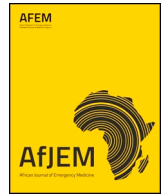




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Original article

The impact of data feedback on continuous quality improvement projects in Rwanda: A mixed methods analysis



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ABSTRACT

Background: Injuries are a leading cause of death and disability globally. Over 90% of injury-related mortality happens in low- and middle- income countries (LMICs). Rwanda's pre-hospital emergency system – Service d'Aide Medicale Urgente (SAMU) – and their partners created an electronic pre-hospital registry and Continuous Quality Improvement (CQI) project in 2014. The CQI showed progress in quality of care, sparking interest in factors enabling the project's success. Healthcare workers (HCW) are critical pieces of this success, yet we found a void of information linking pre-hospital HCW motivation to CQI programs like SAMU's.

Methods: Our mixed methods approach included a 40-question survey using questions regarding HCW motivation. We scored the surveys to compare SAMU staff motivation with other HCWs in LMICs, and used a Likert scale to elicit agreement or disagreement. A semi-structured interview based on employee motivation theory qualitatively explored SAMU staff motivation using constructivist grounded theory. To find interview themes, two researchers independently performed line-by-line analysis.

Results: SAMU staff received 5–21% higher motivation scores relative to other cohorts of HCWs in LMICs. Questions showing disagreement (five) asked about reprimand, damaged social standing, and ease of using the CQI technology. Three questions did not show consensus. Questions showing agreement (23) and strong agreement (nine) asked about organizational commitment, impact, and research improving patient care. Major themes were: improvements in quality of care, changes in job expectations, views on research, and positive experiences with data feedback.

Conclusions: The CQI project provides constant feedback vital to building and sustaining successful health systems. It encourages communication, collaboration, and personal investment, which increase organizational commitment. Continuous feedback provides opportunities for personal and professional development by uncovering gaps in knowledge, patient care, and technological understanding. Complete, personalized data input encouraged by the CQI improves resource allocation, building robust health systems that improve HCW agency and motivation.

African relevance

- Trauma Continuous Quality Improvement (CQI) Project implementation correlated with improved healthcare worker motivation compared to other sub-Saharan African healthcare workers.
- The CQI project encouraged employee communication, collaboration, and commitment by uncovering gaps in clinical and technical

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knowledge, providing opportunities for professional and personal development, and improving resource allocation.

- Lessons from this CQI project may apply to other pre-hospital staff in African countries with similar profiles.

Background

Injuries are a leading cause of death and disability in every country in the world [1,2]. A hallmark of effective trauma systems throughout the world, emergency medical services provide both critical medical intervention and rapid transportation of patients from the scene of injury to more definitive trauma care. Over 90% of the world's injury-related mortality occurs in low- and middle-income countries (LMICs) [3]. Yet despite evidence that proves the life-saving benefits of pre-hospital systems in LMICs [4], very few have a formalized pre-hospital system [5].

Rwanda, an East-African country of 11.6 million people, is home to one of the only publicly funded pre-hospital emergency systems in the region — Service d'Aide Médicale Urgente (SAMU) [6,7]. Established in 2007 by the Rwandan Ministry of Health, SAMU receives over 1000 calls per month at its call center in the capital city of Kigali. Injuries account for a significant portion of the calls to SAMU and are a priority area of clinical excellence for the SAMU leadership [6]. To this end, through a partnership with two academic medical centers in the United States, SAMU developed one of the only electronic pre-hospital trauma registries on the continent [6,7]. Continual, real-time analyses of these data enabled the creation of the SAMU Continuous Quality Improvement (CQI) Project in 2014. Benchmarks and performance targets were established for process measures such as supplemental oxygen for hypoxic patients, placement of cervical collars for patients with head injuries, and intravenous fluid boluses for patients with hypotension [7]. Follow-up data from this CQI program, published in 2017, demonstrated robust immediate and sustained improvements in the quality of pre-hospital care for injured patients in Rwanda [7]. Examples of electronic pre-hospital registries in LMICs are rare, as are examples of successful implementation of programs that use these data in real-time to improve pre-hospital care for injured patients. Prior work has focused on the establishment of SAMU's database [6] and the implementation of its CQI program [7], but little is known about the factors that enable such rare programs to succeed in a low-income country.

