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Original Research

Health professional productivity in Ethiopian hospitals: evidence from a multicenter time-motion study

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Abstract

Introduction: Efficient use of health worker time is critical for improving service delivery in low resource and rural settings, where persistent workforce shortages limit progress toward universal health coverage. Ethiopia faces a severe health workforce deficit, yet empirical evidence on how hospital-based professionals utilize their working hours, particularly in rural and remote hospitals, remains limited. This study assessed productive time use among health professionals and examined factors associated with achieving an 8-hour productive workday.

Methods: A cross sectional time–motion study was conducted in 18 public and private hospitals, including rural facilities across Ethiopia. A total of 180 health professionals representing five cadres were observed over two full working days using a standardized time–motion protocol. Productive activities included direct and indirect patient care and essential administrative functions. Structured interviews assessed workload, workplace conditions, and performance management practices. Descriptive statistics and multivariable logistic regression identified predictors of high productivity.

Results: Health professionals spent a total of 5.55 hours per day on productive activities (69.4% of official working hours). Nearly one-third of time was lost to non-productive activities, primarily waiting for patients and having extended breaks. Productivity was positively associated with postgraduate training, greater experience, higher daily patient load, and receipt of performance appraisal. Patterns were consistent across rural and urban hospitals, though rural facilities reported longer waiting times and greater supply constraints.

Conclusion: Despite systemic constraints, health professionals dedicate a substantial share of their time to productive tasks. A portion of non-productive time reflects system-level factors such as patient flow disruptions and supply constraints rather than individual inefficiency, particularly in rural hospitals. Addressing these bottlenecks – alongside strengthening workforce capacity through training, supervision, and performance systems – could improve efficiency within existing resources and support equitable, high-quality care.

Keywords

Ethiopia, hospital efficiency, productivity, rural health workforce, time–motion study.

Introduction

Health worker productivity is a core determinant of health system performance, especially in low- and middle-income countries where shortages of skilled professionals constrain service availability and quality. Efficient utilization of available working hours is particularly critical in rural and remote settings, where geographic isolation, limited resources, and staffing shortages intensify system pressures[1-4]. Health systems in such environments rely heavily on optimal time allocation to sustain essential services and advance progress toward universal health coverage.

Ethiopia illustrates these challenges distinctly. National and international data indicate that the combined density of doctors, nurses, and midwives in the country remains far below global benchmarks recommended for achieving universal health coverage. In addition, the health workforce is unevenly distributed, with a disproportionate concentration in urban centers and persistent shortages in rural and pastoralist districts, where most of the population resides[5,6]. Rural hospitals experience persistent understaffing, unpredictable patient volumes, delays in supply availability, and weaker managerial systems, all factors known to influence health worker productivity[4,7]. Despite policy priority on improving efficiency within existing workforce constraints, empirical evidence on how hospital-based health professionals use their time, particularly in rural facilities, remains limited.

Time-motion studies offer an objective method for understanding how health workers distribute their time across tasks. Unlike self-reported assessments, they capture real-time workflow patterns that reveal inefficiencies such as waiting times, administrative bottlenecks, and workflow interruptions, problems especially prevalent in rural and resource-constrained contexts[8-11]. Evidence from Sub–Saharan Africa and South Asia shows that only 30–50%

of health worker time is typically devoted to direct patient care, with significant variation across contexts[12,13]. More recent studies from Eswatini and Kenya found higher proportions of time spent in direct care, yet the extent to which these patterns reflect rural constraints remains unclear[14,15].

In Ethiopia, prior research has focused primarily on health extension workers or specific cadres, highlighting time-use inefficiencies driven by systemic barriers such as travel time, waiting, and administrative burdens[16-18]. However, these findings do not reflect the realities of hospital-based professionals who deliver more complex inpatient and outpatient services. Studies among facility-based staff remain scarce, and few have examined differences between rural and urban hospitals, leaving an important evidence gap for workforce planning.

