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Supplement Article

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Going operational with health systems governance: supervision and incentives to health workers for increased quality of care in Tanzania

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Abstract

Improving the quality of care is increasingly recognized as a priority of health systems in low- and middle-income countries. Given the labour-intensive nature of healthcare interventions, quality of care largely depends upon the number, training and management of health workers involved in service delivery. Policies available to boost the performance of health workers—and thus the quality of healthcare—include regulation, incentives and supervision—all of which are typically included in quality improvement frameworks and policies. This was the case in Tanzania, where we assessed the role of selected quality improvement policies. To do so, we analysed data from a representative sample of Tanzanian government-managed health facilities, part of the 2014/15 Service Provision Assessment component of the Demographic and Health Survey. We constructed two healthcare quality indicators from data on patient visits: (1) compliance with Integrated Management of Childhood Illness (IMCI) guidelines and (2) patient satisfaction. Using multilevel ordered logistic regression models, we estimated the associations between the outcomes and selected indicators of incentives and supervisory activity at health worker and health facility level. We did not identify any association for the different indicators of top-down supervision at facility and individual level, neither with IMCI compliance nor with patients' satisfaction. Bottom-up supervision, defined as meetings between community and health facility staff, was significantly associated with higher patient satisfaction. Financial incentives in the form of salary top-ups were positively associated with both IMCI compliance and patient satisfaction. Both housing allowances and government-subsidized housing were positively associated with our proxies of quality of care. Good healthcare quality is crucial for promoting health in Tanzania not only through direct outcomes of the process of care but also through increased care-seeking behaviour in the communities. The results of this study highlight the role of community involvement, better salary conditions and housing arrangements for health workers.

Keywords: Health systems research, multivariate analysis, incentives, quality of care, human resources, governance

Key Messages

- Current institutional arrangements for top-down supervision of health services provision in public health facilities in Tanzania do not show sensible effects on quality of care.
- Community involvement in supervision and management of the health facilities is associated with higher patient satisfaction at point of service.
- HR management policies that include financial incentives in form of salary top-ups to health workers are associated with higher clinical compliance to Integrated Management of Childhood Illness (IMCI) guidelines and higher patient satisfaction.
- Financial allowances for health workers targeted to housing are associated with improved clinical compliance to IMCI guidelines. Assigning health workers to government subsidized housing is associated with higher patient satisfaction at point of service.

Introduction

After past eras of global health focused on the efficiency of interventions, in many low- and middle-income countries (LMICs) policymakers and development partners are gradually directing efforts on improvements in quality of healthcare and equity (Hongoro and Normand, 2006; Chandler *et al.*, 2009; Songstad *et al.*, 2011; Das *et al.*, 2018; Kruk *et al.*, 2018). The reason for this shift of focus is that the effectiveness and efficiency of investments in health are related to the extent to which healthcare services reach an acceptable level of quality (Kruk and Freedman, 2008; Nair *et al.*, 2014). Moreover, quality of care is a determinant of the utilization of healthcare services, above all for public health facilities (Mariko, 2003; Sahn *et al.*, 2003; Kyei-Nimakoh *et al.*, 2017).

Quality of healthcare is typically characterized as a three-dimensional construct, the components being resources, processes and outcomes (Reerink and Sauerborn, 1996; Donabedian, 1997; Hongoro and Normand, 2006). Quality of services is closely related to providers' skills and behaviour. In a systematic review on ambulatory healthcare quality, Berendes *et al.* (2011) list several direct measures of provider performance as indicators of different quality dimensions. Such examples include compliance with guidelines, correct prescribing behaviour, length of consultation time, number of explanations given and friendliness. Likewise, DiPrete-Brown *et al.* (1992) highlight the crucial role of provider effort in achieving effective and efficient care, safety of patients, continuity of care and sound interpersonal relationship with patients among different subdimension of quality of care. The centrality of provider performance emerges also from the components of high-quality health system framework components recently proposed by Kruk *et al.* (2018).

To foster performance among health workers, policymakers have few non-exclusive options, namely: regulation, monetary and non-monetary incentives, supervisory and management activities such as quality control, auditing, supportive supervision, bottom-up supervision, community involvement, accountability mechanisms and active management practices (Rowe *et al.*, 2005, 2010; Dieleman and Harnmeijer, 2006; Lewis, 2006; Willis-Shattuck *et al.*, 2008; Dieleman *et al.*, 2009; Brinkerhoff and Bossert, 2014).

Specific policies addressing the performance of health workers necessarily need to include a mix of different levers, affecting different facets of provider performance. For some of the policy options above, the evidence in the literature points towards clear impact pathways (see below). Other approaches still lack consistent evidence about their effectiveness. Notably, little is known about the combined effect of the different policy tools. Our contribution aims at partially filling this gap, generating evidence on the effects of different policy levers for provider performance combined in different broader policies addressing human resources for health.

The available evidence shows that active human resources management policies—including a mix of financial and non-financial incentives—effectively foster motivation and performance among health workers (Hongoro and Normand, 2006; Mathauer and Imhoff, 2006; Althabe *et al.*, 2008; Lewin *et al.*, 2008; McCoy *et al.*, 2008). The evidence on the impact of policy instruments generally related to oversight is mixed. For example, supportive and external supervision (from higher-level authorities) were found to positively impact provider performance in several studies (Manongi *et al.*, 2006; Bradley *et al.*, 2013; Kiplagat *et al.*, 2014; Moran *et al.*, 2014; Bhatnagar *et al.*, 2017). Yet, different studies report overall inconclusive results (Bosch-Capblanch and Garner, 2008; Rowe *et al.*, 2010; Bosch-Capblanch *et al.*, 2011; Sipsma *et al.*, 2012; Bailey *et al.*, 2016). Likewise, for different forms of community involvement in health service delivery (such as health facility committees or social accountability monitoring) the literature reports only limited qualitative evidence, with lack of robust external validity (Kessy, 2008, 2014; Rosato *et al.*, 2008; Macha and Borghi, 2011; McCoy *et al.*, 2012; Frumence *et al.*, 2014; Kilewo and Frumence, 2015; Bhatnagar *et al.*, 2017). A large systematic review of strategies to improve provider practices in LMICs revealed that most policies mixing different strategies are more effective than strategies employed in isolation. The same study found that policies with larger effect sizes involved a simultaneous combination of community support and training for healthcare providers (Rowe *et al.*, 2018).

In Tanzania, despite the Government's effort to expand geographical access increasing the number of health facilities and aiming at primary healthcare for all, the performance of health providers in rural areas is not yet satisfactory (Leonard and Masatu, 2007; United Republic of Tanzania and Ministry of Health and Social Welfare, 2007; Musau *et al.*, 2011; Kruk *et al.*, 2017). Health policy reforms in Tanzania generally touched upon all the points above, including a wave of decentralization by devolution of decisional and managerial responsibilities towards local government authorities (LGAs; Semali *et al.*, 2005; United Republic of Tanzania and Ministry of Health and Social Welfare, 2007; Mboya *et al.*, 2016). The reform of LGAs in Tanzania strengthened the steering role of councils over the district health systems, with the goal of better addressing the needs of the population by bridging the gap between health services providers and communities (Gilson, 1995).

The current structure of the Tanzanian public health system is parallel to the administrative division of government authorities in the country. The central authorities maintain control over the main basket fund for health, allocation and budget for human resources

as well as national referral and specialized hospitals. The 30 regions act as intermediary oversight bodies between central and the local authorities, represented by 173 districts (Musau *et al.*, 2011; National Bureau of Statistics and Office of Chief Government Statistician, 2013). The President's Office for Regional Administration and Local Government directly oversees and supports the districts in their steering role over the health system, together with Ministry of Health,[1] Ministry of Finance and Planning as well as Regional Authorities. Each district is directly responsible for the management, supervision and audit of public health facilities within its boundaries, including primary (dispensaries), secondary (health centres) and tertiary level (district hospitals) structures (Ministry of Health and Social Welfare/Tanzania *et al.*, 2016). Health facilities are organized in a hierarchical structure that is reflected in the referral flows (bottom-up, from primary to secondary or tertiary level structures) and in the cascade supervision arrangements (top-down). Currently, health facilities have autonomy in the use of funds, both for basket fund (through own bank accounts) and for funds generated locally through user fees and Community Health Funds (Maluka and Chitama, 2017).