Healthcare worker (HCW) satisfaction and motivation have been well-established as critical factors contributing to HCW clinical performance [8]. A few studies examine pre-hospital emergency team recruitment and retention in the United States, [9] and job satisfaction and motivation among HCWs in sub-Saharan Africa [8,10]. However, none have combined these ideas to focus on pre-hospital emergency worker motivation in sub-Saharan Africa — employees who experience a unique set of challenges when providing care to patients outside the hospital. Further, there is a paucity of information regarding the link between pre-hospital HCW motivation and successful implementation of a CQI program such as SAMU's.

In the current study, we built on the recent successful CQI program with a combination of quantitative and qualitative methods. First, we explored the level of worker motivation among SAMU employees and how it compares to other cadres of HCWs in LMICs. Second, we uncovered factors that contribute to HCW motivation at SAMU. Third, we investigated factors contributing to successful implementation of the SAMU CQI program. The results we found may help guide development of additional pre-hospital quality improvement efforts in LMICs throughout the world.

Methods

In this mixed-methods study we sought to better understand the motivation of SAMU workers with a combination of quantitative and

qualitative methods. With emphasis on the recent CQI project, we relied on established employee motivation surveys used on numerous health workers in LMICs. These surveys provided the basis for our quantitative analysis of SAMU employee motivation and factors that drive or inhibit motivated work. We then sought to better understand the SAMU staff's perspective on the CQI program's strengths and weaknesses. Triangulation of data occurred both within and between data set analyses in order to provide a better understanding of themes, which were highlighted in the survey responses and further developed through subsequent interviews.

Our study took place in Rwanda, home to one of the only pre-hospital emergency medical systems in sub-Saharan Africa. Rwanda is also one of the only LMICs to have achieved nearly all of the health-related Millennium Development Goals and their health indices continue to improve at a faster rate than most other LMICs. Given SAMU's experience establishing an electronic pre-hospital database and their success using those data to drive practice change, the SAMU staff provides a salient example to explore motivational factors for pre-hospital emergency care workers in LMICs.

The electronic pre-hospital database began in 2013 and is derived from the paper “run sheets” filled out by SAMU staff during a call, which are subsequently transcribed into a secured REDCap database. The following year, SAMU initiated their CQI program for trauma patients in which they identified five key process measures that they wanted to target, including: supplementary oxygen for hypoxia, intravenous fluids for hypotension, cervical collar placement for head injuries, and both splinting or administration of pain medications for long bone fractures. Targets of > 90% were set for each of these five metrics, and SAMU relied on daily team meetings and monthly feedback sessions to address opportunities for improvement. Analysis at 14 months post-initiation of the CQI program demonstrated a significant increase between the pre-CQI and post-CQI periods for all five process measures, and all five achieved a post-CQI average of above the target of 90% completion [7]. This success occurred without additional employee pay or incentives. Thus, our study seeks to understand the drivers that contribute to HCW motivation at SAMU as well as the factors that led to the success of the CQI program.

Participant selection

First, in order to establish a quantifiable measure of SAMU staff motivation, we invited all 39 SAMU staff members — including nurses, anesthetists, and drivers — based at the Kigali branch to fill out surveys regarding their motivation for working. All SAMU staff members were eligible, their participation was explicitly voluntary, and we used sealed envelopes to ensure anonymity.

For the qualitative portion of the study, we used chain referral sampling to recruit nurses, anesthetists, and drivers via telephone and in-person to participate in semi-structured interviews from May 12–25, 2015. We began recruiting through the head of each HCW cadre and then asked each participant to identify other potential content and context experts. Recruitment was ended once ongoing data analysis revealed no additional emerging themes despite additional data collection. None of the eleven approached individuals declined to participate.