Given Ethiopia's Human Resources for Health strategy, which emphasizes both productivity improvement and strengthening rural service delivery, understanding how hospital-based health professionals allocate their time across diverse settings is essential[19]. This study addresses this gap by conducting a multi-site time–motion assessment across public and private hospitals, including rural hospitals across Ethiopia. By quantifying productive and non-productive time and examining associated factors such as experience, training, supervision, and workload, this study provides context-specific insights crucial for informing workforce optimization in Ethiopia's rural health system.

Methods

Study design, setting, and region

We conducted a cross-sectional time–motion study in 2023 across 18 Ethiopian hospitals (16 public; 2 private), purposively sampled from facilities participating in the Health Workforce Improvement Program, funded by the United States Agency for International Development (USAID). Sites included rural hospitals and urban facilities to capture diverse operating contexts; this manuscript is submitted under the Africa region definition used by *Rural and Remote Health*. The time–motion approach provides objective, real-time observation of health worker activities and is recommended for identifying workflow inefficiencies in resource-constrained settings[20-22].

Participants and eligibility

Eligible participants were hospital-based health professionals: medical doctors, nurses, midwives, pharmacy personnel, and laboratory professionals. From staff rosters in each hospital, we randomly selected 10 health professionals per site (two per cadre), yielding 180 participants. Temporary staff (<12 months) or those unavailable during the data collection were excluded.

Sample size

The original implementation study planned baseline and endline measurements. The required total (baseline + endline) sample size was 360 health professionals (180 per round), calculated using a two-sample comparison of proportions with P_1=0.50, P_2=0.65, 95% confidence, 80% power, design effect=1.2, and anticipated change in the proportion meeting the productive-time threshold. Only the baseline component was ultimately implemented; the achieved number of 180 provides adequate precision for cross-sectional estimates and exploratory regression.

Operational definitions and outcomes

Productive activities defined as time spent on direct patient care (eg consultation, examination, procedures), indirect patient care (eg documentation, case review, care coordination), and essential service activities (eg clinical administration, meetings, training, cleaning/preparation related to service delivery). Non-productive activities included waiting for patients, breaks, unauthorized absences, and social interactions not related to service duties[20,21].

The primary outcome was the mean proportion of official working time spent on productive activities per day. The secondary outcome was a binary indicator of high productivity, defined as 8 hours or more of productive time during the observed workday, aligned with Ethiopian civil-service expectations for civil servants.

The activity classification framework used in this study (Table 1) is consistent with validated time–motion methodologies previously applied in Zanzibar and Tanzania, which distinguish direct patient care, indirect care, administrative activities, outreach, and non-productive time[20,21].

Table 1: Activity categories used in time–motion coding to assess productive time use among health professionals in 18 public and private hospitals, including rural facilities across Ethiopia[†]

Category	Definition/examples
Direct patient care	Patient-facing clinical tasks (consultation, examination, procedures, surgery)
Indirect patient care	Tasks supporting care without the patient present (documentation, record review, clinical coordination/consultation)
Administration	Facility or service management tasks essential to care delivery (non-clerical)
Meetings	Planned work-related meetings (on/off site)
Training	Planned work-related training (on/off site)
Cleaning/preparation/maintenance	Cleaning, room/equipment prep and routine maintenance linked to service delivery
Clinical hygiene	Hand hygiene and related infection-prevention actions
Outreach	Provision of clinical services outside the facility (when applicable)
Non-productive time	Waiting for patients, having personal breaks, unauthorized absence, non-work social interactions

[†] Coding framework adapted from prior productivity studies and a methodological review[20,21].

Data collection procedures

We adapted an observation tool and structured interview questionnaire from prior Zanzibar/Tanzania productivity assessments and an Ethiopian motivation/performance tool (Jhpiego-Ethiopia and Ministry of Health Ethiopia, 2022, unpublished data)[20,21]. Trained observers recorded activities continuously for two full working days per participant (08:30–17:30 with the standard lunch break excluded from observation totals). Data collection was conducted during routine daytime working

hours, when the majority of outpatient and inpatient services are delivered in Ethiopian hospitals. Night shift and on-call duty periods, which are typically characterized by lower patient volume and emergency-focused care, were not included in the observations.

