Can mHealth strengthen health worker performance?

Midwives' experiences using an innovative mHealth program in Timor-Leste

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Abstract

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Background: High-quality performance by health workers is dependent on motivation and job satisfaction. Non-financial interventions to improve motivation and job satisfaction, particularly mHealth, are underexplored. This study examines mHealth's potential impact on motivation and job satisfaction through the lens of midwives using *Liga Inan*, a pilot mHealth program in Timor-Leste.

Methods: Qualitative data on adoption, use, and impact were collected through semi-structured interviews (15) with all available midwives who had used Liga Inan longer than one month. Franco et al.'s (2002) framework of motivation guided qualitative content analysis.

Findings: Liga Inan improves communication processes, strengthens support structures, and increases interaction and information exchange between midwives and patients, likely improving midwives' motivation and job satisfaction.

Conclusion: mHealth's ability to improve organizational structures, processes, resources, and provider-patient relationships has the potential to improve health worker motivation, job satisfaction, and ultimately performance while contributing to sustainable health system strengthening.

Introduction

Health workers are the "ultimate resource of health systems" (1). High-quality health worker performance refers to their availability, productivity, responsiveness, and competence and is essential to the delivery and utilization of life-saving interventions (1-4). However, inadequate health worker performance stemming from chronic underinvestment in human resources, overwhelming disease burden, and accelerating worker migration is an urgent problem in low- and middle-income countries (LMICs) (1-6). Motivation and job satisfaction are considered critical to health worker performance (1-3). Motivation drives health workers' willingness and persistence in fulfilling work responsibilities and achieving organizational goals and mediates quality, efficiency, responsiveness, and equity of service delivery (2-4, 7-10). Job satisfaction is associated with work commitment and is considered vital to health worker retention (3, 4, 7, 8). However, health workers' motivation and satisfaction often suffers in LMICs due to poor working conditions, inadequate resources and equipment, and poor management (7, 8, 11). Interventions improving both motivation and job satisfaction are likely essential for strengthening health worker performance (1, 3).

Health sector directors and managers in LMICs typically have little information on what motivates their health workers and how policies and programs may affect motivation (2, 3). Policies and programs to improve motivation and job satisfaction often focus on financial incentives such as increased salaries or pay-for-performance schemes; however, evidence shows financial incentives alone are not sufficient and may even lead to negative consequences (2, 8, 10). Research suggests interventions that provide non-financial incentives; tools and resources necessary for the job; professional support and supervision structures; community recognition and credibility structures; performance feedback and recognition processes; opportunities for training and professional development; participation in decision-making mechanisms; and inter- and intra-organizational communication processes are likely to improve motivation and job satisfaction (2, 4, 7, 10-13). Further research and documentation on non-financial incentives and interventions with the potential to improve and maintain a motivated and satisfied health workforce is needed (2, 7, 11).

One promising intervention that has underexplored potential for improving health worker motivation and satisfaction is mHealth. Mobile health, or mHealth, is the use of mobile technology to support, provide, or manage health services and/or information (14). In recent years, there has been a proliferation of mHealth programs in LMICs. mHealth is used for a variety of functions within the health system including data collection, health worker training and access to clinical information, point-of-care diagnostics, provider-provider communication, provider work planning and scheduling, provision of job aids and decision support, supervision of health workers, and promotion of healthy behaviors in the population (15, 16). While several mHealth functions align with interventions likely to increase health worker motivation and job satisfaction, research on that relationship is limited (13, 14, 16). Studies to date focus primarily on the specific use of mHealth to increase motivation and retention of community health workers (CHW) through the provision of mobile phones and their use to connect CHWs to the health system (13, 14, 17). Little is known about the impact of mHealth interventions more broadly, on the motivation and satisfaction of the frontline and mid-level health workers tasked with their implementation. This paper addresses this knowledge gap by exploring the potential impact of mHealth on health worker motivation and job satisfaction through the lens of midwives using Mobile Moms, a pilot mHealth program locally known as *Liga Inan,* in Timor-Leste. This study sought to examine Liga Inan's potential impact on organizational-, community/client-, and individual-level factors influencing motivation and job satisfaction.

Background

Maternal and neonatal health and human resources for health in Timor-Leste

Independent in 2002, Timor-Leste is a half-island nation with a population of approximately 1.2 million (18). An estimated 28.7% of the population is centered in urban areas predominately along the coast, while the remaining 71.3% is spread throughout the mountainous, rural interior (18). Decades of conflict against Indonesian and Portuguese colonial rule and the mass exodus of the Indonesian health workforce in 1999 devastated the country's infrastructure and health system (19-21).