Data collection

In order to quantify and identify potential drivers of SAMU staff motivation, we designed a survey based on validated questions regarding HCW motivation, especially in LMICs [8,10,11]. This 40-question survey used a Likert scale ranging from 1 to 5 (1 = strongly disagree, 5 = strongly agree) and was divided into two parts. Part one of the survey consisted of 20 questions drawn from two prior studies of HCW motivation in sub-Saharan Africa [8,10]. The purpose of these questions was to compare SAMU staff against previously published

motivation scores from other cadres of HCWs in LMICs. Part two of the survey consisted of 20 questions drawn from literature that identifies specific motivators driving HCW behavior [11]. Because SAMU staff speak English, French, and Kinyarwanda the surveys were written in all three languages, and reviewed by a member of the research team fluent in all three languages (Z.A.M.).

To better understand what motivates SAMU staff in their daily work, and factors that led to successful implementation of the CQI program, we then recruited participants for semi-structured interviews. Due to scarce resources on theories behind HCW motivation, interview questions were developed in an iterative process using the interviewer's prior knowledge of SAMU and each new survey. In keeping with this constructivist grounded theory approach, we attempted to understand theoretical, professional, social, and situational constructs elicited across staff interview. We used a grounded theory approach to allow the theoretical constructs to emerge 'from the ground up.' [12] A 'constructivist grounded theory' was appropriate for this analysis because of the emphasis this approach places on the fact that data were collected and analyzed in light of their professional, social, and situational contexts [13].

The interviews were originally written from a series of open-ended questions based on employee motivation theory, and were altered after each interview in an iterative process to better understand emerging themes until thematic saturation was achieved [11]. The specific focus of these interviews was to explore the motivation to participate in a CQI program that has been previously described [7]. The interviewer (J.W.S.) was an American resident in general surgery with a graduate-level training in qualitative methods and prior research and clinical experience in LMICs, particularly Rwanda. Before and at the time of the interviews, he spent a year as a surgeon and researcher at SAMU's base hospital — The University Teaching Hospital of Kigali (CHUK) — building professional and trusting relationships with SAMU staff. Therefore, interview participants were aware of the interviewer's interest in understanding their motivation based on the CQI implementation. The interviews took place between May 1, 2015 and May 25, 2015 at the SAMU main office and were performed in English with a French and Kinyarwanda translator (Z.A.M.) present to reduce any miscommunication. After written consent was obtained, these interviews were audio recorded, transcribed verbatim, and reviewed with a Rwandan researcher (Z.A.M.) to clarify the meaning of the text as needed. No repeat interviews were conducted, and participants were not given transcripts to comment or revise.

Data analysis

Our mixed methods data analysis occurred in three distinct phases: the first two based on the surveys and the third based on the semi-structured interview. The first phase of analysis relied on responses from questions 1–20 on the survey to quantify HCW motivation at SAMU as compared to previously published studies [8,10]. After grouping questions 1–10 together and 11–20 together, the two groups of questions received separate subscores ranging from 10 (lowest motivation) to 50 (highest motivation). Subscores allowed comparison against previously published results. The second phase of analysis relied on responses to all survey questions (1–40) to identify consensus around the specific factors underlying employee motivation among HCWs at SAMU. All survey items were answered with a 1–5 Likert scale. Thus, a mean score > 4.5 suggested strong consensus agreement, and a mean score between > 3.5–4.5 suggested consensus agreement. A mean score of 2.5–3.5 suggested no consensus. A mean score between 1.5– < 2.5 suggested consensus disagreement with the survey items, while a mean score < 1.5 suggested strong consensus disagreement.

The third phase of the analysis relied on qualitative coding of the interview transcripts. Quality guidelines for qualitative research and COREQ criteria were employed to streamline qualitative reporting [14]. During the first round of transcription analysis, one researcher (J.W.S.)

read each transcript line-by-line and inductively created a codebook of emerging themes. Next, a second researcher (H.E.N.) performed independent line-by-line analysis of each transcript and highlighted existing themes from the original codebook as well as additional themes not previously identified, which were incorporated into a modified codebook. Coders were blind to the other's coding, and they met to establish consensus on code definitions and resultant major and minor themes. Participants were not asked to provide feedback on these findings.