Observations were conducted on randomly selected weekdays and, where feasible, across outpatient and inpatient areas to reflect typical duty patterns. A short, structured interview captured workload (patient load), supervision/performance management practices, supplies availability, and related workplace conditions. These interviews were used to complement the observational data by providing contextual information on workflow organization, perceived workload, and system-level constraints influencing productivity patterns.

Measures and covariates

We recorded cadre, sex, age, years of experience, highest qualification, department (outpatient or inpatient), hospital type (general v comprehensive/specialized), daily patient load, perceived workload, supervision modalities (work observed, feedback frequency), performance review/appraisal, skill training, availability of job aids, and supplies/drug availability. Motivation, job satisfaction, and turnover intention were also captured for contextual interpretation.

Data management and statistical analysis

Data was captured electronically (Kobo Toolbox), exported to SPSS v29.0 (IBM Corp; https://www.ibm.com/products/spss-statistics) for cleaning and analysis, and summarized using descriptive statistics (means, standard deviations, proportions). Distributional assumptions were examined (Shapiro–Wilk and histograms). Because time-use measures were skewed, we used the Mann–Whitney *U*-test and Kruskal–Wallis test for two-group and multi-group comparisons, respectively. The secondary outcome (≥8 hours productive time) was modeled using bivariable and multivariable logistic regression. Variables with $p<0.25$ in bivariable analysis were considered for the adjusted model. We report crude and adjusted odds ratios with 95% confidence intervals and $p<0.05$ denoting statistical significance. Model fit was assessed using the Hosmer–Lemeshow test. Although observations were clustered within hospitals, we did not adjust standard errors for clustering due to the exploratory nature and small per-cluster sample; we acknowledge this as a limitation and interpret associations cautiously.

Quality assurance and bias mitigation

Observers completed 2 days of standardized training on the coding manual, task classification, and time-recording protocols. This was followed by supervised inter-observer practice sessions conducted during pilot testing to harmonize interpretation of activities and ensure consistency in time-stamping. Discrepancies identified during these sessions were discussed and resolved by consensus, and the observation protocol was refined accordingly. During the main data collection phase, each observation session was conducted by a single trained observer. Daily supervisory checks were used to verify completeness and internal consistency of recorded data. To minimize potential behavioral reactivity (Hawthorne effect), participants were informed that the study assessed workflow at the system level rather than individual performance. No personal identifiers were collected, and data were stored on password-protected systems.

Ethics approval

Ethics approval was obtained from the Ethiopian Public Health Association Institutional Review Board (EPHA/06/583/23) and the Johns Hopkins Bloomberg School of Public Health Institutional Review Board (No. 24523). Written informed consent was obtained from participants; patient permission was sought to observe clinical encounters. The study did not involve Indigenous populations.

Results

Participant characteristics

A total of 180 hospital-based health professionals were observed (response rate: 100%). Just over half were male (52.2%); 60.6% were aged <30 years. Most held undergraduate degrees (70.0%); 13.3% held postgraduate qualifications. Nearly half (47.8%) had less than 5 years of experience. Two-thirds worked in outpatient departments (67.2%). Over half (55.6%) were employed in comprehensive specialized hospitals (Table 2).

Table 2: Study participant characteristics (*N*=180)

Characteristic	Variables	*n*	%
Sex	Male	94	52.2
	Female	86	47.8
Age (years)	<30	109	60.6
	>30	71	39.4
Highest qualification	Postgraduate	24	13.3
	Undergraduate degree (BSc/MD)	126	70
	TVET/diploma	30	16.7
Type of hospital	Specialized hospital	100	55.6
	General hospital	80	44.4
Experience (years)	<5	86	47.8
	5–10	61	33.9
	>10	33	18.3
Department	Outpatient service	121	67.2
	Inpatient service	59	32.8

Current position in facility	In charge of the facility or department	12	6.7
	In charge of a section	34	18.9
	No position	134	74.4
Marital status of health professional	Married	105	58.3
	Single	75	41.7
Housing	Rented from government	13	7.2
	Provided by health facility	15	8.3
	Owned	19	10.6
	Live with a parent/family/friend	19	10.6
	Private rental	114	63.3

TVET, Technical and Vocational Education and Training.