While workforce shortages are improving in Timor-Leste, workforce scale-up must include improvements in training, distribution, working conditions, management, and motivation (20-22). However, insufficient funding is a major obstacle to training, recruiting, deploying, maintaining, and motivating the health workforce (20). There is a need to build competencies and skills for health workers and managers to ensure safe and high-quality services and improve capacity in the areas of management, supportive supervision, and performance monitoring and review (23). The 2011-2030 National Health Sector Plan of Timor-Leste includes strengthening leadership, management, and supervision to enhance health worker motivation and performance and creating an enabling environment for health workers to improve their performance (20).

Improving maternal and neonatal health (MNH) is a national priority (20). Timor-Leste has a maternal mortality rate of 557 per 100,000 live births, a neonatal mortality rate of 22 per 1,000 live births, and a total fertility rate of 5.7 (24). Ensuring skilled antenatal, intrapartum, and postnatal care for mothers and newborns is an important strategy for reducing mortality and morbidity by minimizing risks and providing treatment for hemorrhage, infection, obstructed labor, hypertensive disorders, malnutrition, anemia, and malaria (20). However, the proportion of women continuing antenatal care (ANC), using a skilled birth attendant (SBA) for delivery, and having an early postpartum/newborn care visit by a skilled provider is low (20, 25). Professionally licensed midwives are the primary providers of MNH services and are often service providers for children under five. There are approximately 0.48 midwives per 1,000 persons (26). Midwives provide services in hospitals, maternity wards, community health centers (CHC), rural health posts (HP), monthly community outreach clinics (SISCa), and in women's homes. Working conditions vary according to facility-type and location, with many lower-level facilities lacking basic infrastructure such as electricity, running water, and adequate transportation. Some midwives work as part of a midwifery team, alongside other health worker cadres, while others work alone. Midwives work in the same facility as their immediate supervisor in all facilities except HPs.

Description of intervention

In early 2013, Health Alliance International (HAI), in partnership with the Timor-Leste Ministry of Health, Catalpa International, and the U.S. Agency for International Development, implemented Liga Inan, a pilot mHealth program, in Manufahi District (27). Liga Inan means 'connecting mothers' in the local language. The program's design combines applications to promote healthy behaviors in pregnant women and new mothers, and improve patient-provider communication and information exchange in one mHealth program. Preliminary data from an on-going quasi-experimental evaluation of Liga Inan show significant and sustained increases in both ANC attendance and SBA utilization since implementation in at least one sub-district (27).

Facilities staffing at least one midwife receive smart phones equipped with the Liga Inan software application. Midwives share the phones (two per CHC, one per HP) and all sub-district level supervisors as well as two district-level supervisors each receive their own phone for program monitoring purposes. Pregnant women are registered with Liga Inan by midwives, ideally during their first ANC visit. Registered women receive automated healthy behavior reminders through six-weeks postpartum, a free SMS service to request a consult with their midwife over the phone, and a designated emergency number for maternal and neonatal care. Midwives receive notifications to follow-up with their patients at key points, i.e. in response to a consult request and three weeks before the estimated due date (EDD). Midwives and supervisors can access a list of patients due to give birth in the following week. Notifications and lists include relevant patient information. Midwives can also send batch SMS messages to patients by sub-village. Finally, each phone's SIM card is loaded with USD$10 of phone credit per month to facilitate communication with patients.

Liga Inan was not designed specifically to improve health worker motivation and job satisfaction. However, data gathered on its adoption, use, and impact on the health workforce suggested potential for Liga Inan's impact on midwives' motivation. Thus, Franco et al.'s (2002) framework of motivation was employed as analytical framework by which this potential was explored (8).

Conceptual framework: motivation and job satisfaction

Franco et al.'s (2002) conceptual framework is well-used in studies of health worker motivation and job satisfaction in LMICs (6, 8, 12, 28-33). This framework is based on two main process theories of behavior including goal-setting theory (see Campbell and Pritchard, 1976; Kanfer, 1990; Locke and Latham, 1990) and expectancy theory (see Vroom, 1964; Lawler and Porter, 1967) as well as on social-cognitive theories on self-concepts (see Bandura, 1977; Judge, 1998; Judge, 2001) (34-42). Process theories suggest motivation is both an individual psychological process and a transactional process between a worker and her situation. Determinants of motivation influence workers' selection of tasks or goals, workers' decisions as to the amount of effort and resources to apply towards task or goal achievement, and workers' evaluation of these choices and their outcomes, which influences subsequent motivational processes.