In the last decade, the Government of Tanzania approved two strategic plans aimed at improving quality of care: the 'Human Resource for Health and Social Welfare Strategic Plan 2014–2019' (United Republic of Tanzania and Ministry of Health and Social Welfare, 2014) and 'The Tanzania Quality Improvement Framework in Health Care 2011–2016' (United Republic of Tanzania and Ministry of Health and Social Welfare, 2011). The implementation of bottom-up accountability mechanisms (e.g. social accountability) in the healthcare system has been coupled with a cascade supervision system for public health facilities (from tertiary level down to primary care level) as well as external administrative supervision from council authorities. In addition, specific incentive policies for the retention of health workers have been introduced with the aim of improving motivation and satisfaction of healthcare providers (Kimaro and Sahay, 2007; World Health Organization, 2013; United Republic of Tanzania and Ministry of Health and Social Welfare, 2011, 2014; Mboya *et al.*, 2016). In the last few years—with support from the World Bank—pilot projects have been implemented to test the impacts of results-based financing and pay for performance (P4P) arrangements aimed at linking healthcare providers performance to explicit financial incentives (Manongi *et al.*, 2014; Borghi *et al.*, 2015; Binyaruka and Borghi, 2017).

District councils translated the National policies above into different human resources management practices consistently with the resources available and local availability of public providers.

Rationale

Our study aims at exploiting the variation in human resources management, supervision and accountability practices across Tanzania, studying the role of different levers of health worker performance on healthcare quality. Specifically, we aim at assessing the association of a range of policy tools (financial and non-financial incentives, monitoring and supervision arrangements as well as community oversight) with two relevant quality of care indicators sensitive to provider performance: provider compliance to Integrated Management of Childhood Illness (IMCI) guidelines and patient satisfaction.

We have three main hypotheses guiding our analysis. First, other things equal, incentives to health workers increase the workers' efforts, improving performance and the resulting quality of services produced. Second, higher frequency of supervision visits and active management meetings reduce opportunities for negligence, increase accountability (top-down) and compliance with current regulations whilst also helping health facilities and health workers to address weaknesses. All the above mechanisms lead—in principle—to increased quality of healthcare provision at point of service. Third, higher frequency of meetings between health facility staff and community representatives increases accountability (bottom-up) and bonds between providers and patients, leading to greater effort, improved performance and thus higher quality of care.

Methods

Data

Our analysis relies on a nationally representative sample of public health facilities in Tanzania surveyed by the Demographic and Health Surveys (DHS) programme and selected for the Service Provision Assessment (SPA) survey between 2014 and 2015 (Ministry of Health and Social Welfare/Tanzania *et al.*, 2016). The SPA survey is a health facility assessment that provides a comprehensive overview of a country's health service delivery. It collects information on the overall availability of different facility-based health services in a country and their readiness to provide those services. The data collected range from infrastructure, resources and management through health facility inventory interviews, provider characteristics (from health workers interviews) and process of care through patient visit observations. The latter set of information has proved to be effective in measuring several dimensions of quality of care (Leonard and Masatu, 2005).

We analyse data from government-managed health facilities only, as private ones are not subject to most Government policies on human resources for health, monitoring or supervision. A descriptive overview of the health facilities included in the analysis is provided in Table 1.

The majority of health facilities interviews is in dispensaries (~45%) and in health centres (~39%), located primarily in rural areas (74%). Compared with the actual distribution of government-owned health facilities in Tanzania, our data oversample health centres and hospitals, accounting for ~9.5% and 2.5% of facilities, respectively (Ministry of Health and Social Welfare/Tanzania *et al.*, 2016). The distribution of health facilities is similar across the two samples.

Table 2 describes the sample of health workers included in our analyses. The analysis on IMCI compliance includes ~40% of female health workers. Notably, the share of female health workers doubles to ~80% in the sample employed for the analysis on patient satisfaction. The difference in sample composition is related to the nature of patient visits included in the patient satisfaction sample, which pools visits to sick children and antenatal care (ANC) visits. The latter is typically performed by female nurse midwifes. This is also reflected in the distribution of health worker cadres across the two samples, with 65% of medical officers and 21% of nurses in the IMCI compliance sample, whereas the patient satisfaction sample is characterized by 10% medical officers and 70% nurses (including nurses midwifes).

Empirical strategy

Our empirical strategy takes the specific administrative structure of the Tanzanian health system into account, allowing a multilevel structure in the data. Figure 1 describes the data structure of the sample used in our analysis. The units of analysis are unique patients; given the cross-sectional nature of the survey, no patient

Table 1 Descriptive statistics for sample of health facilities

	Sample IMCI compliance				Sample patient satisfaction			
Variable	*N*	%	Avg. (SD)	Median	*N*	%	Avg. (SD)	Median
Dispensary	250	44.96			303	45.09		
Health centre	218	39.21			260	38.69		
Hospital	88	15.83			109	16.22		
Total	556	100.00			672	100.00		
Rural area	415	74.64			497	73.96		
Results-based financing	40	7.19			37	5.51		
Any client feedback mechanism	256	46.04			333	49.55		
OPD visits last month: <201	124	22.30			156	23.21		
OPD visits last month: 200–400	173	31.12			197	29.32		
OPD visits last month: 400–600	85	15.29			104	15.48		
OPD visits last month: 600–800	39	7.01			48	7.14		
OPD visits last month: >800	135	24.28			167	24.85		
Total staff	556	100.00	42.15 (132.35)	8.00	672	100.00	45.98 (157.10)	8.00
Health Services Index	556	100.00	18.00 (3.66)	18.00	672	100.00	17.91 (3.78)	18.00

Note: The Health Services Index is a proxy measure of breadth of service offered at a specific health facility. The index represents the simple sum of the services provided by the facility, as listed in the health facility inventory interview from the SPA 2014/15.

Source: Author's own elaboration on DHS SPA 2014/15 data.

Table 2 Descriptive statistics for sample of health workers

	Sample IMCI compliance				Sample patient satisfaction			
Variable	*N*	%	Avg. (SD)	Median	*N*	%	Avg. (SD)	Median
Total	682	100.00			867	100.00		
Female	278	40.76			698	80.51		
Managing position	389	57.04			366	42.21		
Qualification								
Medical doctor	26	3.81			11	1.27		
Medical/clinical officer	446	65.40			92	10.61		
Nurse	144	21.11			607	70.01		
Assistant	66	9.68			157	18.11		
Any salary supplement	572	83.87			600	69.20		
Any non-monetary incentive	405	59.38			433	49.94		
Monetary incentives to provider								
Salary top-up	203	29.77			264	30.45		
Per diem when training	190	27.86			250	28.84		
Duty allowance	218	31.96			286	32.99		
Payment for extra activities	66	9.68			107	12.34		
On-call allowance	228	33.43			168	19.38		
Housing allowance	21	3.08			21	2.42		
Non-monetary incentives to provider								
Uniform/caps/backpack	214	31.38			281	32.41		
Training	107	15.69			140	16.15		
Subsidized housing	166	24.34			148	17.07		
Time off/holidays	68	9.97			81	9.34		
Years of tenure at facility	682	100.00	5.22 (7.26)	2	867	100.00	7.16 (9.04)	3
Education years	682	100.00	14.53 (2.43)	15	867	100.00	13.50 (2.53)	13
Days with supportive supervision over last 6 months	682	100.00	2.50 (2.49)	2	867	100.00	3.19 (2.29)	3

Note: The table shows the number of health workers in the two samples that reported benefitting from the different incentives. Each health worker can benefit from one or more incentives at once, depending on the policy in place.

