewers. On the one hand, we wanted interviewers with sufficient experience and knowledge of the district health system who could be credible in the eyes of interviewees. On the other hand, we did not want interviewers to personally know the public health managers working there as to generate bias.

Second, the results from the item analysis indicated that overall psychometric performance of the tool was reasonably strong although some items were identified as being redundant. One third of the items failed to load more than 0.3 on the first principal component analysis factor. These items could be regarded as candidates for elimination in the development of the overall summary score of management practices. While our subsequent analyses were based on a summary score that used all the items, we showed that the results were not sensitive to a score based on the reduced set of items. Decisions regarding the retention and elimination of

items should give consideration to content validity, and specifically the trade-off between adhering to the conceptual framework and better psychometric properties arising from item reduction (Smith et al., 2005). To the best of our knowledge, this study is the first to report on the item response properties of a scale used to measure management practices.

Third, the results showed that the reliability of the tool was commensurate with others used in the literature and there was evidence of validity. Internal consistency of the tool was found to be high. The ICC of 0.52 showed reasonable test-retest reliability. In the WMS, a second interviewer was used to interview a second plant manager in the same firm showing that the correlation between the two interviews was 0.51 (Bloom et al., 2010a). Using a modified management practices tool, another study reports a correlation of 0.55 in the management scores from two independent respondents in the same firm (Bloom et al., 2016a). In a study of business practices, the correlation in scores measured twice in the same firms over a one year period was 0.59 (McKenzie et al., 2016). While none of these test-retest reliability measures are ideal, they serve to place our results in context.

By examining within district variation in the management score, our study goes beyond the literature in being able to identify potential sources of measurement error. Most notably, the position of the respondent seemed to matter. Management scores from the Chief DHO were systematically higher than other respondents. Multiple interpretations of these data are possible but we believe that Chief DHOs responded by describing the management practices that existed on paper, despite our best efforts to push them towards describing actual practices in place. In other words, their responses were overly optimistic, driven by social desirability bias. The implications of these findings are twofold. It is important to interview respondents who are not so senior as to be unaware of (or unwilling to report) actual day-to-day practices. Respondent characteristics should be included as noise controls in further uses of the data to help remove some of the measurement error in the management score.

With regards to validity, we found that management practices were strongly correlated with the number of staff in the district health office with a management qualification. These findings are consistent with those of Bloom et al (2007), who also found that firms with higher skilled staff, as proxied by management qualifications, had better management practices. Factor analysis showed that one principal component loaded positively on all the management practices although there was little support for management sub-scales.

The study had a number of limitations. The tool did not seek to measure leadership practices which, for example, have been shown to be important for staff satisfaction amongst nurses (Cummings et al., 2010). On a related note it is interesting that the leadership literature underscores the point that task-oriented styles are associated with worse performance than relational styles (Bandiera et al., 2017; Cleary et al., 2018; Cummings et al., 2010). There is likely a trade-off between having a tool that is generalisable and one that is sufficiently tailored to the context as to be reliable and valid. We developed the tool for the purposes of measuring management practices in Maharashtra. We believe that the tool could be used to measure management practices in the district health offices of other Indian states with minimal adaptations. Much more work would need to be done to adapt the tool to other countries, although the general framework could be maintained. The validity of the tool was only touched upon. We discuss below future research that could better assess the validity of tool but note that more extensive validation is challenging because there is no gold standard measure of management to assess criterion validity.

There are a number of directions in which we intend to take this research. Future analysis will seek to examine associations between district health management practices and health service coverage in the population by combining these data with large representative household datasets. Findings from such research will provide novel evidence on the question of whether district management matters for population service coverage. Other directions include further work to validate the management practices tool by examining known group

differences and associations with measures of organisational performance. In contrast to private firms in which performance is easily measured by profitability, survival, and market value, public sector organisational performance is much harder to gauge and alternative measures must be sought, such as project completion and budget execution rates. We envisage expanding data collection on district health management practices to other states in India, incorporating questions on leadership and eventually using the tool to test the effectiveness of management strengthening interventions.

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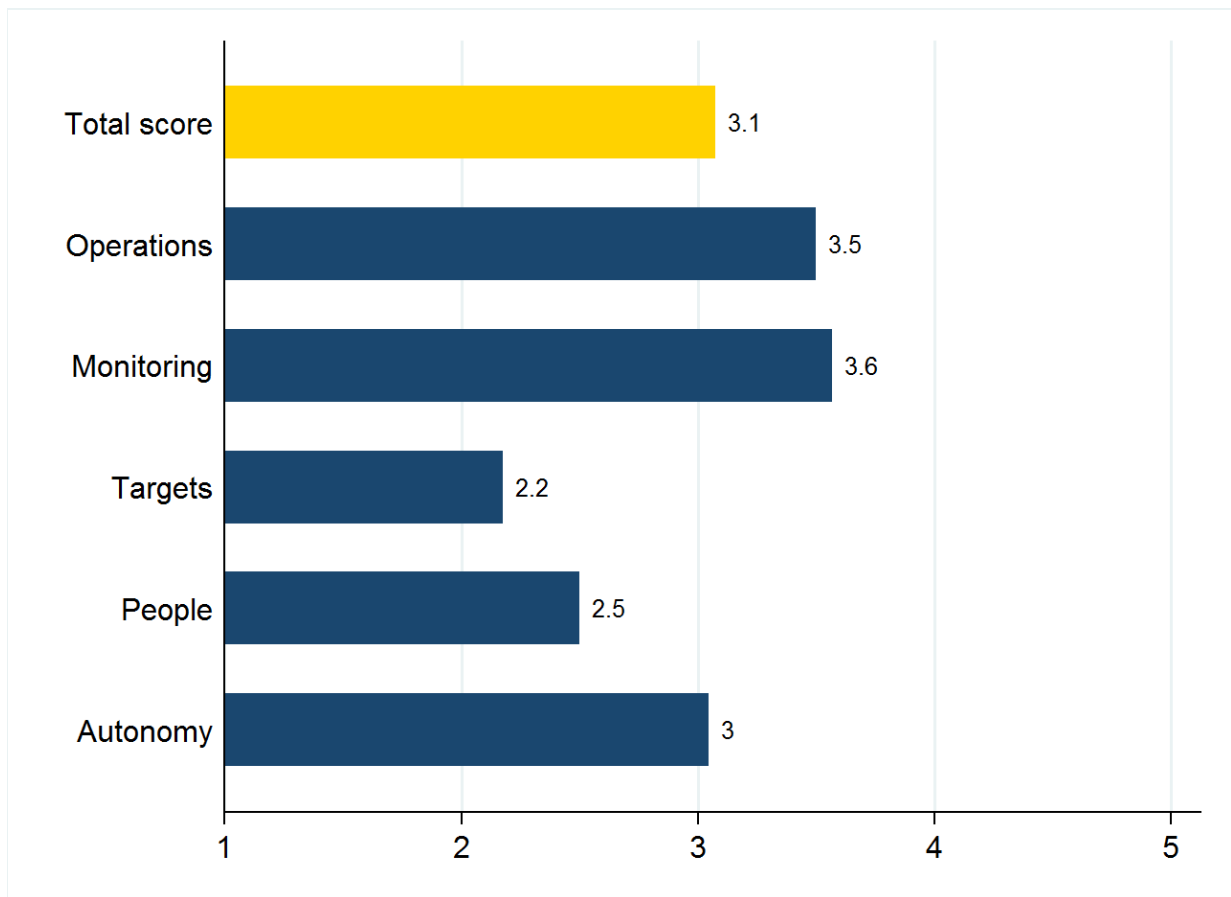
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Figures