Results

Our mixed-methods analyses enabled us to quantify the level of employee motivation among pre-hospital emergency care workers in Kigali, Rwanda, to compare these levels against other cadres of HCWs from LMICs, to identify the factors behind the high levels of motivation we encountered, and to better understand the driving forces behind the success of the SAMU CQI program.

Overall, 34 of 39 (87%) staff members returned a voluntary, anonymous, completed survey. This includes three drivers, seven anesthetists, and 24 nurses. 26 survey respondents (76.4%) were women and the median age of respondents was 35 years old. The median duration of employment at SAMU among survey respondents was six years (range less than one year to eight years). The 11 interview participants consisted of two drivers, three anesthetists, and six nurses. Seven interview participants (63.6%) were female and the median duration of their employment at SAMU was six years (range three to eight years). Interviews lasted from 20.1 to 52.5 minutes, with an average length of 30.9 minutes. Timing may have been skewed based on varying amounts of translation during the interview.

I. Motivation scores among SAMU staff

The first 10 questions of our survey had an average motivational score of 41.68 out of 50, compared to the same questions asked to a cohort of over 600 health care workers at Kenyan government hospitals, which scored 36.94 out of 50 ($p < 0.001$) [8]. The second 50-point scale was calculated from questions nine to 18 and had a motivational score of 38.94, which was significantly higher than average scores from over 2000 HCWs in Tanzania, Malawi, and South Africa ($p < 0.05$ for all) (Table 1). Although the participants in these two published studies are not specifically pre-hospital HCWs, they represent some of the only cohorts of nurses, physicians, and allied health professionals in sub-Saharan Africa for whom objective data regarding motivation are available. Relative to these previously published cohorts of HCWs, SAMU staff scored 5% to 21% higher on average.

Factors contributing to SAMU employee motivation and participation in the CQI project

None of the second set of 20 survey questions scored < 1.5 (low enough to confer strong consensus disagreement). Five questions had

Table 1
Motivation scores of SAMU staff compared to cohorts in the published literature.

Country	Sample size	Average motivation score	s.d.	p-Value
Scale 1: From Mbindyo et al.				
Rwanda	34	41.68	5.38	–
Kenya	684	36.94	5.54	< 0.001
Scale 2: From Blaauw et al.				
Rwanda	34	38.94	4.31	–
Tanzania	567	36.91	5.03	0.02
Malawi	937	34.03	5.80	< 0.001
South Africa	717	32.00	5.80	< 0.001

Table 2
Survey questions exhibiting strong consensus agreement and disagreement.

Question	Mean score (scale 1–5)	Theme
I work on the REDCap database because I want SAMU to continue to improve	4.74	Organizational commitment
Getting feedback on the “Focus Points” and REDCap completion rates helps me provide better care to my patients	4.66	Patient care
I work on the REDCap database because it shows the good work SAMU is doing	4.63	Patient care
I am proud to be working for SAMU	4.61	Organizational commitment
Working for SAMU makes me feel good about myself	4.58	Organizational commitment
I work on the REDCap database because I think research is important	4.58	Research
I am glad that I work for SAMU rather than other health facilities in the country	4.56	Organizational commitment
Research is important to make better policies or provide better patient care	4.55	Research/policies
I work on the REDCap database because I think it will result in better patient care	4.54	Patient care
I work on the REDCap database, but it is difficult to understand how to use	2.37	Technology
I work on the REDCap database because I think I could get fired if I fail to do so	2.36	Supervisory support
I work on the REDCap database because I think my peers will think less of me if I do not	2.33	Team work
I work on the REDCap database because I think my managers will like me more if I do so	2.13	Supervisory support
I work on the REDCap database because I think I will get paid more money if I do a good job	2.13	Financial incentives

scores between 1.5 and < 2.5, showing consensus disagreement (Table 2). Those questions were mostly framed negatively, inquiring about supervisory reprimand or a damaged social standing. Notably, a question about the ease of using REDCap showed consensus disagreement. Three questions scored between 2.5 and 3.5, and did not show consensus among participants (Appendix A). Twenty-three questions conferred consensus agreement with scores between > 3.5 and 4.5 (Appendix A). Nine questions had a strong consensus agreement with scores > 4.5 (Table 2). The major themes in this category were positive: organizational commitment, impact, and research leading to better patient care. See Appendix A for a complete table with all 40 questions and agreement scores.