Time allocation across activities

Across all cadres, participants spent a mean of 5.55 hours/day on productive activities (69.4% of official working hours), with direct patient care accounting for 37.3% (2.99 hours/day) and indirect care for 13.2% (1.05 hours/day). Non-productive time constituted 30.6% of official hours, driven primarily by waiting for patients (9.4%) and having breaks (7.7%) (Table 3).

Table 3: Distribution of working time, by activity category

Activity category	Subcategory	Mean time per day (minutes (hours))	% of official time	SD (minutes)
Productive activities	Direct patient care	179.18 (2.99)	37.3	117.43
	Indirect patient care	63.17 (1.05)	13.2	77.57
	Consultation with colleagues	27.34 (0.46)	5.7	59.28
	Administration (service-related)	26.29 (0.44)	5.5	69.24
	Meetings	15.36 (0.26)	3.2	50.46
	Training	15.75 (0.26)	3.3	63.99
	Cleaning/preparation/maintenance	4.64 (0.08)	1.0	12.56
	Clinical hygiene	1.59 (0.03)	0.3	4.09
Overall, productive		333.32 (5.55)	69.4	131.49
Non-productive activities	Waiting for patients	45.23 (0.76)	9.4	54.94
	Breaks	36.77 (0.61)	7.7	51.38
	Unauthorized leave/absence	19.72 (0.33)	4.1	47.89
	Social visits/contacts	14.14 (0.24)	2.9	49.41
	Work for team morale	15.72 (0.26)	3.3	56.69
	Family obligations	5.05 (0.08)	1.1	31.69
	Illness	2.20 (0.04)	0.5	21.39
	Funeral	1.22 (0.02)	0.3	16.39
	Other unclassified	7.26 (0.12)	1.5	30.95
Overall, non-productive		146.68 (2.44)	30.6	130.26

SD, standard deviation.

Productive time by cadre, sex, and hospital type

Average productive time ranged from 303.4 minutes (63.2%) among nurses to 354.3 minutes (73.8%) among medical doctors; differences by cadre were not statistically significant (Kruskal–Wallis $p=0.508$). Mean productive time was 348.5 minutes (72.6%) for male versus 317.9 minutes (66.2%) for female professionals (Mann–Whitney $p=0.128$). General hospitals and comprehensive specialized hospitals showed similar productive-time profiles ($p=0.672$) (Table 4).

Table 4: Mean productive time (minutes and % of official hours), by subgroup

Characteristic	Subgroup	*n*	Mean time (minutes (% of official time))	SD	*p*-value
Cadre	Medical doctor	36	354.25 (73.8)	127.90	0.508
	Nurse	36	303.39 (63.2)	138.66	
	Pharmacy professional	36	341.91 (71.2)	129.17	
	Laboratory professional	36	325.17 (67.7)	139.45	
	Midwife	36	344.61 (71.8)	122.64	
Sex	Female	86	317.85 (66.2)	138.72	0.128
	Male	94	348.52 (72.6)	129.71	
Hospital type	General	80	338.52 (70.5)	125.95	0.672
	Comprehensive specialized	100	330.14 (68.8)	136.27	

SD, standard deviation.

Patient volume and observed waiting

Table 5 shows that the majority of healthcare professionals, 56.1% (*N*=101), reported managing between 11 and 30 clients per day, consistent between general (56.3%, *n*=45) and specialized hospitals (56%, *n*=56). Notably, a substantial proportion of respondents, 32.2% (*n*=58), reported a high workload, handling more than 30 clients daily; another 11.7% (*n*=21) reported a low patient load of 0 to 10 clients daily.

Table 5: Distribution of patient volume and service demand, by facility type

Characteristic	Patient volume and demand	General hospital (*N*=80)	Specialized hospital (*N*=100)	Total (*N*=180)
		n (%)	*n* (%)	*n* (%)
Daily patient/client load per healthcare worker	0–10	9 (11.2)	12 (12)	21 (11.7)
	11–30	45 (56.3)	56 (56)	101 (56.1)
	>30	26 (32.5)	32 (32)	58 (32.2)
Average number of patients in waiting area (outpatient) per day	<50	56 (70)	73 (73)	129 (71.7)
	>50	24 (30)	27 (27)	51 (28.3)