Source: Author's own elaboration on DHS SPA 2014/15 data.

experienced multiple visits. Patients are treated by providers (clustering level 3), working in a given health facilities (clustering level 2) in a given region (clustering level 1). Statistical tests that support the use of a multilevel model are provided in Supplementary Table SM1. We employ regions as highest level in the data structure in order to maintain the highest level of representativeness in the results, although the administrative units effectively steering the health systems in Tanzania are LGAs represented by District Councils. Unfortunately, the survey sampling design did not allow the use of the latter. The data analysis was carried out with the statistical software STATA 14. For the analysis of the two main dependent variables, both coded as ordered scales, we estimated multilevel

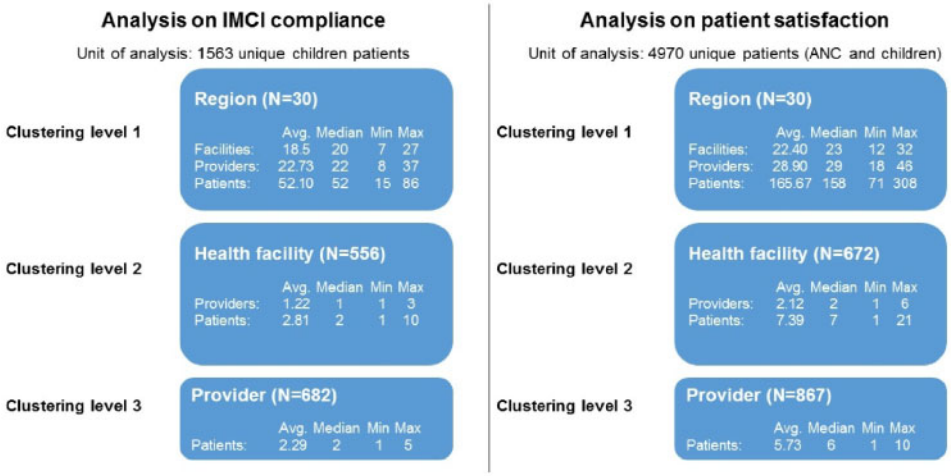

Figure 1 Data structure and clustering levels for the two samples considered in the analyses. *Source*: Author's own elaboration.

ordered logistic models with three clustering levels. To check the robustness of our results, we estimated the same specifications with multilevel models with two clustering levels as well as with standard logistic models with clustered errors.

Outcomes

The two quality of care measures selected as dependent variables are (1) compliance with IMCI guidelines and (2) patient satisfaction. Both outcome measures are referred to our two samples of patient visits. The characteristics of patients in the two samples are described in Table 3.

Compliance with recommended treatment or assessment guidelines represents a process indicator for quality of care (Donabedian, 1997; Boller *et al.*, 2003; Rowe *et al.*, 2005; Berendes *et al.*, 2011; Das *et al.*, 2016; Kruk *et al.*, 2018). Among the health issues with higher prevalence in LMICs, child mortality is arguably the most prioritized in global health. The Millennium Development Goals (MDGs) explicitly addressed this issue and the Sustainable Development Goals continue to focus on child mortality outcomes, together with maternal health and the disease control (Travis *et al.*, 2004; Liu *et al.*, 2016). A global initiative that emerged from the MDGs to tackle child mortality is the IMCIs strategy, fostered by the World Health Organization and the United Nations Children's Fund. IMCI guidelines have been implemented in several LMICs (Osterholt *et al.*, 2009; Chakkalakal *et al.*, 2013; Rakha *et al.*, 2013). In Tanzania guidelines were implemented since 1996 with positive impacts on child survival (Armstrong *et al.*, 2004; Rakha *et al.*, 2013; Gera *et al.*, 2016). In spite of the focus on primary healthcare embedded in the IMCI guidelines, the country extended the implementation to outpatient departments (OPDs) of secondary and tertiary level facilities like district hospitals (MoHSW *et al.*, 2016; Muhe *et al.*, 2018). We obtained the indicator for compliance with IMCI guidelines directly from patient visits observations for sick children. Patient visit observations include information on processes and activities carried out by the healthcare provider during the visit. The index of compliance with recommended assessment and treatment guidelines is referred to the IMCI chart booklet (World Health Organization, 2014) and counts the share of activities executed by the provider out of all the activities recommended by IMCI for any specific health condition. We computed the IMCI compliance index only for a subset of health conditions that allowed a clean isolation of the care process in the data, namely: respiratory problems, conditions affecting the digestive system, malaria, fever and ear infections. We coded the resulting index to a five points ordinal scale representing 20% incremental steps in the percentage of recommended activities executed by the health provider. In spite of comparable results in terms of sign and statistical significance obtained with linear regression analysis on the crude IMCI compliance index, the choice of generating a five points ordinal scale is supported by two main arguments. First, IMCI guidelines encompass a finite limited number of activities. Although treating the IMCI compliance index as a continuous variable is feasible, the index remains a variable 'whose range is restricted in some important way' (Wooldridge, 2010). Hence, we preferred to treat it accordingly and avoided using standard linear regression analysis. Second, the use of an ordinal scale analysed with ordinal logistic regression that produces odds ratios (ORs) allows direct comparability of coefficients with our second outcome of interest, described below and measured on a three points Likert scale. Table 3 shows that IMCI compliance is higher than 40% for less than half of the sick children observed.

Patient satisfaction is another important measure related to the quality of care (Hongoro and Normand, 2006; Kruk and Freedman, 2008; Glick, 2009). Patient satisfaction indicators were readily available in the SPA survey data for all patient visit observations. The opinions collected at the end of a visit measure a quality dimension directly related to the experience with health service provision. The SPA patient exit interview includes patient satisfaction coded to a three points Likert scale (i.e. 'Not satisfied', 'Somewhat satisfied' and 'Very satisfied'). Table 3 shows the distribution of patient satisfactions in our study sample. For the analysis on patient satisfaction, we gathered data of sick children visits and ANC visits. In case of sick children (under five), the satisfaction rating was collected from the caretaker who brought the child to the health facility (mother, father, sibling or other family member). The sample of visits to sick children used in our analysis of patient satisfaction includes all observations from the IMCI compliance analysis sample. The additional sick children included in the patient satisfaction sample (2671 compared with 1563 in the IMCI compliance sample) represent the visits for which we were not able to compute our IMCI compliance index. Patient satisfaction is generally high, with 79% of patients/caretakers reporting being 'Very satisfied' and only 3.9% reporting being 'Not satisfied'. Interestingly, looking at the restricted sample of sick children included in the IMCI compliance analysis, satisfaction is sensibly lower with 8% of caretakers

Table 3 Descriptive statistics for sample of patients

Variable	Sample IMCI compliance				Sample patient satisfaction			
	N	%	Avg. (SD)	Median	*N*	%	Avg. (SD)	Median
Total	1563	100.00			4970	100.00		
Type of patient: sick child	1563	100.00			2671	53.74		
Female (sick children only)	794	50.79			1151	50.07		
Age for sick children (years)	1563	100.00	1.59 (1.21)	1.25	2299	46.76	1.70 (1.24)	1.33
Age for ANC patients (years)					2671	53.74	26.42 (9.55)	25
Age of adult caretaker (years)	1543	98.72	27.97 (8.35)	27	2299	46.76	29.44 (12.12)	27
Relationship between patient and caretaker (if any)								
Mother	1431	91.55			2093	42.11		
Father	56	3.58			94	1.89		
Sibling	22	1.41			31	0.63		
Other	54	3.45			81	1.63		
Literacy level of patient/caretaker								
Cannot read or write	379	24.25			1227	24.68		
Read only	38	2.43			109	2.19		
Read and write	1146	73.32			3634	73.12		
Diagnosis related to								
Respiratory problem	1177	75.30						
Digestive system	178	11.39						
Malaria	478	30.58						
Fever	251	16.06						
Ear infection	38	2.43						
Insurance coverage (any)	258	16.51			745	14.99		
Treatment with drug prescription	1523	97.44			4601	92.57		
Client waiting time								
No waiting time					315	6.34		
Up to 30 min					1360	27.36		
31–60 min					880	17.71		
61–90 min					169	3.40		
1.5–2 h					827	16.64		
2–3 h					644	12.96		
3–4 h					346	6.96		
More than 4 h					429	8.63		
Compliance with IMCI guidelines								
0–20% of activities	264	16.89						
21–40% of activities	566	36.21						
41–60% of activities	582	37.24						
61–80% of activities	129	8.25						
81–100% of activities	22	1.41						
Satisfaction of patient/caretaker								
Very satisfied	1113	71.21			3963	79.72		
Somewhat satisfied	325	20.79			813	16.35		
Not satisfied	125	8.00			195	3.92		

Notes: (1) All observations from the IMCI compliance sample are included in the sample used for the patient satisfaction analysis. The sample employed for the analysis on patient satisfaction includes a higher number of sick children compared with the IMCI compliance sample because the outcome variable in the latter analysis was computed on a subset of IMCI compatible health conditions. (2) We reported the share of female patients only for sick children because all antenatal care patients are female, by definition. The percentage is computed accordingly on the total number of sick children included in the sample.