Figure 1 Management practices and broader dimensions of management



Figure 2 Management practice score by dimension



Tables

Table 1 Descriptive statistics on respondent characteristics

Variable	n / N (%) or mean (SD)
Age (years)	40.2 (7.5)
Tenure in post (years)	2.8 (2.5)
Tenure working in district (years)	4.6 (5.2)
Gender	
Male	86 / 99 (87%)
Female	13 / 99 (13%)
Position	
Chief District Health Officer (DHO)	28 / 99 (28%)
Additional District Health Officer (ADHO)	23 / 99 (23%)
District Program Manager (DPM)	32 / 99 (32%)
District Reproductive and Child Health Officer (DRCHO)	14 / 99 (14%)
District Surveillance Officer (DSO)	2 / 99 (2%)
Type of position	
Permanent	39 / 99 (39%)
Acting position	28 / 99 (28%)
Contract	32 / 99 (32%)
Appointment	
Direct	77 / 99 (78%)
Departmental Promotion Committee	22 / 99 (22%)
Highest degree	
MD	41 / 99 (41%)
Master of Business Administration	19 / 99 (19%)
Diploma in Public Health	15 / 99 (15%)
PhD	2 / 99 (2%)
Master's in Public Health	5 / 99 (5%)
Other	17 / 99 (17%)

Table 2 Psychometric tests

Psychometric property	Criteria	Result	Failed items
Item analysis	All items should load on first principal component analysis factor >0.3	16/48 failed	5c, 6b, 8a, 8c, 9a, 9b, 10a, 10c, 11b, 11c, 12a, 12b, 13a, 16a, 16b, 16c
Item analysis	Inter-item correlation should be <0.75	No item failed	
Item analysis	Item-total correlation should be >0.25	15/48 failed	5c, 6b, 8a, 9a, 9b, 10a, 10c, 11b, 11c, 12a, 12b, 13a, 16a, 16b, 16c
Item analysis	Maximum endorsement frequency (MEF) should be <80% (includes floor and ceiling effect <80%)	No item failed	
Item analysis	Missing data should be <5%	No item failed	
Acceptability	Missing data of summary score should be <5%	No missing observations	
Acceptability	Floor and ceiling effect of summary score <10%	% floor: 0 observations % ceiling: 0 observations	
Reliability	Cronbach's alpha for summary score >0.7	0.9040	
Reliability	District intraclass correlation for summary score	0.5215	

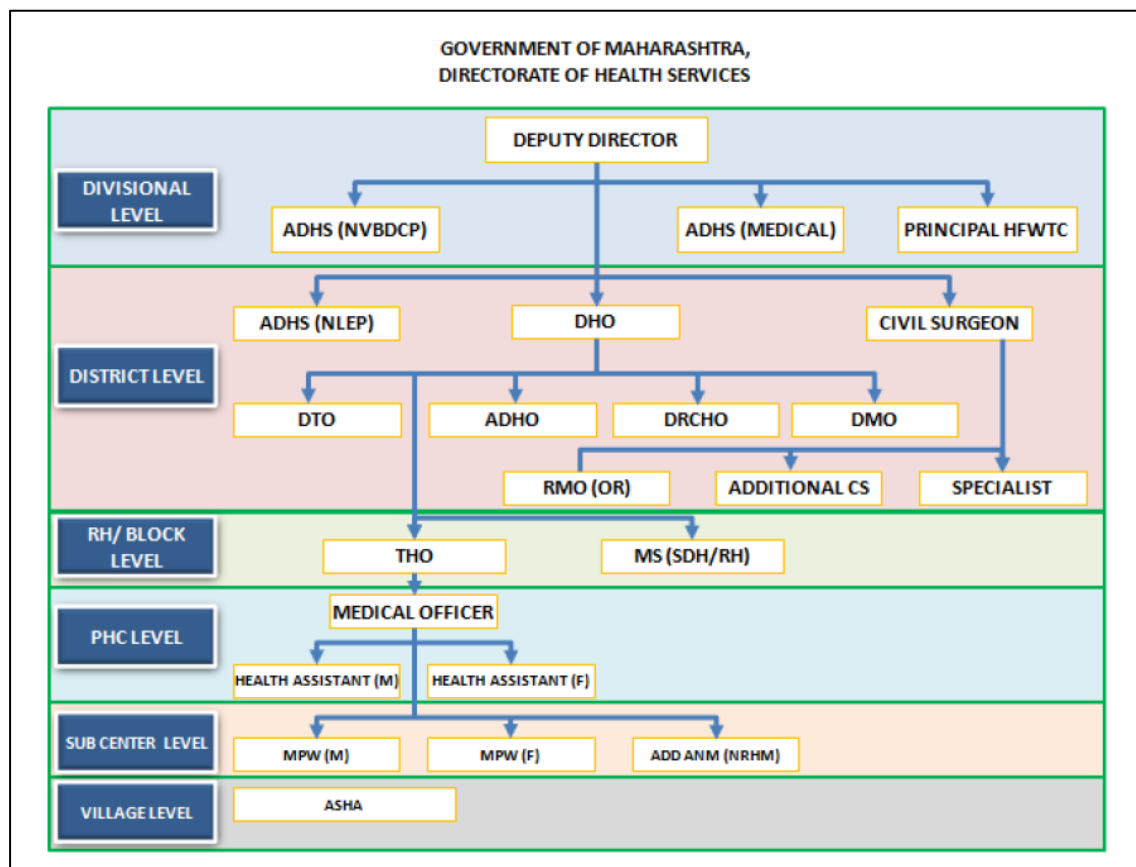
Table 3 Management score and respondent characteristics