Workplace conditions, incentives, and attitudes

As shown in Table 6, across all cadres, 81.7% reported that supplies and drugs were partially available (only 18.3% reported full availability); 76.7% perceived workload as excessive. Slight majorities reported being satisfied with their work environment (56.7%) and management support/feedback (55.0%). Non-financial incentives were received by 18.3%; financial incentives were received by 17.2%. Motivation (59.4%) and overall job satisfaction (58.3%) were moderate; 39.4% planned to leave their facility within the next year. Differences across cadres were significant for work environment satisfaction (p=0.005), motivation (p=0.007), overall job satisfaction (p=0.022), supplies availability (p=0.015), and receipt of financial incentives (p=0.042) (full cadre-stratified outputs available on request).

Table 6: Workplace conditions and perceptions (overall)

Item (yes/satisfied)	*n*	%
Supplies/drugs/equipment fully available	33	18.3
Participated in team-building exercise	70	38.9
Formal communication occurs in unit/facility	137	76.1
Perceives workload as excessive	138	76.7
Fully authorized to accomplish delegated tasks	155	86.1
Receives non-financial incentive	33	18.3
Receives financial incentive (beyond salary)	31	17.2
Satisfied with work environment	102	56.7
Satisfied with management support/feedback	99	55.0
Feels motivated to work at this facility	107	59.4
Overall job satisfaction	105	58.3
Planning to leave within next year	71	39.4

Supervision and performance management

Nearly all professionals (98.9%) reported having a supervisor and 72.8% had a written job description. Supervision commonly included work observation (76.7%), record review (67.8%), feedback (68.9%), and problem-solving discussion (68.3%). Feedback at least monthly was reported by 72.2%. While 72.2% reported receiving formal performance review/appraisal, only 42.8% perceived a clear system for managing underperformance, rewards, and sanctions, and only 30.6% perceived reward processes as fair (Table 7).

Table 7: Supervision and performance management (overall)

Item	*n*	%
Has supervisor	178	98.9
Has written job description	131	72.8
Supervision includes record review	122	67.8
Supervision includes work observation	138	76.7
Feedback provided during supervision	124	68.9
Problem-solving discussed	123	68.3
Administrative updates provided	73	40.6
Receives feedback at least monthly	130	72.2
Receives performance review/appraisal	130	72.2
Receives skill enhancement training	111	61.7
Formative job aids available	113	62.8
Clear system for underperformance/reward/sanction	77	42.8
Rewards handled the same for all employees	55	30.6

Factors associated with high productivity (≥8 hours productive time)

In multivariable logistic regression, postgraduate training, greater experience, higher daily patient load, and receipt of recent performance review/appraisal were associated with higher odds of achieving a productive workday of 8 hours or more. Compared with postgraduates, undergraduates had 84% lower odds (adjusted odds ratio (AOR) 0.16, 95%CI 0.05–0.44), and diploma/TVET (Technical and Vocational Education and Training) holders had 82% lower odds (AOR 0.18, 95%CI 0.05–0.71) of meeting the threshold. Each additional year of experience increased the odds by 1% (AOR 1.01, 95%CI 1.00–1.11). Each additional patient per day increased the odds by 6% (AOR 1.06, 95%CI 1.00–1.11). Not receiving a recent performance review/appraisal was associated with 57% lower odds (AOR 0.43, 95%CI 0.19–0.99) (Table 8).

Table 8: Multivariable predictors of 8 hours or more of productive time[†]

Predictor (reference)	Adjusted OR	95%CI	*p*-value
Education			
Undergraduate (v postgraduate)	0.16	0.05–0.44	<0.001
Diploma/TVET (v postgraduate)	0.18	0.05–0.71	0.015
Experience (per year)	1.01	1.00–1.11	0.024
Patients seen per day (per patient)	1.06	1.00–1.11	0.016
Performance review (no v yes)	0.43	0.19–0.99	0.048

[†] Model fit: Hosmer-Lemeshow p<0.05.

CI, confidence interval. OR, odds ratio. TVET, Technical and Vocational Education and Training.