Source: Author's own elaboration on DHS SPA 2014/15 data.

reporting being 'Not satisfied'. To account for the difference in characteristics of the two groups of patients, we also ran the analysis on the two separated sub-samples (sick children and ANC patients only).

Covariates

The variables of interest in our analysis are indicators representing supervision and incentive policies for health workers.

Monitoring and supervision are the only options available to central administrators to directly oversee and support the activity of decentralized health service providers. Despite mixed results in terms of effectiveness (Leonard *et al.*, 2007; Bosch-Capblanch and Garner, 2008; Bosch-Capblanch *et al.*, 2011; Bradley *et al.*, 2013; Bailey *et al.*, 2016; Bhatnagar *et al.*, 2017; Snowdon *et al.*, 2017; Vasan *et al.*, 2017; Renggli *et al.*, 2018), supportive, external and managerial supervision remain an important lever of health system governance.

To measure the extent of supervision, we computed proxy indicators for the intensity of supportive, cascade, managerial and community supervision (see Box 1). The proxy indicator for supportive supervision to health workers corresponds to the count of work supervision visits in the 6 months prior to the interview. For managerial and community supervision, the proxy indicators were coded as three points ordinal scales indicating whether the facility

Box 1 Overview of supervision and management activity at health facility and health worker level in Tanzania and relevant frequency indicators from SPA 2014/15

Type of activity

Management meetings in the last 6 months

Health facilities (in particular health centres and dispensaries, as hospitals naturally have a different management system) are required to organize regular staff meetings to review progress in implementing yearly plans, identify performance problems and develop actions to improve performance.

We coded a three-level variable indicating whether the facility held none, one or more than one management meetings in the 6 months prior to the day of the interview.

Meetings with the community in the last 6 months

Health facilities are required to conduct statutory quarterly meetings as well as ad hoc meetings with the Health Facility Governing Committee (HFGC). The HFGC is a governance body—that contributes to the management of the health facility—composed by community representatives. HFGCs are the strongest form of community participation in health service delivery in Tanzania.

We coded a three-level variable indicating whether the facility held none, one or more than one meeting with community representatives (HFGC) in the 6 months prior to the day of the interview.

Cascade supervision visit in the last 6 months

Higher-level authorities are responsible for the supervision the activity of lower level health facilities, down in the administrative hierarchy (from district, regional, zonal or national offices, depending on the type of health facility).

We coded a three-level variable indicating whether the facility experienced a cascade supervision visit within the 6 months prior to the day of the interview, more than 6 months before the interview or not at all.

Work-related supportive supervision to staff

Health facility managers are required to provide health providers employed in their facilities with continuous supportive supervision of work. The goal of supportive supervision is to ensure positive feedback and quality improvement of healthcare provision.

We used the SPA 2014/2015 variable stating the number of work supervisions for the interviewed health professional in the 6 months prior to the day of the interview.

had none, one or more supervisory visits in the 6 months prior to the interview. Likewise, we coded intensity of cascade supervision from higher-level authorities as an ordinal scale indicating whether the facility experienced any supervision (within the last 6 months or less often).

Table 4 offers an overview of the distribution and variability of our proxy indicators for supervision intensity at the health facility level, for our two samples and for different types of health facilities. The two samples show comparable frequencies for all supervision indicators considered.

Financial and non-financial incentives are powerful tools available to policymakers to trigger extrinsic motivation of healthcare providers. Despite some evidence of crowding-out effect on intrinsic motivation (Leonard and Masatu, 2010), financial incentives remain an important health system governance tool (Mathauer and Imhoff, 2006; Leonard *et al.*, 2007; Lewis, 2007; Althabe *et al.*, 2008; Das *et al.*, 2008; Lewin *et al.*, 2008; McCoy *et al.*, 2008; Chandler *et al.*, 2009; Chimhutu *et al.*, 2015, 2014). The current Tanzanian strategic plan incorporates 'a mix of monetary and non-monetary incentives for high performers' implemented through LGAs (Ministry of Health and Social Welfare, 2015). Nevertheless, at sub-national level, no detailed guidelines or specific data on financial incentives are available. The Health Sector Strategic Plan IV also envisages good working conditions for staff employed in all health facilities, specifying housing and other non-monetary incentives as important elements on the path to better quality healthcare provision (United Republic of Tanzania and Ministry of Health and Social Welfare, 2007; 2014; Ministry of Health and Social Welfare, 2015). Again—apart from generic strategic statements—no specific implementation plan is provided from central authorities to LGAs. Local authorities maintain great discretion in the allocation of funds to human resources for health and thus present great variability in the type of non-monetary incentives and working conditions offered to health workers. Variability is exacerbated by two factors, namely (1) lack of coordination among different development partners working across the country (Rubin, 2012) and (2) high prevalence of informal payments and corruption (Stringhini *et al.*, 2009), both highly detrimental for the quality of healthcare provision. In our analysis, the specific incentive policy in place in the health facility was modelled as a series of dummy variables (generated from health worker self-reported answers) indicating whether the health worker benefits from a given incentive. Both monetary and non-monetary incentives are included in our analysis although, for monetary incentives, specific amounts are not available. Table 5 below offers an overview of the distribution and variability for the incentive categories considered in our analysis across different health workers cadres. Box 2 includes a description of the different incentives.

Several control variables were included in the analysis to account for observed heterogeneity in patients, providers and health facilities that may concur to affect the selected dependent variables. Table 3 includes summary statistics for the available controls at patient level.

Results

Below we report results for our preferred model with three clustering levels (region, health facility and provider). Two comparison models (multilevel ordered logistic with two clustering levels and standard ordered logistic regression with clustered errors) are reported in Supplementary Tables SM2 and SM3. We report all results in form of ORs with 95% confidence intervals to facilitate interpretation.

Compliance with IMCI guidelines

Concerning our analysis on compliance to IMCI guidelines, the final sample includes 1563 different children aged 5 years or less treated in the surveyed facilities. Table 6 shows the results.