	Model 1		Model 2		Model 3	
	Coefficient	p value	Coefficient	p value	Coefficient	p value
Chief District Health Officer (CDHO)			0.236	<0.001	0.244	<0.001
District Program Manager (DPM)			-0.003	0.955	0.072	0.423
District Reproductive and Child Health Officer (DRCHO)			0.066	0.410	0.131	0.097
District Surveillance Officer (DSO)			-0.242	0.188	-0.076	0.668
Permanent position					0.161	0.040
Departmental promotion committee appointment					0.194	0.018
Age					-0.003	0.484
Male					-0.172	0.022
Tenure in post					0.021	0.042
Tenure in district					-0.0097	0.102
Residual intraclass correlation	0.51		0.63		0.65	
Districts	34		34		34	
Observations	99		99		99	

Table 4 Management score and management qualifications

	Model 1		Model 2	
	Coefficient	p value	Coefficient	p value
Number of staff in district health office	0.0048	0.289	0.0057	0.166
Number of staff with a management qualification	0.123	0.002	0.136	<0.001
Chief District Health Officer (CDHO)			0.239	<0.001
District Program Manager (DPM)			0.100	0.258
District Reproductive and Child Health Officer (DRCHO)			0.164	0.036
District Surveillance Officer (DSO)			-0.100	0.566
Permanent position			0.173	0.024
Departmental promotion committee appointment			0.230	0.004
Age			-0.002	0.633
Male			-0.164	0.027
Tenure in post			0.024	0.018
Tenure in district			-0.012	0.051
Residual intraclass correlation	0.40		0.51	
Districts	34		34	
Observations	99		99	

Appendix 1 DHO structure



ADHO - Additional District Health Office
 ADHS - Assistant Director Health services
 DHO - District Health Officer
 DTO - District Tuberculosis Officer
 DRCHO - District Reproductive & Child Health Officer
 DMO - District Malaria Officer
 RMO(OR) - Residential Medical Officer (Outreach)
 THO - Taluka Health Officer
 MS(SDH/RH) - Medical superintend (Sub Divisional Hospital/Rural Hospital)
 MPW - Multi Purpose Worker

Appendix 2 Tool

District Health Survey of Management Practices 2016

Interview Information		Manager Information	
District ID:	_____ [USE CODING SHEET]	Position of manager	_____ [CURRENT POSITION]
District:	_____ [NAME OF DISTRICT]	Permanent or in-charge:	_____ [INDICATE PERMANENT OR IN-CHARGE]
First interviewer:	_____ [FULL NAME]	Direct or DPC appointment:	_____ [RELATES TO OFFICIAL POSITION]
Second interviewer:	_____ [FULL NAME]	Highest degree:	_____ [WRITE OUT IN FULL]
Third interviewer:	_____ [FULL NAME]	Degree obtained from:	_____ [NAME OF UNIVERSITY OR COLLEGE]
Date:	_____ [DD/MM/YYYY]	Place of degree:	_____ [PLACE OF UNIVERSITY OR COLLEGE]
Start time:	_____ [24 HOUR CLOCK]	Tenure in current post:	_____ [INDICATE WHETHER MONTHS OR YEARS]
End time:	_____ [24 HOUR CLOCK]	Tenure in district:	_____ [INDICATE WHETHER MONTHS OR YEARS]
Language of interview:	_____ [MAIN LANGUAGE OR MIXED]	Gender:	_____ [MALE, FEMALE]
Agreed to provide consent: <input type="checkbox"/>		Age:	_____ [YEARS]
		Result of interview:	_____ [REFUSED, PARTIAL, FULLY COMPLETE]

A. Management Practices

1) **Use of human resources**

Tests whether staff roles are clear and staff are used effectively

a. How do DHO staff know what their job involves? Describe the induction process?			1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: Staff do not know what their job entails	Score 3: Staff have some awareness of their role and responsibilities but any induction process is ad hoc	Score 5: All staff go through a rigorous induction process in which they learn what is their role and responsibilities					
b. Do you have flexibility in assigning responsibilities to different staff in the DHO? What happens when different programmes under the DHO become busier than others?			1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: There is no flexibility in shifting staff to busy programme areas when the need arises	Score 3: Staff may move when particular programmes are busy but often in an uncoordinated manner	Score 5: Shifting staff to busy programme areas is done routinely in a coordinated manner					
c. How do you monitor whether health workers regularly report to work at health facilities?			1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: There is no effective monitoring of attendance of health workers (eg. attendance sheet mentioned only)	Score 3: There is an effective system of monitoring health worker attendance but it only covers some health facilities	Score 5: Health worker attendance is continually monitored using an effective system (eg. random phone calls, extensive random spot checks, biometric system)					

2) **Drug supply chain management**

Tests whether the drugs supply chain system functions efficiently

a. How does the drug supply chain system work? Where in the process are there delays?			1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: Drug supply chain system is poorly understood and incredibly slow	Score 3: Drug supply chain system is understood by senior staff only. Delays in supply chain system occur	Score 5: Drug supply chain system is well understood by all staff. The supply chain system is fast and transparent					
b. How often are RKS funds used for procurement of drugs and supplies in health facilities?			1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: The central system of procurement at the district level is side-stepped using local procurement with RKS funds	Score 3: Local procurement using RKS funds does happen but the district system of procurement is mostly used	Score 5: There is no or limited procurement using RKS funds because the district system functions efficiently					
c. How well does the e-Aushadhi system for the management of drug stocks work?			1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: The e-Aushadhi is not used at any level. Almost all health facilities fail to input information into the system	Score 3: The e-Aushadhi is used by facilities but on an ad hoc basis. Some facilities fail to input the information needed to assess drug stock levels	Score 5: The e-Aushadhi system is widely used by health facilities on a regular basis. The DHO procures and distributes drugs using the information in the system					