Discussion

This multi-site time–motion study provides granular evidence on how hospital-based health professionals in Ethiopia allocate their working time and which factors are associated with higher

productivity. Overall, nearly 70% of official working hours were devoted to productive activities, while approximately 30% were classified as non-productive, primarily due to waiting for patients and other interruptions. However, this estimate should be interpreted cautiously. In the Ethiopian context, the standard workday consists of 8 hours of duty, excluding a 1-hour lunch break (which was not included in productivity estimates). Within working hours, not all non-productive time reflects inefficiency, as short breaks, informal interactions, and brief pauses are often necessary for recovery and sustained clinical performance. Similarly, periods of inactivity may reflect low or irregular patient flow rather than avoidable inefficiency. A fully 'productive' schedule is therefore neither realistic nor desirable in routine practice.

In rural hospital settings, the key challenge is distinguishing between necessary recovery time and avoidable system-level inefficiencies such as workflow fragmentation, supply constraints, and patient flow disruptions. Moreover, the observed non-productive time includes both system-related delays (eg waiting for patients) and individual breaks, which have distinct implications for service organization. These findings align with the broader literature from low-resource settings, which consistently shows substantial portions of provider time spent outside direct care, particularly in rural and remote environments characterized by irregular patient flow, supply constraints, and constrained management systems[8-11,14,23].

The mean productive time (5.55 hours/day) is comparable to reports from peri-urban and rural public facilities in Lima, Peru, and South Africa, where time–motion and work-sampling methods identified sizeable fractions of the day outside direct care[9,11]. In contrast, Eswatini and Kenya have reported higher direct-care shares in specific services or cadres, but those estimates often reflect narrower clinical contexts and do not fully capture hospital-wide workflow variation in rural settings[14,23]. The cross-cadre uniformity we observed – no statistically significant differences between doctors, nurses, midwives, pharmacy and laboratory professionals –underscores the systemic nature of time losses, suggesting that bottlenecks (patient flow, supplies, and supervision) are facility-level phenomena rather than cadre-specific behaviors[8,24].

The prominent role of waiting for patients points to unpredictable demand and queue formation in outpatient areas, which are frequently exacerbated in rural hospitals by travel distances, seasonal patterns, and referral delays[16,24]. Non-productive time attributable to waiting has also been documented among community and facility cadres in Ethiopia and Albania, with the latter reporting higher idle time when patient arrivals were not synchronized with staffing[16,25]. Our participants' reports that supplies and drugs were often only partially available (81.7%) further mirrors evidence that stock-outs and logistics disruptions remain pervasive in low- and middle-income settings and can indirectly depress provider productivity by causing encounter interruptions, rework, or rescheduling effects likely to be more pronounced at rural peripheries[26].

Findings from the structured interview items (closed-ended measures of workplace conditions and perceptions) provide additional context to these patterns. High levels of perceived excessive workload (76.7%), alongside limited access to financial (17%) and non-financial incentives (18.3%), and only moderate levels of motivation (59.4%) and job satisfaction (58.3%), suggest that productivity is influenced by not only time use but also workplace environment and system constraints.

Importantly, although a substantial proportion of respondents (76.7%) perceived their workload as excessive, time–motion findings indicated that approximately 30% of working hours were non-productive. This apparent discrepancy suggests that perceived workload is influenced by not only task volume but also how work is organized and experienced. In rural health systems, where service delivery is often fragmented and resources are constrained, health workers may face alternating periods of high activity and enforced waiting, alongside administrative demands and frequent interruptions, creating a sustained sense of pressure. This mismatch highlights the need to improve workflow organization, patient flow, and service coordination, underscoring that improving productivity requires attention to not only staffing levels but also these system-level factors, and warrants further investigation using mixed-method approaches[24].

Several organizational and individual factors were associated with meeting the productive threshold of 8 hours or more. Postgraduate training and greater experience were positively associated with higher productivity; these patterns are consistent with evidence that advanced training and accumulated clinical familiarity can streamline decision-making and reduce task switching[27,28]. Regular performance review/appraisal was also associated with higher productivity, supporting prior conclusions that structured supervision and feedback are among the most reliable levers to improve health worker performance in resource-constrained systems[29].