Health worker motivation

Worker motivation is an unobservable psychological process driven by what the worker 'will-do', or the extent to which she adopts work-related responsibilities or goals, and what the worker 'can do', or the extent to which she effectively mobilizes her personal resources to fulfill these responsibilities or goals (7, 8, 10). The results of this process impact the behavioral (i.e., performance), affective (i.e., job satisfaction), and cognitive aspects (i.e., work commitment) of the health worker (7, 10). On an individual level, this process is determined by personal values, goals and expectations; self-concepts; perceptions of available resources; personality tendencies; and competencies (7, 8, 10). In addition, health worker motivation is influenced by complex individual-situation transactions, where the situation is shaped by organizational structures, processes, resources, and culture as well as community and client relationships and expectations, as shown in *Figure 1*. Underpinning and influencing all aspects of the framework is the socio-cultural, political, and economic environment.

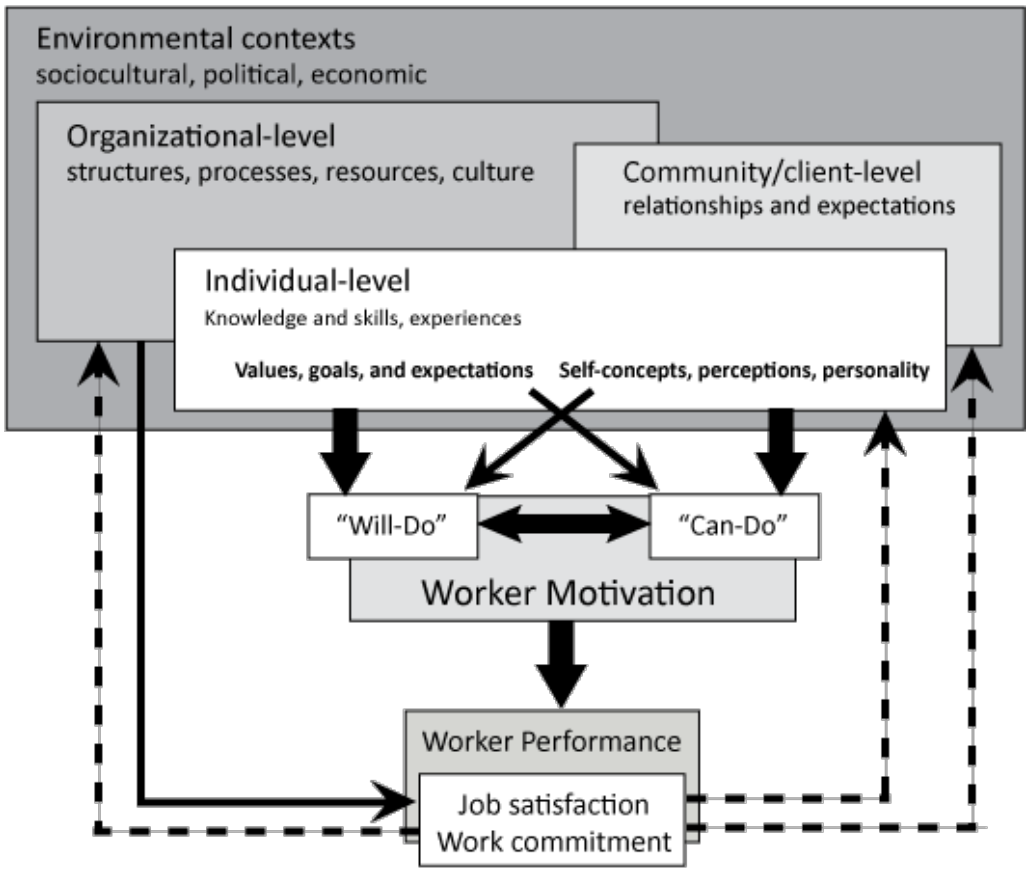

Figure 1: Conceptual framework of health worker motivation and job satisfaction (8, 10, 12)
Adapted graphic from Mathauer and Imhoff, 2006 (12)

Job Satisfaction

Although closely related, job satisfaction is a distinct concept from motivation (2, 7). Job satisfaction is the affective consequence of the worker's performance and is associated with work commitment as well as the extent to which workers will devote their personal resources towards the fulfillment of work responsibilities and organizational goals (8, 10, 39, 43). Research also suggests that job satisfaction mediates the relationship between a worker's motivation, performance, and her intention to remain at her job (2, 7). Key determinants of job satisfaction include workplace conditions such as infrastructure and availability of resources; organizational and management support; job-related factors such as pay, promotions, and job security; work-related factors such as autonomy, workload, and complexity; organizational culture such as organizational and interpersonal communication and co-

worker relationships; and performance-related factors such as support, supervision, feedback, and recognition (2, 10, 44). Similar to motivation, determinants of job satisfaction are likely to vary across cultures and contexts (45).

Methods

Data collection

Semi-structured interviews were conducted by the primary investigator (PI) and an interpreter with the entire population of midwives (17), sub-district supervisors (3), and doctors (3) using Liga Inan, who were available over a three-month primary data collection period. In addition, the PI observed midwife activities at their facilities (9) to provide contextual information. This paper focuses on midwives' use of Liga Inan and includes qualitative data from interviews with fifteen (15) midwives, excluding two (2) midwives who had been using Liga Inan for less than one month at the time of data collection due to delays in program implementation.