3) Quality of care and standardization

Tests whether there is a concerted effort to improve the quality of service delivery through adherence to standard guidelines

a. What are the mechanisms for identifying problems in the clinical quality of care (treatment of patients) in PHCs?		1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: Problems are never exposed. Staff are not aware of any problems in the quality of care in PHCs	Score 3: Senior staff are informed about problems through supervision and ad hoc reporting	Score 5: Exposing problems in quality of care in a systematic way is integral to every member of staff's responsibility. There is a specific problem reporting system used by all staff				
b. Are national programme guidelines on quality of care (treatment protocols) available and used in PHCs? Give an example?		1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: There is no awareness of national guidelines or standards and they are not used by staff	Score 3: National guidelines are widely circulated but are not commonly used for various reasons (eg. too complicated, lack of training)	Score 5: National guidelines are widely available and used; the DHO goes to great length to ensure they are implemented				
c. How does the DHO office ensure that national programme guidelines (treatment protocols) are actually followed?		1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: There is no monitoring of whether guidelines are put into practice since there are no tools and resources for such monitoring	Score 3: There is some monitoring of whether guidelines are followed but mainly it only becomes an issue when there is an incident or problem	Score 5: Adherence to national guidelines is carefully monitored using tools and forms designed for the task. Staff report if someone is not following standards				

4) Supervision

Tests whether supervision of health providers is used as an effective tool for problem solving

a. What do you do during a supervision visit to a health facility? Tell me what happened in your last supervision visit?		1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: Supervision is used for no clear purpose	Score 3: A couple of activities related to quality assurance, reviewing performance, and identifying problems are mentioned but these do not appear well structured	Score 5: Supervision routinely involves a comprehensive set of well-structured activities to do with quality assurance, reviewing performance, and identifying problems				
b. Tell me about your reporting mechanism for supervision visits? Who receives the reports?		1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: There are no formal reporting tools. Reporting on supervision does not happen	Score 3: There are supervision tools available but formal reporting is sporadic	Score 5: There are supervision tools available and formal reporting of supervision is routinely done				
c. What process is in place to ensure follow-up actions are taken after identifying problems during a supervision visit?		1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: Rarely is there follow-up action. Problems remain unresolved / same problems come up repeatedly	Score 3: Follow-up actions are taken on an ad hoc basis. Problems take some time to get resolved	Score 5: There is a process of follow-up actions being taken after every supervision visit. Supervision regularly identifies and addresses problems				

5) Financial management

Tests whether budgets are regularly monitored and well executed

a. How often is the financial position of the district reviewed? Who is involved? Is the system used to record financial transactions computerised?			1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: There is no awareness of the financial position of the district. Recording of financial transactions is purely paper-based	Score 3: Financial position is reviewed monthly amongst a few individuals. Accounting is computerised but can only report on expenditures several months previous	Score 5: Financial position is reviewed in detail every month and communicated to all staff. Accounting is fully computerised with expenditure monitored almost in real-time					
b. How long and how complicated is the process of making a financial transaction for a routine activity? Does it delay activities?			1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: The process is far too complicated. Financial transactions are so slow most activities are severely delayed or never happen.	Score 3: The process is quite simple but only well understood by a few staff. The process of making financial transactions delays some activities but most go ahead as planned.	Score 5: The process is well understood by all staff. The process of making financial transactions does not delay any activities					
c. To what extent did the DHO spend all of its budget last year?			1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: There is no awareness of whether the budget is spent or the DHO routinely fails to spend most of the budget (less than 75%)	Score 3: DHO spends most of the budget each year (85% to 90%)	Score 5: DHO spends all the budget each year (100%)					

6) Performance tracking

Tests whether performance of the district is tracked using meaningful metrics with appropriate regularity

a. What indicators are used to track the performance of the district? Are some indicators more important than others?			1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: Only indicators of patient volume are tracked	Score 3: There are a large number of indicators, not only indicators of patient volume, that are tracked but there is no clear sense of what indicators are most critical	Score 5: There are 5-7 key indicators that are tracked and can be recited off the top of senior management head. They cover key aspects of performance (ie. service coverage, mortality, quality of care, disease outbreaks, financial budget)					
b. How frequently are the data on these indicators available at the DHO?			1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: Data are tracked on a monthly basis but take at least six months to be available	Score 3: Data are tracked on a monthly basis but take three months to be available	Score 5: Data are tracked on a monthly basis at least and are available within two weeks of the previous month					
c. Do these data get fed back down to health facilities? If I were to visit a health facility, how could I tell how well it is performing?			1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: Data compiled at the DHO are not shared with health facilities. Health facilities do not display any performance data	Score 3: Data compiled at the DHO are shared with health facilities in monthly meetings. Health facilities display only basic information regarding patient volume	Score 5: Data compiled at the DHO are shared electronically with facilities each month. Health facilities display information regarding key aspects of performance using appropriate visual displays (eg. charts or dashboards)					

7) Performance review

Tests whether performance of the district is reviewed with appropriate rigour and communicated to staff

a. How do you review your main district performance indicators? Can you tell me about a recent review meeting?		1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: Performance is reviewed once a month in an un-meaningful way (e.g. only success or failure is noted)	Score 3: Performance is reviewed once a month with basic analysis of indicators tracked. Both successes and failures are identified	Score 5: Performance is reviewed every month, based on a comprehensive analysis of the indicators tracked				
b. Who gets to see the results of the review? Is a review report made?		1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: Results are shared only verbally. No formal report is made	Score 3: Results are communicated in the form of meeting minutes highlighting key results on performance	Score 5: Results are communicated widely using a formal report with a range of visual tools such as charts				
c. How are results of the review used to inform follow-up actions		1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: There are never any follow-up actions in response to a performance review	Score 3: Follow-up actions are noted in minutes but there is no formal timetable or responsibilities assigned	Score 5: Written follow-up actions are developed with responsible persons identified and informed				

8) Addressing district performance (consequence management)