Our analysis shows no statistically significant association between compliance with IMCI and supervision, of any kind. The rate

Table 4 Distribution of supervision indicators across health facility types

Variable	Total	Dispensary	Health centre	Hospital
	(Column percentages in parentheses)			
Sample for IMCI compliance analysis				
Frequency of management meetings in the last 6 months				
Never	89 (16.01)	70 (28.00)	17 (7.80)	2 (2.27)
Once	25 (4.50)	15 (6.00)	10 (4.59)	0 (0)
More than once	442 (79.50)	165 (66.00)	191 (87.61)	86 (97.73)
Total	556 (100)	250	218	88
Frequency of meetings with the community in the last 6 months				
Never	176 (31.65)	80 (32.00)	59 (27.06)	37 (42.05)
Once	50 (8.99)	22 (8.80)	21 (9.63)	7 (7.95)
More than once	330 (59.35)	148 (59.20)	138 (63.30)	44 (50.00)
Total	556 (100)	250	218	88
Last cascade supervision visit in the last 6 months				
Never	3 (0.54)	3 (1.20)	0 (0)	0 (0)
Within past 6 months	540 (97.12)	241 (96.40)	212 (97.25)	87 (98.86)
More than 6 months ago	13 (2.34)	6 (2.40)	6 (2.75)	1 (1.14)
Total	556 (100)	250	218	88
Sample for patient satisfaction analysis				
Frequency of management meetings in the last 6 months				
Never	108 (16.07)	86 (28.38)	20 (7.69)	2 (1.83)
Once	28 (4.17)	16 (5.28)	12 (4.62)	0 (0)
More than once	536 (79.76)	201 (66.34)	228 (87.69)	107 (98.17)
Total	672 (100)	303	260	109
Frequency of meetings with the community in the last 6 months				
Never	219 (32.59)	105 (34.65)	69 (26.54)	45 (41.28)
Once	56 (8.33)	25 (8.25)	24 (9.23)	7 (6.42)
More than once	397 (59.08)	173 (57.10)	167 (64.23)	57 (52.29)
Total	672 (100)	303	260	109
Last cascade supervision visit in the last 6 months				
Never	7 (1.04)	5 (1.65)	1 (0.38)	1 (0.92)
Within past 6 months	639 (95.09)	283 (93.40)	249 (95.77)	107 (98.17)
More than 6 months ago	26 (3.87)	15 (4.95)	10 (3.85)	1 (0.92)
Total	672 (100)	303	260	109

Source: Author's own elaboration on DHS SPA 2014/15 data.

of compliance with IMCI guidelines seems to be unaffected by the intensity of supportive supervision to health workers, cascade supervision from higher-level authorities, internal managerial activity or community supervision through meetings with community representatives.

On the other hand, our preferred three levels ordered logistic model shows a strong significant association between monetary housing allowances to health workers and higher compliance with IMCI. Health workers provided with housing allowance, other things equal, are four times more likely to show higher compliance with IMCI. Salary top-ups are also positively and significantly associated to IMCI compliance (OR 1.640). All other specific incentives show no significant association with IMCI treatment compliance.

The compliance to IMCI was higher for diagnoses related to malaria and digestive system problems, as opposed to acute ear infections (our reference category). The result is not surprising given the focus of national and international campaigns on reducing malaria morbidity and mortality. On the other hand, children with a respiratory diagnosis and/or later in childhood are less likely to be treated in compliance with IMCI. The compliance with IMCI guidelines was lower for clinical assistants compared with Medical Doctors (reference category) and for younger children. Other control variables do not show significant association with our measure of compliance with IMCI guidelines.

Patient satisfaction

The final pooled sample for our analysis of patient satisfaction includes 4970 patient visits, including ANC visits and treatment of sick children in the surveyed facilities. The results are provided in Table 7 for the full sample and the sub-samples of sick children and ANC patients separately.

Higher intensity of community supervision (in form of meetings with the community) is significantly associated with higher patient satisfaction in the analysis on the full sample and the sub-sample of ANC patients, but not in the sub-sample of sick children. Our analysis shows that, when community meetings were held more than once within the 6 months prior to the survey, patients were consistently more satisfied with health service provision (point estimate for OR is 1.316 for full sample and 1.727 for ANC patients).

Among the different incentive categories, two were significantly associated with higher patient satisfaction in the full sample: salary top-ups and subsidized housing for health workers. In both cases, providers benefiting from these incentives are about 1.3 times more likely to leave their patients satisfied. The analysis on the sub-sample of sick children shows a positive and significant association between patient satisfaction and salary top-ups (OR 1.456), payment for extra activities (OR 1.784) and subsidized housing (OR 1.593). The sub-sample of ANC patients does not show any significant positive association with the incentive categories considered

Table 5 Distribution of incentives across health worker cadres

Variable	Managing position	Medical doctor	Medical/clinical officer	Nurse	Assistant
Sample for IMCI compliance analysis					
Total staff in cadre	934 (59.76)	38 (2.43)	1038 (66.41)	349 (22.33)	138 (8.83)
Monetary incentives to provider					
Salary top-up	277 (29.66)	16 (42.11)	298 (28.71)	101 (28.94)	54 (39.13)
Per diem when training	310 (33.19)	7 (18.42)	282 (27.17)	134 (38.40)	28 (20.29)
Duty allowance	320 (34.26)	2 (5.26)	352 (33.91)	106 (30.37)	45 (32.61)
Payment for extra activities	128 (13.70)	1 (2.63)	122 (11.75)	40 (11.46)	3 (2.17)
On-call allowance	326 (34.90)	27 (71.05)	388 (37.38)	64 (18.34)	42 (30.43)
Housing allowance	29 (3.10)	8 (21.05)	23 (2.22)	5 (1.43)	0 (0)
Non-monetary incentives to provider					
Uniform/caps/backpack	293 (31.37)	14 (36.84)	313 (30.15)	95 (27.22)	58 (42.03)
Training	196 (20.99)	1 (2.63)	175 (16.86)	75 (21.49)	15 (10.87)
Subsidized housing	296 (31.69)	3 (7.89)	251 (24.18)	102 (29.23)	31 (22.46)
Time off/holidays	79 (8.46)	0 (0)	109 (10.50)	33 (9.46)	14 (10.14)
Sample for patient satisfaction analysis					
Total staff in cadre	2379 (47.87)	96 (1.93)	1622 (32.64)	2570 (51.71)	682 (13.72)
Monetary incentives to provider					
Salary top-up	693 (29.13)	32 (33.33)	436 (26.88)	789 (30.70)	186 (27.27)
Per diem when training	743 (31.23)	9 (9.38)	414 (25.52)	765 (29.77)	177 (25.95)
Duty allowance	941 (39.55)	8 (8.33)	570 (35.14)	928 (36.11)	240 (35.19)
Payment for extra activities	366 (15.38)	11 (11.46)	201 (12.39)	326 (12.68)	85 (12.46)
On-call allowance	772 (32.45)	61 (63.54)	616 (37.98)	493 (19.18)	161 (23.61)
Housing allowance	91 (3.83)	14 (14.58)	41 (2.53)	68 (2.65)	16 (2.35)
Non-monetary incentives to provider					
Uniform/caps/backpack	830 (34.89)	31 (32.29)	464 (28.61)	896 (34.86)	269 (39.44)
Training	446 (18.75)	4 (4.17)	246 (15.17)	436 (16.96)	87 (12.76)
Subsidized housing	618 (25.98)	19 (19.79)	399 (24.60)	418 (16.26)	122 (17.89)
Time off/holidays	269 (11.31)	0 (0)	189 (11.65)	255 (9.92)	77 (11.29)

Source: Author's own elaboration on DHS SPA 2014/15 data.

Box 2 Overview of monetary incentives to health workers in Tanzania and relevant frequency indicators from SPA 2014/15

Type of incentive

Salary top-ups

Long-term permanent monetary payments that top-up the basic government salary payable to medical cadres for permanent additional activities, responsibilities, within the facility or with external partners (e.g. project funded by donors that involves activity of health facility staff).

Per diem when training

Lump sum monetary subsistence allowance payable to medical cadres spending days/nights away on training within the country or abroad.

Duty allowance

Lump sum monetary allowance payable to a number of medical cadres for duties such as nightshifts.

Payment for extra activities

Lump sum monetary payment payable to a number of medical cadres if he/she personally worked beyond normal working hours for exceptional reasons and but cannot compensate taking time off during normal working hours.

On-call allowance

Lump sum monetary allowance payable to a number of medical cadres who after a nightshift (or similar) cannot be granted a day off.

Housing allowance

Lump sum monetary allowance meant to facilitate payment of the rent (or part of it) payable to medical cadres entitled to free or subsidized housing for which Government housing (usually within the health facility compound) is not available.