Questions and probes drawn from the literature on motivation and job satisfaction were included in an interview guide. The guide was written in English, which was later translated into Tetun and reviewed by a second assessor. Revisions were made after field-testing with Liga Inan program staff, among whom Timorese midwives were included. Prior to interviews, the interpreter was trained on the study and the Liga Inan intervention. Interviews were conducted in English and Tetun, which were translated back and forth by the interpreter in real time; interviews lasted one hour on average. The research's focus on midwives' personal and professional experiences were generally appreciated and no indications were given that midwives hid their true opinions or concerns. The semi-structured approach and use of an interpreter enabled the PI to clarify specific issues, employ probes and appropriate follow-up questions, and allow midwives' experiences to lead the discussion. Interviews were recorded and audibly reviewed in the field. Translation errors were audibly detected and documented. During morning hours when the majority of patients seeking antenatal or child health care visit the facility, midwife activity, task-sharing with other providers, patient workload, facility infrastructure, and

availability of necessary resources and equipment were observed. Clinical patient care was not observed.

Data Analysis

Data analysis employed the Framework Method of qualitative content analysis (46). Data were managed and analyzed using Atlas.ti (Version 7.1.8, Scientific Software Development GmBh, 2014). English portions of the interviews (PI questions and real-time English translations of health worker responses), facility observations, and field notes were transcribed in full. Data were primarily analyzed by the PI who conducted the interviews. First, all transcripts were reviewed to regain familiarity with the content. Transcripts were coded using a start code list based on Franco et al.'s conceptual framework of motivation and job satisfaction, and axial coding was used to identify additional themes and apply refinements to a working analytical framework. After coding the first few transcripts, three un-coded transcripts were independently coded by a second reviewer to test coding construct validity. Following discussions with the second reviewer, agreed-upon modifications and additions were applied. The revised code list was applied to all remaining transcripts. In an iterative process, further adjustments to the analytical framework were made until the final transcript was coded. All transcripts were reviewed using the final analytical framework and were assessed by a second reviewer. Disagreements were noted and discussed; modifications were made through consensus. In the analysis, themes were first identified within the data, which were then deductively explained and supported using extant literature on health worker motivation and job satisfaction in LMICs (47, 48). International differences exist in the importance assigned to and relationships between determinants of motivation and job satisfaction; researcher effects were continuously assessed to ensure analysis remained grounded in the data. Researchers' backgrounds and experiences in public health and public administration influenced interpretation. Findings were shared with HAI and Ministry of Health officials.

Ethical considerations

Approval to conduct this study was obtained from both the University of Washington International Review Board (Seattle, Washington, USA) and the Timor-Leste National Institute for Health (Dili, Timor-

Leste). Study details were discussed with relevant members of District Health Services, facility-level managers, and health staff. Before starting the interviews, written individual consent to participate and record the interviews was sought after the study's aims, methods, benefits, and potential consequences were discussed. The researchers explained that refusal to participate would have no negative implications on their employment and that interviews would remain anonymous.

Findings and Discussion

All midwives in this study were female, were professionally licensed, and worked in facilities operated by the Timor-Leste Ministry of Health in Manufahi District. In this study population, as shown in *Table 2*, midwives' responsibilities varied depending on their role and the type of facility in which they worked. Midwives worked at multiple levels. In supervisory roles their primary responsibilities were to support and supervise midwives and the delivery of MNH services. In maternity wards their primary responsibilities were to attend deliveries and provide consultations and care for complicated cases. In CHCs and HPs midwives were responsible for all MNH services as well as services for children under five (U5). Within their facilities, midwives either worked in midwifery teams or as the only midwife on staff, the latter occurring in both CHCs and HPs. Facilities were located in either semi-urban or rural areas. In rural areas, populations were often spread over larger distances, lacked adequate transportation, and had less-developed road and cellular infrastructures than those in semi-urban areas. Rural facilities lacked basic infrastructure, such as water and electricity, and resources and equipment were less available. Midwives' ages ranged from 31 to 46 years (mean=38, median=38). Midwives' experience ranged from 4 years (midwife, 46 years old) to 22 years (midwife, 44 years old).

Midwives described the use of Liga Inan for eight key functions: monitoring patients' condition and care, coordinating patient care in emergency and non-emergency situations, disseminating information to patients, accessing professional support and resources, inter- and intra- organizational communication, work preparation, work planning, and Liga Inan supervision. Several of these uses align with intervention areas likely to improve health worker motivation and job satisfaction in LMICs. Using

Franco et al.'s (2002) framework, findings are organized by organizational-level, community/client-level, and individual-level to explore their potential influence on motivation and job satisfaction.