Tests whether differing levels of performance (NOT personal but process based) lead to different consequences

a. Let's say you've agreed to follow-up actions at one of your meetings, what would happen if the actions were not taken?		1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: Failure to achieve agreed objectives does not carry any consequences	Score 3: Failure to achieve agreed results is tolerated for a period before action is taken	Score 5: A failure to achieve agreed targets drives an intensification in resources devoted to identified areas of weakness, retraining or shifting of staff				
b. How long does it take for a major problem with the functioning of a health facility to be solved? Can you give a recent example?		1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: It would take at least one year for any action to be taken	Score 3: It would take around six months for action to be taken	Score 5: Action is taken immediately after a problem is identified				
c. How do you ensure that a major problem in the functioning of a health facility does not keep happening? Do you have any system which records problems exposed and how they were addressed?		1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: No measures are taken to ensure repeated failure does not happen. The solution to a problem is not recorded and no manager would be aware they faced a similar problem previously	Score 3: Senior staff make a note of past problems and how they were solved. However, there is nothing done to prevent repeated failure / problems	Score 5: There is a reporting system which details all problems and responses. All staff have access to the reporting system and make regular use of it				

9) Types of targets and difficulty

Tests whether targets cover a sufficiently broad set of metrics defined by the district

a. How are your targets set? How tough are your targets to achieve – are you pushed by them?		1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: Targets are set without any clear thought or rationale. Targets are either far too easy or impossible to achieve	Score 3: In some areas, targets are demanding yet feasible but in other areas they are either too easy or impossible to achieve	Score 5: Targets are genuinely demanding yet feasible. In most cases targets are met despite being challenging				
b. How often are targets revised because they are too easy or too hard?		1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: Targets that are consistently too easy or too hard are never revised to be more realistic	Score 3: Targets are sometimes reviewed and adjusted accordingly to make them easier or more challenging	Score 5: Targets are constantly being reviewed in consultation with relevant staff in the DHO				
c. In what areas does the district, rather than the state, set targets itself?		1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: Targets are focused solely on those set by the state government. There is no effort to broaden the set of metrics by the DHO	Score 3: A small number of targets are determined by the district. They are a balanced set of targets covering health outcomes, health service utilisation, quality of care, and financial balance	Score 5: Numerous targets are set locally by the district. They are a balanced set of targets covering health outcomes, health service utilisation, quality of care, and financial balance				

10) Time horizon of targets

Tests whether the DHO has short- and long-term targets that are linked

a. Do you set short-term (one or three month) targets? Give me some examples?		1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: No short term targets are set by the district	Score 3: There are short term targets set by the district but these are fairly narrow in scope	Score 5: There are short-term targets set by the district that are comprehensive in scope and cover multiple time periods (eg. one month and three month targets)				
b. Do you set your own short term targets independently of the one-year targets set by the state? Could you meet all your short-term targets but miss your targets set by the state?		1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: The entire focus of staff is on achieving the state set one-year targets	Score 3: Targets are set independently and therefore are not necessarily linked to one another. It is possible to meet short-term targets and miss state set targets but it is not inevitable	Score 5: State set targets are translated into specific short-term targets so that short-term targets become a 'staircase' to reach the state set one-year targets				
c. Does the district have any long-term targets beyond one year? Give me some examples?		1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: There are no longer-term targets beyond the one-year targets set by the state	Score 3: District has longer-term targets for some indicators but the respondent cannot specify exactly what the numerical targets are	Score 5: District has longer-term targets for which the respondent can give the precise numerical targets of each indicator				

11) Promoting and supporting outstanding staff

Tests whether promotion is based primarily on job performance

a. How does your appraisal system (ACR) evaluate how well individual staff in the DHO are performing?			1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: The appraisal system does not specify any criteria to evaluate the performance of staff	Score 3: The appraisal system specifies some formal criteria although these are narrow in scope and / or can be subjective	Score 5: The appraisal system specifies a formal set of criteria to evaluate performance that is both broad in scope and objective.					
b. In your experience, if two people joined the DHO five years ago and one was much better at their work than the other, would he / she be promoted faster? What is promotion typically based on?			1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: People are promoted purely on the basis of tenure (years of service) and / or political connections	Score 3: People are sometimes promoted upon the basis of performance but the process is not consistently applied	Score 5: Top performers are actively identified, developed and promoted based purely on performance					
c. What type of career development opportunities are there for well performing staff?			1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: There are no career development opportunities for any staff	Score 3: High performing staff are occasionally offered training and attendance at workshops as a reward	Score 5: High performing staff are consistently offered training and attendance at workshops as a reward.					

12) Rewarding high performing staff

Tests whether good performance is rewarded (financial or otherwise) proportionately

a. What mechanisms, other than the ACR, are used to assess how well individual staff in the DHO are performing?			1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: There is no system used to assess individual staff performance (eg. staff never sit down with their line manager for face-to-face assessments)	Score 3: Performance of staff is assessed regularly against a formal set of criteria although these are narrow in scope and / or can be subjective	Score 5: Performance of staff is assessed regularly against a formal set of criteria that is both broad in scope and objective. Staff have confidence in system to identify good performers					
b. What financial or in-kind benefits (eg. housing) are given to high performing staff in the DHO? Can you give a recent example?			1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: Staff are rewarded in the same way irrespective of their level of performance	Score 3: There is a system which provides financial or in-kind benefits (eg. housing) but it is only loosely based on individual performance of staff	Score 5: There is a formal system which provides financial or in-kind rewards to staff based on performance. Rewards are given as a consequence of well-defined individual achievements					
c. What non-financial benefits or recognition are given to high performing staff in the DHO? Can you give a recent example?			1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: Staff are rewarded in the same way irrespective of their level of performance	Score 3: There is a system which provides non-financial rewards based on performance but it is only loosely based on individual performance of staff	Score 5: There is a formal system which provides non-financial rewards based on performance. Non-financial rewards are given as a consequence of well-defined individual achievements					