Uniform/caps/backpack

Equipment and clothing offered to health workers in excess to what is strictly necessary to perform their activities.

Training

Opportunities to attend additional training, specialization, diplomas and degrees.

Free or subsidized housing in government housing (usually within the health facility compound).

Subsidized housing

Time off/holidays

Compensation offered for extra time spent at work or reward in form of time off during normal working hours.

Table 6 Regression results for IMCI compliance

Three levels ordered logit	Sick children OR (95% CI)
Rural area	1.182 (0.647–2.160)
Results-based financing	1.429 (0.326–6.265)
Health Services Index	1.024 (0.930–1.127)
Any patient feedback mechanism	1.045 (0.683–1.599)
Caretaker literacy (reference: neither read nor write)	
Read only	0.592 (0.264–1.326)
Read and write	0.980 (0.730–1.314)
Caretaker relationship with patient (reference: mother)	
Father	0.846 (0.430–1.663)
Sibling	1.710 (0.624–4.687)
Other	0.958 (0.488–1.880)
Patient gender: female	0.900 (0.706–1.148)
Patient age	0.823*** (0.740–0.915)
Health insurance coverage	0.976 (0.678–1.403)
Diagnosis (reference: ear problem)	
Respiratory problem	0.230*** (0.155–0.340)
Digestive system	1.681** (1.141–2.476)
Malaria	2.009*** (1.393–2.897)
Fever	0.927 (0.619–1.388)
Patient charged for visit	0.727 (0.376–1.406)
Provider gender: female	1.075 (0.715–1.615)
Provider tenure at facility	1.025 (0.997–1.053)
Provider qualification (reference: medical doctor)	
Medical/clinical officer	0.484 (0.153–1.530)
Nurse	0.301 (0.0830–1.088)
Assistant	0.199* (0.0464–0.851)
Provider manager or in-charge of unit	1.126 (0.722–1.756)
Facility has IMCI guidelines	1.507 (0.973–2.334)
Number of OPD visits during the last month (reference: 0–200 visits)	
200–400 visits	1.290 (0.738–2.255)
400–600 visits	0.881 (0.456–1.704)
600–800 visits	0.715 (0.299–1.712)
More than 800 visits	0.705 (0.354–1.403)
Type of health facility (reference: dispensary)	
Hospital (any level)	1.311 (0.484–3.551)
Health centre	0.799 (0.426–1.498)
Frequency of management meetings at the health facility in the last 6 months (reference: never)	
Once	0.586 (0.217–1.586)
More than once	1.073 (0.607–1.897)
Frequency of meetings with the community at the health facility in the last 6 months (reference: never)	
Once	1.240 (0.604–2.546)
More than once	1.230 (0.804–1.880)
Last external supervision at the health facility (reference: never)	
More than 6 months ago	0.247 (0.0153–4.012)
Within past 6 months	0.300 (0.0238–3.777)
Days of work supervision to the provider	1.073 (0.988–1.165)
Monetary incentives to provider	
Salary top-up	1.640* (1.035–2.599)
Per diem when training	0.891 (0.568–1.398)
Duty allowance	1.068 (0.705–1.620)
Payment for extra activities	1.024 (0.545–1.927)
On-call allowance	1.079 (0.703–1.658)
Housing allowance	3.988* (1.229–12.94)
Non-monetary incentives to provider	
Uniform/caps/backpack	1.134 (0.743–1.732)
Training	1.096 (0.607–1.980)
Subsidized housing	1.460 (0.918–2.324)
Time off/ holidays	1.129 (0.573–2.227)
N	1563
Log-likelihood	−1717.1
LR chi^2	175.3
Prob > chi^2	1.13e−16
Number of iterations	6

Exponentiated coefficients; 95% confidence intervals in brackets.
*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.,
OPD, outpatient department; LR, likelihood-ratio test.

in the analysis. In contrast, non-monetary incentives to health workers in the form of additional holidays are associated with lower patient satisfaction for the full sample and the sub-sample of ANC patients. Other forms of supervision and incentive categories are not significantly associated with patient satisfaction in our estimated models.

Among the control variables, we found that patients that obtained a prescription for medicines during the visit are about 1.5 more likely to report higher satisfaction (1.9 times for the sub-sample of sick children). Second, patients waiting >90 min for the visit at the health facility are increasingly less satisfied. These findings are consistent with the existing literature as well as with the anecdotal evidence about patient satisfaction in rural settings in LMICs. Third, the literacy level of patients (or caretakers, for sick children) has a negative influence on satisfaction. Fourth, consistently with descriptive statistics in Table 3, patient satisfaction is significantly lower for visits of sick children (as opposed to ANC visits) and in health centres (secondary level of care) as opposed to dispensaries (primary level of care). Last, in the sub-sample of sick children, being charged for the visit results in sensibly lower patients' satisfaction (OR 0.552). This latter result is consistent with the policy in place in Tanzania on free healthcare for children under five.

Robustness checks

We conducted several types of robustness checks to verify the consistency of our results. From the technical point of view, we ran the preferred three levels ordered logistic regression with different numbers of integration (quadrature) points, namely 8, 12 and 16 as opposed to the standard of 7. The results—perfectly equivalent to the standard specification—are not reported.

Second, we estimated our main models using a multilevel regression with two clustering levels (provider and health facility) as well as a standard ordered logistic model with clustered errors. The results are reported in Supplementary Tables SM2 and SM3.

The SPA survey data employed for our analysis oversample the number of hospitals and health centres. We accounted for this characteristic of the dataset controlling for the type of facility in our analysis within the analysis. To further check the robustness and stability of our results, we ran the analyses omitting patients treated in hospitals. Supplementary Tables SM4 and SM5 show that the estimates do not differ significantly.

Finally, the set of independent incentives proposed in our analysis (Box 2) may hinder some degree of interaction or multicollinearity. Supplementary Table SM6 shows the cross-correlation matrix (Spearman's rho) for our 10 incentive variables. The higher