Midwife responsibility*	**Facility Type**				**Location**		**Age**				**Experience**		
	DHS	MW	CHC	HP	S-U	R	30-34	35-39	40-44	45+	> 5	6-10	11+
Midwife-supervisors supervise and support midwives in facilities	1	1			2				2				2
Midwife-maternity ward primary duties are to attend deliveries & consult complicated pregnancies; midwifery team or alone†		5			5		2	2	1			2	3
Midwife-CHC primary duties are ANC, attend deliveries, SISCa, MNH & U5 services; midwifery team or alone†			6		2	4	2	2	2			3	3
Midwife-HP primary duties are ANC, attend deliveries, SISCa, MNH & U5 services; alone†				2		2		1		1	1		1
TOTAL	**1**	**6**	**6**	**2**	**9**	**6**	**4**	**5**	**5**	**1**	**1**	**5**	**9**

* *Distinctions between midwives and facilities used in this paper are meant to provide a summary of the midwives included in this study and are not official Ministry of Health classifications nor are necessarily generalizable to other districts.*

† *Alone refers to working in the absence of another midwife; midwives often work alongside other cadres of health workers.*

Table 1: Summary of descriptive characteristics of study population

Liga Inan and organizational structures, processes and resources

Midwives described Liga Inan as an added resource to assist in fulfilling their work responsibilities and improving their communication. While the provision of phones was helpful, midwives described the phone credit Liga Inan provided as especially important for overcoming financial barriers to communication. Midwives described more efficient, responsive, and effective communication both externally and internally, as a benefit of using Liga Inan.

Midwives described Liga Inan as helpful in monitoring patients and obtaining information on patients' conditions directly from women themselves, which enabled midwives to make informed decisions on patients' care. Prior to Liga Inan, midwives described communication with patients as through family members or only when the midwives visited their homes. However, Liga Inan enabled midwives to speak directly and immediately with patients. As one midwife shared, "*when the mother contacts us and we speak directly with the mother so we can know her condition. Not like before. Before, they usually sent someone else to come here to tell us*" (P15). Midwives also described using Liga Inan to communicate and coordinate that care with their patients.

Another important communication process was midwives' coordination of support and resources in both emergency and non-emergency situations. As one midwife explained, "*when I work alone here by myself and the patient has complications...I can contact another midwife to come help me using Liga Inan because it is very quick*" (P4). Another midwife described accessing transportation and support from a different health facility, "*while I was attending a patient in [village A], I received a notification from a patient in [village B]. I cannot leave the patient...I used Liga Inan to contact the health center in [town C] and they came with an ambulance and took the patient* (P2).

Midwives' ability to use Liga Inan and build new communication processes to access information and support increased the autonomy of midwives in fulfilling their work responsibilities. As one midwife explained, "t*he way of communication before Liga Inan was in the SISCa (outreach health clinics) and when we went to them some were already in bad condition...now they just 'miss call' us or send us a message and we can call them or go to their home and check on them*" (P17) ('miss call' refers to the practice where a caller lets the phone ring once before hanging up in order to avoid monetary charges that would be incurred if their call was answered). Liga Inan not only provided a means to access support but also outlined a clear support structure for transportation starting with the patient, then either the ambulance driver or co-workers (each doctor has a Ministry-issued motorbike), and finally their supervisor, who was ultimately responsible for finding transportation outside of the health system

if necessary. While this process did not always result in securing transportation, it did provide a structure midwives could follow to improve their chances of finding transportation.

Liga Inan improved three key communication processes: monitoring patients, coordinating care, and accessing professional and resource support. In addition, Liga Inan strengthened the support structure for transportation by clarifying a hierarchy of channels by which midwives could request and receive support. This support structure likely improved motivation by providing a clear hierarchy and transferring ultimate accountability to their supervisor, increasing midwives' control and ability to secure the resources. Our findings support existing research which suggests that improving organizational structures and processes such as internal communication processes, autonomy structures, support structures, and human resource management processes, influence worker motivation by determining how workers fulfill their responsibilities and by providing access to resources necessary for fulfilling them (8, 11, 12, 49).