13) Dealing with poorly performing staff

Tests whether the DHO is able to deal with poor performers

a. How are poorly performing staff in the DHO identified?			1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: There is no formal or informal system of identifying poorly performing staff	Score 3: There is a formal set of criteria to identify poor performers although these are narrow in scope	Score 5: Performance of staff is assessed regularly against a formal set of criteria that is both broad in scope and objective. Staff have confidence in the system as a way of identifying poor performers					
b. If you had an individual in the DHO who was not doing their job, what would happen? Can you give me a recent example?			1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: Nothing would happen. Poor performance is not addressed at all	Score 3: Poor performers can face real consequences but the process is not consistently applied. A range of carrot (eg. training and support) and stick (transferred or fired) approaches are used	Score 5: Persons performing poorly consistently face a range of possible actions. The most severe under-performers are moved to less critical role					
c. How long is under-performance tolerated? Do some individuals in the DHO, despite not doing their job, always manage to avoid getting disciplined, transferred or fired?			1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: There is no action because nothing is identified or addressed. Individuals not doing their job always avoid getting disciplined	Score 3: Suspected poor performers stay in position for as long as two years before being moved to less critical role	Score 5: Poor performance is not tolerated. Action is taken immediately, and if this does not solve the problem the person is moved to less critical role					

14) Autonomy in programme implementation

Tests whether the DHO adapts implementation of programmes to reflect local health needs

a. Do colleagues in the DHO discuss which state level programmes to prioritise in the district?			1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: DHO makes no effort to prioritise programmes in the district. It is not the role of the district to prioritise the implementation of state policies in any way	Score 3: DHO seeks to prioritise the implementation of some programmes over others in the district. Only the most senior staff in the DHO feed into this process	Score 5: DHO seeks to prioritise the implementation of some programmes over others in the district based on a needs assessment. All staff in the DHO feed into process					
b. In what ways does the DHO influence the implementation of programmes to reflect local needs? Can you give a specific example?			1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: There is no strategic effort to influence implementation of health programmes in such a way as to target those most in need	Score 3: Senior staff seek to ensure implementation is prioritised to reach certain geographical areas or marginalised groups but this does not always translate into changes in implementation at the programme level	Score 5: With every health programme, the DHO systematically ensures that implementation prioritises certain geographical areas or marginalised groups. All staff buy into these efforts					
c. How does the DHO monitor whether implementation has targeted priority groups (eg. poor areas, ethnic minorities)?			1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: There is no monitoring of implementation to judge whether activities have been targeted to certain groups	Score 3: Activities are systematically recorded and mapped geographically but infrequently and not below the block level	Score 5: Activities are systematically recorded and mapped geographically down to the facility or village level. This is updated on a monthly basis					

15) Autonomy in financial allocation

Tests whether the DHO in practice influences how financial resources get allocated to reflect local priorities

a. Under what circumstances does the DHO choose how money is spent? Can you give an example?		1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: Under no circumstances does the DHO deviate from the financial allocations specified in the PIP	Score 3: On some occasions in special circumstances (eg. disease outbreak) the DHO shifts funds to address an emerging local health priorities	Score 5: There is wide range of circumstances in which the DHO shifts funds to address an emerging local health priorities				
b. How does the DHO ensure that unexpected health priorities are adequately financed?		1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: Financial allocations are decided mostly by the State and the district does little to deviate from these decisions	Score 3: The DHO partially exploits opportunities for flexibility in making its own financial allocation decisions	Score 5: The DHO fully exploits any opportunity for flexibility in making its own financial allocation decisions				
c. How does the DHO monitor whether locally identified health priorities are adequately financed?		1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: DHO never reviews expenditure data disaggregated by health programme, health facility or geographical area	Score 3: DHO periodically reviews expenditure data disaggregated by health programme, health facility or geographical area but this is not systematically mapped against strategic priorities	Score 5: DHO frequently reviews expenditure data disaggregated by health programme, health facility or geographical area and maps this information against strategic priorities				

16) Autonomy in human resources management

Tests whether the DHO in practice influences the deployment of health personnel and administrative staff

a. How much does the DHO influence the posting and transfer of health staff to particular facilities?		1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: The posting of all staff is dictated purely by the state	Score 3: For some positions, the district uses various strategies to influence decisions in the posting of staff	Score 5: The district frequently uses a range of strategies to influence the posting and transfer of staff at all levels				
b. How long do vacant positions of health workers (regular staff) remain unfilled? Can you give a recent example?		1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: Positions can remain vacant indefinitely	Score 3: Positions are typically vacant for a year or more before they are filled	Score 5: Positions are never vacant for more than 6 months				
c. To what extent do you use contract staff? What proportion of all staff in the district are contract?		1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Score 1: The DHO makes little use of contract staff. Less than 5% are contract staff	Score 3: DHO uses contract staff to a moderate degree. Between 10% and 15% of staff are contract staff	Score 5: DHO makes extensive use of contract staff. At least 20% of staff are contract staff				

B. Human Resources

- 17) How many people work in the DHO?
[CONSIDER ONLY TECHNICAL STAFF, NOT DRIVERS OR CLEANING STAFF] _____
- 18) How many people working in the DHO have a management qualification?
[CONSIDER ONLY PGDPHM OR MBA IN HEALTH MANAGEMENT] _____
- 19) What single factor *most* influenced your decision to work in government in the DHO?
[TICK ONLY ONE OPTION]
- 1=I was interested in the job
 - 2=Income prospects
 - 3=Prestige of the job
 - 4=Stable career path that a job in government provides
 - 5=To serve my country and my State
 - 6=It was the only employment I could get
 - 7=Educational and training opportunities
 - 8=Other
- 20) Where do you see yourself working in five years' time?
[TICK ONLY ONE OPTION]
- 1=The same position as I am now
 - 2=A different district but at the same level
 - 3=At a higher level, either in this district or a different district
 - 4=In government, at the State level
 - 5=A private company
 - 6=My own company or consultancy
 - 7=University or college
 - 8=Retired
 - 9=Other
- 21) How satisfied are you with your current position?
[READ OUT OPTIONS. TICK ONLY ONE OPTION]
- 1=Very dissatisfied
 - 2=Dissatisfied
 - 3=Neither dissatisfied or satisfied
 - 4=Satisfied
 - 5=Very satisfied
- 22) Are you aware of any grievance redressal system at work?
- 1=Yes
 - 2=No

23) Think about your daily job. How often do you face the following challenges? [READ OUT OPTIONS]