Table 7 Regression results for patient satisfaction

Three levels ordered logit	Full sample OR (95% CI)	Sick children only OR (95% CI)	ANC only OR (95% CI)
Rural area	1.207 (0.859–1.698)	1.094 (0.709–1.689)	1.203 (0.703–2.060)
Results-based financing	0.618 (0.241–1.583)	0.653 (0.241–1.768)	0.619 (0.196–1.952)
Health Services Index	1.021 (0.965–1.080)	0.986 (0.920–1.057)	1.094 (0.995–1.204)
Any patient feedback mechanism	0.858 (0.671–1.098)	1.108 (0.814–1.507)	0.541** (0.359–0.815)
Patient or caretaker literacy (reference: neither read nor write)			
Read only	0.567* (0.334–0.962)	0.579 (0.298–1.126)	0.508 (0.212–1.214)
Read and write	0.940 (0.767–1.152)	0.805 (0.624–1.039)	1.218 (0.870–1.705)
Patient or caretaker age	0.987* (0.975–0.999)	1.061 (0.975–1.156)	0.986* (0.974–0.998)
Health insurance coverage	0.982 (0.853–1.130)	1.157 (0.847–1.580)	0.950 (0.815–1.107)
Drug prescription during visit	1.511* (1.076–2.122)	1.974* (1.002–3.888)	1.410 (0.943–2.107)
Waiting time (reference: no waiting time)			
Up to 30 min	0.833 (0.553–1.254	0.926 0.580–1.481	0.591 (0.247–1.416
30–60 min	0.769 (0.501–1.179	0.884 0.540–1.448	0.562 (0.230–1.375
60–90 min	0.587 (0.329–1.046)	0.765 (0.378–1.548)	0.334* (0.114–0.975)
90–120 min	0.588* (0.383–0.903)	0.605* (0.368–0.994)	0.500 (0.205–1.218)
120–180 min	0.516** (0.331–0.806)	0.669 (0.390–1.146)	0.338* (0.139–0.821)
180–240 min	0.358*** (0.220–0.581)	0.454* (0.244–0.845)	0.237** (0.0947–0.592)
More than 240 min	0.390*** (0.245–0.623)	0.457** (0.254–0.821)	0.279** (0.113–0.687)
Patient type: sick child	0.190*** (0.123–0.293)		
Patient charged for visit	0.699 (0.489–1.000)	0.552* (0.350–0.870)	0.829 (0.461–1.491)
Provider gender: female	1.145 (0.892–1.469)	1.322 (0.992–1.762)	0.719 (0.416–1.241)
Provider tenure at facility	1.001 (0.987–1.015)	1.010 (0.991–1.030)	0.993 (0.973–1.012)
Provider qualification (reference: medical doctor)			
Medical/clinical officer	1.519 (0.774–2.981)	1.178 (0.548–2.533)	3.819 (0.728–20.03)
Nurse	1.990 (0.958–4.135)	1.329 (0.553–3.195)	5.469* (1.097–27.25)
Assistant	1.709 (0.758–3.852)	0.947 (0.354–2.529)	6.380* (1.169–34.81)
Provider manager or in-charge of unit	0.991 (0.780–1.259)	0.878 (0.638–1.206)	1.062 (0.735–1.534)
Number of OPD visits last month at the health facility (reference: 0–200 visits)			
200–400 visits	1.134 (0.818–1.572)	0.961 (0.637–1.450)	1.245 (0.724–2.140)
400–600 visits	1.195 (0.821–1.739)	1.168 (0.723–1.888)	1.057 (0.574–1.948)
600–800 visits	0.962 (0.589–1.572)	0.787 (0.431–1.437)	1.191 (0.507–2.799)
More than 800 visits	1.119 (0.766–1.635)	1.078 0.667–1.742	0.931 (0.499–1.739)
Type of health facility (reference: dispensary)			
Hospital (any level)	0.722 (0.409–1.274)	0.526 (0.258–1.073)	0.852 (0.339–2.144)
Health centre	0.684* (0.474–0.988)	0.762 (0.482–1.205)	0.554 (0.301–1.023)
Frequency of management meetings at the health facility in the last 6 months (reference: never)			
Once	0.869 (0.482–1.565)	0.848 (0.428–1.681)	0.991 (0.322–3.048)
More than once	0.951 (0.676–1.340)	0.918 (0.606–1.388)	1.030 (0.570–1.860)
Frequency of meetings with the community at the health facility in the last 6 months (reference: never)			
Once	1.177 (0.788–1.756)	1.104 (0.667–1.828)	1.582 (0.803–3.119)
More than once	1.316* (1.029–1.685)	1.210 (0.892–1.640)	1.727** (1.146–2.605)
Last external supervision at the health facility (reference: never)			
More than 6 months ago	1.169 (0.293–4.664)	1.606 (0.264–9.763)	0.621 (0.0720–5.348)
Within past 6 months	1.243 (0.368–4.198)	1.328 (0.269–6.555)	0.950 (0.141–6.420)
Days of work supervision to the provider	0.997 (0.951–1.046)	0.975 (0.919–1.033)	1.018 (0.941–1.101)
Monetary incentives to provider			
Salary top-up	1.343* (1.030–1.752)	1.456* (1.040–2.039)	0.621 (0.0720–5.348)
Per diem when training	0.824 (0.642–1.058)	1.051 (0.755–1.462)	0.950 (0.141–6.420)
Duty allowance	1.001 (0.794–1.262)	1.033 (0.769–1.388)	1.018 (0.941–1.101)
Payment for extra activities	1.261 (0.898–1.771)	1.784* (1.117–2.850)	0.621 (0.0720–5.348)
On-call allowance	1.043 (0.815–1.335)	1.056 (0.781–1.427)	0.950 (0.141–6.420)
Housing allowance	1.538 (0.788–3.004)	2.042 (0.864–4.828)	1.018 (0.941–1.101)
Non-monetary incentives to provider			
Uniform/caps/backpack	1.003 (0.795–1.265)	1.069 (0.788–1.451)	0.840 (0.590–1.196)
Training	1.124 (0.804–1.572)	1.036 (0.679–1.582)	1.320 (0.778–2.238)
Subsidized housing	1.386* (1.046–1.836)	1.593** (1.129–2.247)	1.109 (0.693–1.776)
Time off/ holidays	0.674* (0.465–0.977)	0.873 (0.534–1.428)	0.534* (0.306–0.931)
N	4970	2299	2671
Log-likelihood	−2679.1	−1655.3	−984.7
LR chi^2	256.3	87.85	75.97
Prob > chi^2	1.32e−30	0.000199	0.00355
Number of iterations	6	6	55

Exponentiated coefficients; 95% confidence intervals in parentheses.

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.,

LR, likelihood-ratio test.

value for a pairwise correlation is about 0.3, between per diem allowances for training and non-monetary incentives in the form of additional training. This value does not seem excessive and reflects the obvious connection between the two types of incentives. Further, a stepwise approach in including our independent variable did not show sensible changes in the estimated coefficients indicating no relevant confounders and absence of multi-collinearity (results not provided in tables). A full modelling of all interaction terms between incentive indicators would result in model overfitting.

Discussion

The empirical approach employed here represents a novel attempt to simultaneously assess the effect of supervision and incentives on selected measures of quality of care. We considered a broad range of quantitative proxy variables that map the extent of supervision and the incentive policy in place in the surveyed health facilities.

Our analysis revealed a positive and significant association between the frequency of meetings with the community and patient satisfaction for the full sample and the sub-sample of ANC patients only. First, the results suggest a difference in the patients' experiences between ANC patients and adult caretakers assisting sick children during visits to health facilities. This may be related to the interaction of both demand and supply-side factors. With higher frequency of meetings with the community, healthcare providers may be more aware of the needs of the community and, therefore, able to address them better. Consistently, this seems to be more prominent in the domain of ANC visits as opposed to acute health issues affecting children. In the full sample (pooling sick children and ANC patients), depending on the type, between 25% and 40% of health facilities reported that they did not have meetings with the community within the 6 months prior to the survey date (see Table 4). The IMCI compliance sample alone shows comparable percentages across all types of supervision indicators included in the analyses, supporting the hypothesis that the difference is driven by patients' perceptions and experiences rather than structural differences in the health facilities. The result contributes to the weak evidence base showing that—all other things equal—a closer interaction between health service providers and community improves patient satisfaction (Nair *et al.*, 2014; Dansereau *et al.*, 2015). Our interpretation of the mechanism is that community participation influences access to healthcare—and thus social health protection outcomes—through multiple channels. On the one hand, there is an indirect impact through increased patient satisfaction, favouring health-seeking behaviour in the served community (Rutherford *et al.*, 2010). The quality of every patient experience is crucial in determining future patient behaviours towards healthcare services and access to care in general (Andaleeb, 2001; Andaleeb *et al.*, 2007; Glick, 2009; Alrubaiee and Alkaa'ida, 2011). On the other hand, community participation can have a direct impact on access to care as a result of health promotion activities within the communities (Fotso *et al.*, 2009). The self-reinforcing loop described above is also consistent with the high-quality health system framework proposed by Kruk *et al.* (2018). In the race for universal health coverage, there is a need for further research to shed light on this 2-fold relationship.

Another interesting finding in our analysis relates to the effects of financial and non-financial incentives for health workers. This result is particularly valuable in light of the distribution of incentives across cadres reported in Table 5. In fact, salary top-ups appear to be evenly distributed across health worker qualifications, supporting the hypothesis that the positive association results from true individual incentive effect rather than capturing the role of one or two incentivized categories. The overall positive effects of incentive policies on quality—especially in terms of financial incentives such as salary top-ups—are in line with the available evidence (Chaudhury *et al.*, 2006; Dieleman and Harnmeijer, 2006; Hongoro and Normand, 2006; Mathauer and Imhoff, 2006; Dambisya, 2007; Henderson and Tulloch, 2008; Chandler *et al.*, 2009; Munga *et al.*, 2014). Nevertheless, our contribution provides additional evidence based on a robust analytical strategy, high-quality data and a wide range of controls of contextual factors. This result has implications for Tanzanian policymakers, e.g. in case of implementation of new policies and improvement of existing arrangements. Based on our results, we believe that pilot projects across the country should expand the role of better housing and general salary conditions for health workers in government-managed health facilities, instead of focusing on performance-related incentives such as P4P projects.