Liga Inan and community/client relationships and expectations

Most midwives indicated that they believed Liga Inan had improved their relationships with their community and their patients. They felt that relationships with their patients improved as a result of increased interaction and information exchange as well as their increased availability and responsiveness to addressing patients' needs. Midwives described both themselves and patients as having the ability to call each other as a result of Liga Inan. In addition, midwives described their interaction with patients at the facility, during SISCa, and in the home as also increasing due to messages and calls from midwives and Liga Inan that encouraged patients to attend at least four ANC visits and deliver with an SBA either at the facility or in the home. As one midwife explained, "*before Liga Inan the mothers just come for consulting once or twice and we don't have any communication, but since using Liga Inan we always keep contacting the mothers so it seems like we are a family between midwives and mothers*" (P23). Midwives also described Liga Inan's provision of both emergency and non-emergency phone numbers dedicated to maternal and neonatal health as a factor increasing their availability to patients. In addition, midwives felt the provision of phone credit for

each phone mitigated financial barriers to returning patients' calls. Midwives also described supervision of Liga Inan as encouraging their responsiveness to patients' calls as supervisors were also notified when patients called the Liga Inan number.

Midwives also described Liga Inan as helping midwives to give patients important information about healthy behaviors, danger signs and risks, and about upcoming MNH services at both outreach clinics and the facility. As one midwife shared, "*before when we want to have SISCa we just post the information and they [women] cannot access it...but using Liga Inan we can send messages to mothers in the sub-village and they can inform other people in the community*" (P2). Midwives believed this information improved their relationships with patients by increasing patients' knowledge and keeping them informed as to when and where services would be provided. Midwives also indicated that improved relationships personally made them happier and more satisfied.

More data is needed from the patient perspective to demonstrate actual improvements in midwife-patient relationships, however midwives' perceptions as to the factors driving improvement are consistent with literature on the patient-provider relationship that suggests provider availability and responsiveness are key determinants of the patient-provider relationship (50). Our findings support theories that suggest trust, prestige, social interaction, and respect from the local community and the health workers' active involvement in earning and maintaining that respect are motivational for health workers in LMICs (6, 28, 51).

Liga Inan and the individual-level determinants of motivation

Midwives' responses revealed their perceived benefits from using Liga Inan were strongly tied to their values of helping their patients and achieving Ministry of Health targets, which reflected a strong professional ethos and commitment to organizational goals. Whether they described Liga Inan as increasing or decreasing their workload, midwives consistently expressed the sentiment that the work was their responsibility and they would be ready and willing to do it. As one midwife said, "*even though our job is increasing, we don't care, it is our job...we are happy to do it"* (P19). Midwives also

indicated that Liga Inan's provision of notifications and its limited supervision encouraged them to engage in tasks which they had not done before, such as call women three weeks before their EDD, and to be more responsive to patients' needs and requests for consultation. As one midwife said, "*[the notifications] are important because we have a lot of work and sometimes we forget*" (P4).

Midwives' feelings about their changes in workload suggest that they likely already possessed considerable "will-do" motivation for undertaking existing work responsibilities. These findings support theories suggesting that strong national identities and appreciation for secure jobs in countries recently independent, such as Timor-Leste, have resulted in workers highly committed to organizational goals within the public sector (19). In addition, our findings support research that has shown health workers as a cadre of worker particularly driven by intrinsic motivation (7). Midwives' descriptions also reveal Liga Inan likely helped to align midwives' work goals with new organizational goals by encouraging their undertaking of new responsibilities through notifications and supervision, which supports theories suggesting that the provision of guidelines, supervision, and support motivates workers to adopt new responsibilities or less-prioritized responsibilities (7).

Midwives expressed strong sentiments of pride and professionalism stemming from achieving or their ability to achieve Ministry of Health targets as a result of using Liga Inan. As one midwife shared, "*with Liga Inan, we feel like real midwives. Mothers can call us to tell us their sicknesses and their feelings to us. We feel that we are professional midwives because we better attend the mother and her baby" (P20).* Another midwife said, "*a lot of patients are coming and we see the weights of the babies increasing and normal deliveries and I am happy with that and feel proud of that*" (P7). Even in other sub-districts that had not yet achieved their targets, midwives' responses indicated they perceived themselves as having the ability to be successful. Midwives also consistently used the words, 'now we can', when describing changes since using Liga Inan. As one midwife said, *"before Liga Inan the only way we know the [woman's] condition is if they come to us...so through this [Liga Inan] now we can know"* (P15). Midwives expressed being in more control of their responsibilities such as monitoring patients, coordinating care, and making decisions regarding care. As one midwife shared, "*it adds*

more to our responsibility so we like it. How can we take care of the mothers and the babies? Before we only know if they come to the facility. Today, every word that we speak on the phone, that is our responsibility" (P15).