- | | | | | | | | | | | |
|--|--------------------------|---------|--------------------------|----------|--------------------------|-------------|--------------------------|---------|--------------------------|----------|
| a) There are inadequate resources for me to perform my job effectively | <input type="checkbox"/> | 1=Never | <input type="checkbox"/> | 2=Rarely | <input type="checkbox"/> | 3=Sometimes | <input type="checkbox"/> | 4=Often | <input type="checkbox"/> | 5=Always |
| b) People I work with and manage do not have the required skills | <input type="checkbox"/> | 1=Never | <input type="checkbox"/> | 2=Rarely | <input type="checkbox"/> | 3=Sometimes | <input type="checkbox"/> | 4=Often | <input type="checkbox"/> | 5=Always |
| c) People I work with and manage do not come to work | <input type="checkbox"/> | 1=Never | <input type="checkbox"/> | 2=Rarely | <input type="checkbox"/> | 3=Sometimes | <input type="checkbox"/> | 4=Often | <input type="checkbox"/> | 5=Always |
| d) I don't have the authority to make decisions | <input type="checkbox"/> | 1=Never | <input type="checkbox"/> | 2=Rarely | <input type="checkbox"/> | 3=Sometimes | <input type="checkbox"/> | 4=Often | <input type="checkbox"/> | 5=Always |
| e) People I work with and manage break the rules for their own benefit | <input type="checkbox"/> | 1=Never | <input type="checkbox"/> | 2=Rarely | <input type="checkbox"/> | 3=Sometimes | <input type="checkbox"/> | 4=Often | <input type="checkbox"/> | 5=Always |
| f) People I work with and manage aren't motivated | <input type="checkbox"/> | 1=Never | <input type="checkbox"/> | 2=Rarely | <input type="checkbox"/> | 3=Sometimes | <input type="checkbox"/> | 4=Often | <input type="checkbox"/> | 5=Always |

C. Post-Interview

<p>24) Interviewee knowledge of management practices</p> <p>Score: 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/></p>	<p>Score 1: Some knowledge in his / her position, but no knowledge about the rest of the DHO</p>	<p>Score 3: Expert knowledge in his / her position, and some knowledge about the rest of the DHO</p>	<p>Score 5: Expert knowledge in his / her position, and the rest of the DHO</p>
<p>25) Interviewee willingness to reveal information</p> <p>Score: 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/></p>	<p>Score 1: Very reluctant to provide more than basic information</p>	<p>Score 3: Provides all basic information and some more confidential information</p>	<p>Score 5: Totally willing to provide any information about the DHO</p>
<p>26) Interviewee patience</p> <p>Score: 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/></p>	<p>Score 1: Little patience - wants to run the interview as quickly as possible. I felt heavy time pressure</p>	<p>Score 3: Some patience - willing to provide richness to answers but also time constrained. I felt moderate time pressure</p>	<p>Score 5: Lot of patience - willing to talk for as long as required. I felt no time pressure</p>

END OF QUESTIONNAIRE

Appendix 3 Examples of what the tool was testing

Table A1 Examples of what the tool was testing and the questions asked

Management practice	Testing	Questions
Use of human resources	Whether staff roles are clear and staff are used effectively	<ul style="list-style-type: none"> ▪ How do DHO staff know what their job involves? ▪ Do you have flexibility in assigning responsibilities to different staff in the DHO? ▪ How do you monitor whether health workers regularly report to work at health facilities?
Drug supply chain management	Whether the drugs supply chain system functions efficiently	<ul style="list-style-type: none"> ▪ How does the drug supply chain system work? Where in the process are there delays? ▪ How often are RKS funds used for procurement of drugs and supplies in health facilities? ▪ How well does the e-Aushadhi system for the management of drug stocks work?
Performance tracking	Whether performance of the district is tracked using meaningful metrics with appropriate regularity	<ul style="list-style-type: none"> ▪ What indicators are used to track the performance of the district? ▪ How frequently are the data on these indicators available at the DHO? ▪ Do these data get fed back down to health facilities? If I were to visit a health facility, how could I tell how well it is performing?
Types of targets and difficulty	Whether targets cover a sufficiently broad set of metrics defined by the district	<ul style="list-style-type: none"> ▪ How are your targets set? How tough are your targets to achieve – are you pushed by them? ▪ How often are targets revised because they are too easy or too hard? ▪ In what areas does the district, rather than the state, set targets itself?
Promoting and supporting outstanding staff	Whether promotion is based primarily on job performance	<ul style="list-style-type: none"> ▪ How does your appraisal system (ACR) evaluate how well individual staff in the DHO are performing? ▪ In your experience, if two people joined the DHO five years ago and one was much better at their work than the other, would he or she be promoted faster? ▪ What type of career development opportunities are there for well performing staff?
Autonomy in financial allocation	Whether the DHO in practice influences how financial resources get allocated to reflect local priorities	<ul style="list-style-type: none"> ▪ Under what circumstances does the DHO choose how money is spent? Can you give an example? ▪ How does the DHO ensure that unexpected health priorities are adequately financed? ▪ How does the DHO monitor whether locally identified health priorities are adequately financed?

Appendix 4 Probing questions

Instructions to interviewers: “Here is a suggested list of probing questions for each management practice. This list is not exhaustive and is only a guide. Ultimately you must judge during interview what is a good probing question based on the response you have just heard.”

Use of human resources

- Did you go through an induction process?
- How did you learn what your job involves?
- How can you be sure health workers are turning up to work?

Drug supply chain

- If a PHC requests drugs how long does it take for those drugs to reach the PHC?
- You say you don't encourage the use of RKS funds, but in practice are they used to purchase drugs?
- Do health facilities enter the information into the e-Aushadhi system?

Quality of care and standardization

- If a PHC was providing incorrect or harmful treatment to patients how would this be exposed?
- Why do health staff in PHCs sometimes not follow national programme guidelines?
- Do you use any tools or checklists to monitor adherence to national government clinical guidelines?

Supervision

- What exactly is in the supervision tool you mentioned?
- What format does the supervision report follow?

Financial management

- Do you hold meetings specifically to review the financial position of the district?
- What exactly happens during these meetings?
- If I asked would you be able to tell me exactly how much money has been spent in the past month by each budget line?

Performance tracking

- Do you track any indicators other than patient volume? Give me examples?
- How do track quality of care in PHCs?
- How frequently do you measure mortality?
- Are data from last month available now?

Performance review

- How is this review meeting different from the usual monthly meeting?
- What exactly happens during these review meetings?
- What visual tools are used to present the information?
- How do you know if performance is good or bad based on these data?
- Are any reports produced from the review meeting? What is in these reports?

Addressing district performance

- Do you have any system which records problems exposed and how they were addressed? Give more details?