These findings also provide context for interpreting motivation, job satisfaction, and turnover intention measured in this study. Although widely recognized as important workforce determinants[30-32], they were not statistically significant predictors in the multivariable model, suggesting indirect or mediated effects through organizational and workload-related factors. The relatively high prevalence of supervision in our sample (eg work observation and feedback) is encouraging; however, weaknesses in reward/sanction systems and perceived unfairness indicate that performance management remains incompletely institutionalized, an issue frequently highlighted in African health systems and with tangible implications for rural retention and motivation[33-36]. Although a slight majority reported satisfaction with job and management support, this likely reflects the influence of supervisory systems and may explain why satisfaction coexists with underlying system constraints affecting motivation and turnover intention, even without a direct association with productivity.

Higher daily patient load was associated with increased odds of achieving the productive threshold of 8 hours or more. While this may reflect reduced idle time, caution is needed. Increased workload may also interact with motivation and job satisfaction, as higher patient volumes can enhance perceived productivity while contributing to fatigue and reduced engagement. Although not statistically significant, these psychosocial factors may still be influenced by workload pressures over time, contributing to burnout and turnover intention. Evidence from Ethiopia and similar settings shows that excessive caseloads in understaffed rural facilities increase risks of provider fatigue, burnout, and reduced

quality of care[24,37-39]. Such conditions may elevate turnover intention even when job satisfaction is reported by a slight majority of respondents. Productivity strategies should therefore emphasize flow optimization (eg appointment systems, triage, task shifting) rather than simply increasing throughput alone[24,40]. In rural hospitals, interventions such as synchronized clinic scheduling, fast-track diagnostics, and improved referral communication can reduce delays without overburdening providers[40,41].

Overall, organizational and workload-related factors more directly shape productivity, while psychosocial factors such as motivation, job satisfaction, and turnover intention appear to operate indirectly within the broader work environment.

Policy and program implications

This study's findings indicate that avoidable non-productive time principally driven by waiting for patients and the partial availability of supplies represents a tractable efficiency reserve in Ethiopian hospitals. This issue is likely more pronounced in rural facilities where long travel distances, referral delays, transport limitations, and unreliable supply systems are common structural realities. While increasing staffing may be desirable, resource constraints make large-scale recruitment unrealistic in the short term. Instead, targeted, low-cost management interventions offer a feasible pathway to convert idle time into productive care activities. Implementing these strategies will require navigating existing institutional norms and resource limitations through a phased approach. Based directly on the system bottlenecks and organizational predictors identified in our study, we propose the following five practical interventions.

Improving patient flow within the existing system

Facilities can optimize patient arrival patterns by utilizing existing human resources such as temporarily reallocating card-room staff or liaison officers during early morning peak hours to implement a low-cost, paper-based structured triage system. Synchronizing outpatient clinic hours with the known arrival times of patients directly acknowledges the geographical realities faced by rural communities. This practical alignment reduces periods of inactivity by distributing the workload more evenly throughout the day and minimizing sudden surges, without requiring additional capital investment.

Stabilizing point-of-care readiness via low-resource inventory

Frequent stock-outs interrupt clinical encounters and trigger operational rework. While rural hospitals cannot fix national supply chains or alter the delivery lead times of the Ethiopian Pharmaceutical Supply Service, they can drastically reduce facility-level stock opacity. Implementing visual controls such as physical bin cards with clearly marked minimum-stock thresholds and weekly communication huddles between clinical department heads and the logistics team requires no budget. This shifts institutional norms from reactive crisis-purchasing to proactive internal redistribution, maximizing the utility of available commodities.

Institutionalizing formative rather than bureaucratic supervision

The positive association of recent performance appraisal with high productivity underscores the value of regular feedback. However, in the Ethiopian civil service context, performance management systems are often perceived as a punitive or purely bureaucratic exercise, leading to staff resentment and perceived unfairness. To overcome this institutional norm, facility leaders must decouple supportive supervision from formal salary-scale adjustments (which are rigidly controlled by central civil service laws). Instead, they should focus on non-monetary, localized recognition systems such as public acknowledgment during staff meetings or priority selection for short-term training to build a credible, transparent feedback culture that drives motivation without requiring budgetary expansion.