Midwives' responses suggest that Liga Inan influenced determinants of "can-do" motivation, improving midwives' self-perceived ability to fulfill their roles and responsibilities. As discussed in the conceptual framework, "can-do" determinants include workers' self-concepts and perceptions of availability of resources. Midwives' responses suggest Liga Inan improved midwives' self-concepts, notably self-esteem (i.e., sentiments about oneself as capable, significant, and successful), self-efficacy (i.e., perception of having the necessary knowledge and resources to fulfill responsibilities), and locus of control (i.e., degree to which worker controls her roles and responsibilities) by increasing their sense of achievement and recognition from the community and co-workers as well as providing them with an added resource for communication and information exchange (8, 35, 36, 52). Our findings support theories that suggest when workers have access to information, support, and resources to do the job their feelings of autonomy, self-efficacy, and organizational commitment may also increase (8). Findings are consistent with other studies in LMICs that found the main motivating factors to include sense of achievement, recognition, ability to do the work, and relationships with the community (2, 51, 53). When comparing before Liga Inan to after, midwives described an ability to do their job and achieve Ministry of Health targets which they didn't have before, which supports the theory that workers with negative self-concept may feel helpless in fulfilling their responsibilities and hopeless in achieving organizational goals, whereas workers with positive self-concept perceive they have the ability to do so (8).

Liga Inan and job satisfaction

Midwives were also directly asked about any changes in their job satisfaction as a result of using Liga Inan. Midwives generally perceived increases in job satisfaction since using Liga Inan; the most commonly reported reasons for increased satisfaction included making their jobs easier, improving their relationship with their patients, and the ability to achieve Ministry of Health targets, which was

often associated with praise from colleagues and supervisors at both district and national levels. These findings were demonstrated by a few midwives who said, "*I am more satisfied than before because I work alone so when the patient needs me, I don't need to go to their home to know their condition. I can just contact them with Liga Inan. It makes my work easier*" (P4); "*[change] in satisfaction is from contact with mothers and having good relations with the patients*" (P23); and "[*I feel more satisfied] because sometimes people say, 'oh the midwives in [town A] are working so hard!'*" (P5).

Midwives' responses indicated that Liga Inan's ability to make their work easier was not about reducing the complexity of certain tasks such as monitoring patients, but rather about mitigating challenging working conditions that otherwise would limit their ability to fulfill those responsibilities. Midwives' responses suggest that working conditions and recognition are key determinants for job satisfaction among midwives in our study. These findings support a large body of evidence which identifies both working conditions and recognition as key determinants of job satisfaction (2, 44, 51). While the provider-patient relationship is not commonly included as a key determinant of job satisfaction, our findings suggest it was a key determinant in their increased job satisfaction (2, 44). However, an analysis of the benefits midwives perceived as a result of their improved relationships with their patients revealed that benefits included praise and respect, or recognition, from patients and intrinsic reward as a result of positive experiences with patients and improving patients' health outcomes. While both recognition and non-financial reward are determinants of job satisfaction, our findings suggest greater attention to the impact of provider-patient relationships on job satisfaction is warranted.

Factors moderating the effect of Liga Inan on motivation and job satisfaction

Our analysis highlighted three key factors which may moderate Liga Inan's effect on midwives' motivation and job satisfaction: workload, working conditions, and organizational culture.

Some midwives felt that Liga Inan made their jobs easier, increasing their self-reported job satisfaction and likely influencing their individual motivation by improving their perception of self-efficacy.

However, other midwives felt their workload had increased due to increasing numbers of patients utilizing health services, but that this increase was good because of its benefit in reaching Ministry targets. Even so, some midwives expressed a need to adjust their expectations for workload and voiced concerns as to the implications of an increasing patient load in terms of both personal workload and facility capacity. As one midwife explained, "*the benefit is we can reach our targets, but the disadvantage is a lot of patients come and you will feel tired, you will spend all your power at work. We should mentally prepare for that...we only have five beds and sometimes when the patients come we don't have any beds for them. Where should we transfer them? That is a concern for us*" (P7). In this context, strong congruence among personal values and goals and organizational goals within individual midwives mitigated the effect of workload on motivation and job satisfaction. However as workload increases, growing discrepancies between workload expectations and workload realities as well as perceptions as to the inadequacy of current resources may affect midwives' motivation and job satisfaction (8).

Lack of transportation and inadequate facility infrastructure were the most commonly reported challenges and midwives' responses revealed their effect on midwives' experiences of performance outcomes, perceptions as to the availability of necessary resources, perceived relationships with patients, and their self-reported job satisfaction. As one midwife shared, "*Liga Inan gives benefits, but sometimes the problems we have are no transportation...and mothers say we are using Liga Inan, but still find this condition...patients press us for not having transportation...I feed sad*" (P6). Another midwife explained, "*when the mother calls and we can only say wait, wait for transportation, sometimes this takes away the trust the mothers have with midwives*" (P3). While some midwives were able to use Liga Inan to mitigate these challenges by accessing support from co-workers and supervisors, others expressed a feeling of helplessness in overcoming these obstacles. Availability of necessary resources and infrastructure are two factors most likely to moderate Liga Inan's effect on motivation and job satisfaction. Our findings support research that shows adequate working conditions are critical to both motivation and job satisfaction, particularly for health workers in rural facilities (2, 8, 29, 51).