The differential effect of financial and non-financial housing incentives on the different quality of care measures is a puzzling yet interesting result. It is indeed reasonable to assume that certain classes of incentives may affect some quality dimensions more than others. Specifically, salary supplements for housing are positively associated with IMCI compliance, whereas non-financial incentives in the form of subsidized housing showed a positive association with patient satisfaction. Our interpretation is that subsidized housing—namely the chance of living in houses usually built by the government in the compound of the health facility—affects only the outcome dimension of quality of care related to the patients' experiences. In the authors' own experience, the opportunity of knocking on the door of the health facility in-charge just metres away from the closed health facility leaves a sense of great availability and proximity to the patient. There is no such direct link between actual living arrangements and the process dimension of quality, which may be the reason why we did not find the same association with the measure of compliance with IMCI. The salary supplement, despite being targeted to housing, increases the monthly budget of health providers. As such is closer to any other form of salary supplement and does not show the direct link with the proximity effect of subsidized housing described above. To this extent, the difference in the results on patient satisfaction across patients groups is informative. In fact, subsidized housing shows a significant association for the sub-sample of sick children but not for ANC patients. This can be interpreted in light of the difference in timing of visits for the two groups of patients: planned and scheduled for ANC visits—with no clear advantage of having providers living close-by—vs potentially unplanned and urgent needs for sick children.

The distribution of housing incentives, presented in Table 5, is generally consistent with the above interpretation. In the patient satisfaction full sample, subsidized housing is evenly distributed across health worker qualifications and roles. This rules out the hypothesis of the effect capturing the role of specific cadres. On the other hand, in the IMCI compliance sample, financial housing allowances are disbursed disproportionately to Medical Doctors (compared with other qualifications). The IMCI compliance sample includes health conditions affecting sick children for which the process of care dimension is more relevant. As Medical Doctors are likely to be more competent than other professionals in handling the process of care, the effect in our results may reflect an higher responsiveness of the process of care to financial incentives for this professional category.

Another curious result is the negative association between patient satisfaction and additional holidays. Although additional holidays should make health workers happy and motivated, additional time off and related abuses (i.e. absenteeism) may lead to

suboptimal organization of shifts in the health facilities and excessive workload for health workers on duty. Our finding supports the argument that overloaded providers tend structurally to produce queues and longer waiting times, besides healthcare of lower quality (Kisakye *et al.*, 2016). Another finding that supports the latter statement is the negative effect of per diem allowances for training, consistently across type of quality of care measure. The effect is statistically significant only in the analysis on patient satisfaction that excludes hospitals from the sample. Yet, the result is consistent with some literature pointing to the negative effects of per diems—and the associated travelling away from work—on provider performance (Ridde, 2010; Vian *et al.*, 2012). Nonetheless, our interpretation of latter nuances in the results related to incentive policies is far from being conclusive and would greatly benefit from further research focused on the decision-making process of health workers.

The last major result of our analysis is the lack of any association between quality of care and frequency of external, supportive or managerial supervision. Besides problems related to effective coverage of supervision in remote areas (Manzi *et al.*, 2012) and nature of supervision activity (Snowdon *et al.*, 2017; Vasan *et al.*, 2017), the result fits well with the literature suggesting that supervision alone is not effective in generating improvements in provider performance and quality of care (Kok *et al.*, 2018; Kruk *et al.*, 2018). On the one hand, our interpretation is that the quality of feedback from supervision matters as much (if not more) as the frequency of supervision itself. The importance of feedback for the effectiveness of supervision is not new to the literature (Manongi *et al.*, 2006; Moran *et al.*, 2014; Kok *et al.*, 2018; Renggli *et al.*, 2018). In fact, health providers may turn out to feel judged and not supported with constructive feedback, no matter if positive or negative. As a result, they may lack the necessary motivation to put more effort into work, resulting in suboptimal quality of healthcare provision. On the other hand, the combination of supervision, training and community involvement in multifaceted quality improvement initiatives proved to be largely more effective than isolated policies (Kruk *et al.*, 2018). These broad approaches to quality improvement are likely to enhance the characteristics and perception of supervision among healthcare workers (Rowe *et al.*, 2010). Although our results are based on a survey and employ a statistical technique that is not meant to detect all real-life human interactions between supervisors and health workers, they may also reveal problems in the implementation of these activities in Tanzania. Further research should focus on thorough evaluation of the effectiveness of supervisory practices within public health facilities, in Tanzania and elsewhere.

Finally, among the control variables included in our analysis on patient satisfaction, two main results arise and confirm the existing evidence. First, high-waiting times are detrimental for patient satisfaction with health services provided. Second, drug prescription during treatment is associated to higher patient satisfaction.

One major limitation of our analysis is that we look at a proxy of the outcome—quality of care—that results from an intermediate process related to the effort put in the work by different health providers, with varying levels of expertise and skills. In particular, our analysis overlooks the direct impact pathway of incentives and supervision on healthcare quality through provider motivation and effort. Future research in this field should try to disentangle the process and outputs of measured quality of care.

The accuracy of quality measurement also has room for improvement. Routine monitoring and evaluation programmes should collect objective measures of quality of care, such as appropriateness of prescribing behaviour and diagnosis accuracy. Further, integration between healthcare quality data and patient cohort studies could help to capture long-term impacts on health status.

The sample of health facilities included in our analysis is limited to public (government managed) health facilities, intentionally excluding relevant factors such as faith-based, non-profit and private healthcare providers. The sampling strategy employed to collect the data ensures the statistical validity of the sub-sample but does not elude the fact that we portray only part of the full healthcare provision panorama. Still, we believe that—in low-income settings—public health facilities maintain a major role in granting access to affordable healthcare for the poor and thus reducing social inequalities.

In conclusion, we acknowledge the explorative nature of our study, which is based on cross-sectional data and includes simultaneously a large set of control variables. Although the large number of controls is essential to reduce omitted-variable bias, it also reduces the power to detect significant associations. As suggested by Kruk *et al.* (2018), future research should produce better multi-year evidence on the impact of quality improvement initiatives, including supervision and incentives.

Conclusion

High quality of care is a key for promoting health in Tanzania not only through direct positive outcomes of the process of care but also through increased care-seeking behaviour in the communities. Our results confirm that better salary conditions for health workers are beneficial for both our quality of care indicators, namely compliance with IMCI and patients' satisfaction. Consistently with its labour-intensive nature, the effort put in by adequately incentivized health workers influences the quality of healthcare produced.

Housing arrangements for health workers—especially in rural settings—are associated with higher patient satisfaction. Based on our analysis, health facility compounds should include living spaces for health workers that are likely to create a sense of closeness with community and ultimately patients. Along the same lines, higher frequency of meetings between community and health facility representatives improves patients' satisfaction with health services provided. In turn, increased patient satisfaction will most likely favour a positive attitude of patients towards health service provision—in our case for government-owned health facilities—and increased health-seeking behaviour.

The policy tools described above are all subject to direct control of LGAs and central authorities. Besides testing new interventions with pilot projects funded by development partners, policymakers in Tanzania and in other LMICs should take into serious account the available body of evidence to shape effective health policies ensuring good quality healthcare for all.

Note

1. As of 2018, the full name is Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC).

Supplementary data

Supplementary data are available at *Health Policy and Planning* online.

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Conflict of interest statement. None declared.

Ethical approval. The specific study did not require any ethical clearance. Nevertheless, the researchers involved in the project obtained ethical clearance to conduct research in Tanzania from the Institutional Review Board at Ifakara Health Institute (IHI, Dar es Salaam, Tanzania) and from the National Institute for Medical Research (NIMR, Dar es Salaam, Tanzania).

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