Type of targets and difficulty

- Last year did you achieve any of your targets set by the state? Which ones?
- Do you set any targets yourself at the district level beyond those given to you by the state?
- Who in the DHO reviews the targets if they are too easy or difficult?

Time horizon of targets

- No probing questions

Promoting and supporting outstanding staff

- Does the district use any additional criteria to evaluate staff than those specified in the ACR?
- What influence does the DHO exercise in speeding up or slowing down the promotion of staff?
- Give me some examples of these criteria?

Rewarding high performing staff

- Do you have any mechanisms other than the ACR to evaluate staff performance?
- Do staff have confidence in this system?
- What performance criteria do you use? Give an example?
- Is there any other way in which staff get recognised for doing a good job?

Dealing with poor performing staff

- How consistently are these strategies applied [to deal with poor performers]?
- Payment to absent staff can be withheld you say - have you actually done this in the past year?

Autonomy in programme implementation

- Can you give an example of prioritising implementation of one programme over another?
- How do you record or map when and where activities have been carried out?

Autonomy in financial allocation

- Under what circumstance do you deviate from the PIP?
- What constitutes an emergency?
- Can you give an example when the DHO made a special request for funds?

Autonomy in human resource management

- When did you [the DHO] last transfer someone? What was the reason?
- How many vacant positions are there currently?

Appendix 5 Further results

Table A2 Psychometric tests based on reduced-item summary score

Psychometric property	Criteria	Result
Acceptability	Missing data of summary score should be <5%	No missing observations
Acceptability	Floor and ceiling effect of summary score <10%	% floor: 0 observations % ceiling: 0 observations
Reliability	Cronbach's alpha for summary score >0.7	0.9225
Reliability	District intraclass correlation for summary score	0.587

Table A3 Management and respondent characteristics based on reduced-item summary score

	Model 1		Model 2		Model 3	
	Coefficient	p value	Coefficient	p value	Coefficient	p value
Chief District Health Officer (CDHO)			0.272	<0.001	0.288	<0.001
District Program Manager (DPM)			-0.014	0.840	0.076	0.482
District Reproductive and Child Health Officer (DRCHO)			0.062	0.507	0.131	0.171
District Surveillance Officer (DSO)			-0.260	0.226	-0.129	0.546
Permanent position					0.170	0.075
DPC appointment					0.177	0.077
Age					-0.003	0.571
Male					-0.171	0.062
Tenure in post					0.016	0.204
Tenure in district					-0.005	0.472
Residual intraclass correlation	0.57		0.69		0.70	
Districts	34		34		34	
Observations	99		99		99	

Table A4 Management and management qualifications based on reduced-item summary score

	Model 1		Model 2	
	Coefficient	p value	Coefficient	p value
Number of staff in district health office	0.008	0.178	0.009	0.166
Number of staff with a management qualification	0.150	0.004	0.161	<0.001
Chief District Health Officer (CDHO)			0.283	<0.001
District Program Manager (DPM)			0.107	0.317
District Reproductive and Child Health Officer (DRCHO)			0.167	0.079
District Surveillance Officer (DSO)			-0.151	0.475
Permanent position			0.183	0.051
DPC appointment			0.215	0.030
Age			-0.002	0.705
Male			-0.161	0.075
Tenure in post			0.019	0.119
Tenure in district			-0.007	0.356
Residual intraclass correlation	0.47		0.59	
Districts	34		34	
Observations	99		99	

Table A5 Management and respondent characteristics based on factor analysis score

	Model 1		Model 2		Model 3	
	Coefficient	p value	Coefficient	p value	Coefficient	p value
Chief District Health Officer (CDHO)			0.606	<0.001	0.619	<0.001
District Program Manager (DPM)			-0.031	0.844	0.159	0.516
District Reproductive and Child Health Officer (DRCHO)			0.116	0.582	0.275	0.202
District Surveillance Officer (DSO)			-0.603	0.216	-0.248	0.606
Permanent position					0.413	0.055
DPC appointment					0.418	0.063
Age					-0.008	0.530
Male					-0.410	0.046
Tenure in post					0.043	0.127
Tenure in district					-0.018	0.275
Residual intraclass correlation	0.55		0.66		0.68	
Districts	34		34		34	
Observations	99		99		99	

Table A6 Management and management qualifications based on factor analysis score

	Model 1		Model 2	
	Coefficient	p value	Coefficient	p value
Number of staff in district health office	0.015	0.230	0.017	0.152
Number of staff with a management qualification	0.329	0.004	0.355	0.001
Chief District Health Officer (CDHO)			0.607	0.001
District Program Manager (DPM)			0.232	0.336
District Reproductive and Child Health Officer (DRCHO)			0.360	0.093
District Surveillance Officer (DSO)			-0.300	0.529
Permanent position			0.443	0.036
DPC appointment			0.506	0.023
Age			-0.006	0.679
Male			-0.391	0.055
Tenure in post			0.051	0.069
Tenure in district			-0.021	0.188
Residual intraclass correlation	0.45		0.56	
Districts	34		34	
Observations	99		99	

Table A7 Factor loadings on management practices

Management practice	Factor 1	Factor 2	Factor 3	Factor 4
1 Use of human resources	0.648	0.165	-0.370	-0.196
2 Drug supply chain	0.654	-0.049	0.130	-0.476
3 Quality & standardisation	0.693	0.220	-0.194	-0.386
4 Supervision	0.773	0.048	-0.261	0.175
5 Financial management	0.532	-0.364	0.442	-0.223
6 Performance tracking	0.573	-0.457	-0.357	0.077
7 Performance review	0.780	-0.244	-0.067	-0.108
8 Addressing performance	0.550	-0.450	-0.064	0.029
9 Types of targets & difficulty	0.497	0.367	-0.081	0.474
10 Time horizons of targets	0.498	0.599	0.292	-0.072
11 Promoting outstanding staff	0.354	0.561	-0.205	0.123
12 Rewarding good performers	0.496	0.233	0.493	-0.168
13 Dealing with poor performers	0.547	-0.198	0.093	0.531
14 Autonomy in programme implementation	0.726	-0.140	-0.014	0.117
15 Autonomy in financial allocation	0.669	0.109	0.052	0.129
16 Autonomy HR management	0.304	-0.091	0.641	0.301