While none of the midwives specifically described organizational culture as a moderating factor, analysis revealed that midwives who described teamwork and positive communication with their co-workers and supervisors generally found Liga Inan to be more beneficial than those who described their relationships and responsibilities as being more separate and segregated. In comparing these two groups, midwives describing teamwork and positive co-worker relationships more often used Liga Inan to access support and assistance from those co-workers to mitigate challenges and increased work and patient loads. However, Liga Inan's ability to improve internal communication and support structures may improve organizational culture and in turn, motivation and job satisfaction. Our data supports similar findings from LMICs that have shown that lack of communication between health workers and lack of supportive supervision may decrease motivation (54). Findings also support literature suggesting that in LMICs, the social environment of the workplace is a key moderator of the physical environment (i.e., working conditions), motivation, and job satisfaction, particularly for health workers in rural areas (10, 29, 30, 55). Our data also supports findings from a study in Kenya, which found that good working relationships between cadres enhanced worker motivation (31).

Conclusion

Findings from this study suggest that Liga Inan influences midwives' motivation and job satisfaction by providing new tools for patient monitoring and care coordination, improving inter- and intra-communication processes, strengthening professional and resource support structures, and increasing recognition for achieving goals, as well as improving provider-patient relationships and patient expectations. These organizational and community/client-level changes improve midwives' self-concepts, perceptions of availability of necessary resources, and experiences resulting from their performance. Liga Inan's impact on organizational- and community/client-level factors influencing motivation supports existing evidence, which has shown that information and communication technologies may improve health worker performance by improving coordination and communication, increasing responsiveness for the transfer and transportation of patients, documenting and monitoring

patient health status and treatment given, connecting communities with healthcare providers, and educating clients and the community (56).

This study found that Liga Inan's ability to combine multiple functions into a single program increased its potential to improve motivation, job satisfaction, and performance. Our findings support research suggesting that multi-faceted or cross-cutting interventions might be more likely to improve motivation, retention, and performance than single interventions (3, 13). Our analysis also suggests that mHealth applications may affect health worker motivation and job satisfaction even when not specifically designed or implemented to do so. As such, current and future interventions should consider mHealth's impact, both positive and negative, on motivation and job satisfaction as well as their organizational- and community/client-level influencers. At the very least, mHealth should not strain or overburden health workers, lower their motivation to work, or reduce their satisfaction with their job. At its greatest potential, mHealth may improve motivation, job satisfaction, and ultimately performance of health workers.

Health worker motivation is difficult to measure due to sociocultural differences between the interpretation of the term motivation and difficulties in the ease at which health workers express themselves in the context of motivation (12). While indices and tools measuring the determinants of motivation exist to circumnavigate these difficulties, their utility is often limited by a lack of contextual understanding of the relative importance of determinants and the relationships between them. Given no prior data on midwife motivation and job satisfaction in Timor-Leste, a strength of this study is its use of a theory-based conceptual framework, which has been validated through studies conducted in a number of LMICs, to guide analysis and illuminate the mechanisms by which mHealth may affect motivation and job satisfaction. Qualitative methods provided an opportunity for in-depth exploration of health workforce experiences during the pilot project and context-specific understanding of influential factors of motivation and job satisfaction.

This study has a number of limitations. The study population is small, midwives were the only cadre included, and data were limited to one district, which was chosen by program implementers in part

due to its strong and dedicated leadership at both district and sub-district levels. As such, midwives may not be representative of all midwives or other cadres of health workers, and changes in organizational structures and processes may be more successful and more likely to influence motivation and job satisfaction. Due to implementation delays, some interviews were conducted after only four months of use and full benefits and consequences of the program may have not been fully realized. In addition, this study examines only one specific mHealth program. Despite these limitations, which may limit generalizability, potential implications derived from this work may be applicable to other health worker cadres and mHealth programs. Further comparative research is needed to build evidence and map different types of mHealth applications to changes in organizational-, community/client-, and individual-level determinants of motivation and job satisfaction. Given the context-specific nature of these concepts, quantitative research should always be complemented by qualitative methods.

As policy makers and managers realize the importance of non-financial incentives and the need for multi-faceted interventions to address health worker performance, mHealth is ripe with promise and potential. As with any intervention, the manner in which mHealth programs are designed, communicated, and introduced will have enormous impact on their success. However, exploiting mHealth to improve organizational structures, processes, and resources as well as provider-patient relationships has the potential to improve health worker motivation, job satisfaction, and ultimately performance while contributing to sustainable health system strengthening. Perhaps even more significantly, this study demonstrates the need for future mHealth research to look beyond workload and acceptability and consider mHealth's impact on the motivation and satisfaction of the health workers tasked with its implementation.

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