Targeted peer upskilling and practical role optimization

Productivity gains associated with postgraduate training highlight the value of advanced expertise, yet sending rural staff away to undertake long-term degrees exacerbates local staffing shortages. A more realistic, immediate alternative is to institutionalize facility-governed peer mentorship. Pairing undergraduate and diploma-holding staff with highly experienced or postgraduate peers for structured, on-the-job experience sharing costs nothing. Furthermore, introducing simple, standardized clinical order sets and health professional-initiated protocols for common conditions can streamline clinical decision-making, reducing the cognitive load and frequent task-switching that bog down rural clinical teams.

Balancing workload with safety measures

While higher daily patient loads minimize non-productive time, pushing staff to a maximum threshold risks severe fatigue and burnout challenges, already heavily documented among Ethiopian health professionals. In rural settings, where staff cannot easily be replaced, safeguarding wellbeing is vital for workforce retention. Rather than relying on unfeasible financial bonuses, hospital management can implement practical, no-cost workflow adjustments. This includes integrating micro-breaks into peak clinic hours, designing rotating schedules that offer predictable time off, and establishing rapid, informal peer case reviews to maintain clinical quality under high-volume pressure.

Limitations

- Cross-sectional design precludes causal inference; associations (eg patient load and productivity) should be interpreted as signals, not causal effects.
- Clustering by hospital was not modeled; per-cluster sample sizes were small, and precision may be optimistic.
- Despite mitigation (briefings, multi-day observation), Hawthorne effects may have biased time toward productive categories.
- Facilities were selected from a programmatic network and are not nationally representative; generalization to all Ethiopian rural hospitals should be cautious.
- We did not formally quantify quality outcomes; future rural studies should pair productivity metrics with quality/safety indicators to guard against throughput-only gains.
- Observations were limited to daytime working hours and therefore may not fully capture productivity patterns during night shifts or emergency on-call periods. However, since routine service delivery in Ethiopian hospitals predominantly occurs during daytime hours, the findings remain highly relevant for understanding standard operational workflows.
- Formal inter-rater reliability was not assessed, as observations were conducted by a single observer per session; although structured training and inter-observer practice sessions were used to standardize procedures, the absence of dual-independent observations may affect measurement consistency. A single-observer approach was adopted based on pilot findings that multiple observers increased participant discomfort and could influence routine workflow (the Hawthorne effect).

Conclusion

This time–motion study provides robust, context-pecific evidence on how hospital-based health professionals in Ethiopia across both rural and urban settings allocate their working hours. While nearly two-thirds of official working time was spent on productive tasks, a substantial portion was lost to avoidable non-productive activities, primarily patient-flow interruptions and supply constraints. Importantly, not all non-productive time reflects inefficiency – some periods represent necessary recovery or result from irregular patient demand.

In rural hospitals, where resource scarcity, logistical challenges, and staffing shortages are more pronounced, even modest improvements in workflow reliability, supply continuity, and performance feedback processes may yield meaningful gains in productivity and service readiness. The positive associations observed with postgraduate training, experience, performance appraisal, and patient load highlight practical levers for strengthening efficiency and quality in rural health services, while also underscoring the importance of how work is organized and experienced.

Efforts to enhance productivity must prioritize system-level improvements, patient-flow management, supply chain stabilization, supportive supervision, fair recognition systems, and targeted skill development, while protecting provider wellbeing and quality of care. Aligning these strategies with broader health-system strengthening efforts can contribute to more equitable access to timely, high-quality care, particularly in rural and underserved areas, and support Ethiopia's progress toward universal health coverage.

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Conflicts of interest

The authors declare no competing interests.

AI disclosure statement

Generative AI tools were used during manuscript preparation to assist with language editing, grammar correction, formatting references in journal style and improvement of clarity. No AI tool was used for data analysis, data interpretation, or generation of scientific findings. All primary data collection, qualitative and quantitative analyses, and final interpretation of findings, were conducted entirely by the authors, who maintain full responsibility and accountability for the accuracy, integrity, and conclusions of the work.

Availability of data and materials

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request. Data are de-identified and stored securely.

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