Based on Likert scale of 1–5. Consensus agreement was defined as scores of > 3.5 to 4.5, while strong consensus agreement was defined as mean scores of > 4.5 to 5.0. Consensus disagreement was defined as mean scores of 1.5 to < 2.5. There were no questions with strong consensus disagreement (mean scores 1.0 to < 1.5).

II. Understating Successful Implementation of the SAMU CQI Project:

Four major themes and 15 minor themes emerged from the interviews relating to the implementation of the CQI (Table 3). The four major themes were improvements in quality of care, changes in job expectations, views on research, and positive experience with data feedback. First, SAMU staff felt that the CQI database led to improved clinical knowledge, which led to better patient care, enhanced use of resources, increased individual accountability, and more complete data in patient records. Second, SAMU staff felt that the CQI database led to expanded job skills and roles. Specifically, respondents highlighted ways that the database relied on consistent computer data entry skills which were developed through staff trainings. While the database initially increased their workload, they found that individual involvement in data entry led to a sense of team building. Third, SAMU staff commented on ways that the database changed their views on research. Specifically, many respondents felt that the database led to improved patient care through research, increased national pride as they witnessed their government-sponsored pre-hospital care delivery improve, and created personal curiosity in ways that research could answer their new questions on pre-hospital care in Rwanda. Finally, many SAMU staff commented on ways that the continuous data feedback personalized their work, helped them improve in real time, and gave more meaning to the data entry process. Representative quotations highlighting these four themes are outlined in Table 3.

Discussion

In this study, we aimed to quantify the levels of employee motivation among pre-hospital HCWs in Rwanda, to identify the factors that contribute to overall staff motivation, and to understand the successful

implementation of a recent quality improvement program at one of the few publicly supported ambulance systems in sub-Saharan Africa.

One of the key findings from this study was the importance of feeding data back to front-line providers to drive behavior change. Registries used only for research or solely by administrative personnel are less likely to have an immediate and sustained impact on daily employee behavior compared to dynamic registries. Constant feedback through the CQI analysis encourages communication among SAMU staff at all levels [7]. In line with prior studies, we found that collaboration and feeling part of a successful team creates personal investment in the system and an organizational commitment, increasing motivation levels [15]. Constant feedback also uncovers individual gaps in clinical knowledge, patient care, and technological understanding. Knowing these gaps in knowledge creates space for SAMU to provide personal and professional development through trainings, which further improves HCW motivation. In fact, understanding the patterns of such knowledge gaps has enabled SAMU to improve their initial staff training, enhancing HCW expertise and thus improving provider performance to further motivate staff [15–17]. This feedback results in patterns of multifactorial improvement over time by illustrating SAMU's impact, which promotes career gratification and motivation.

While outlining SAMU's impact, the CQI program provided a data-driven definition of the specific medical equipment and supplies needed for SAMU's patient population. When CQI meetings revealed that c-collars or oxygen tanks were not used because they were unavailable overnight, SAMU responded by ensuring that such requisite equipment was always available on ambulances. This can be translated into improved allocation of supplies and better use of funds, working towards a more robust health system and further enhancing HCW motivation in resource-limited settings [18].

The CQI program also encouraged complete entry of patient information into REDCap. Here, the improvements in motivation are two-fold: by inputting data, SAMU staff feel greater agency within the system, and more complete pre-hospital ambulatory care data reveals improvement areas, which encourages action towards a stronger health system. There was a learning curve with use of the REDCap software, and there was overall agreement that it was difficult to use. The SAMU staff were able to overcome this barrier with staff and peer training. However, future such projects would be well served to trial multiple data entry options to identify data entry software preferred by those inputting the data.

Our results of motivational factors were similar to those from previous research including recognition, appreciation, higher responsibility, and professional satisfaction. Continued education, improved hospital infrastructure, and availability of necessary resources contributed strongly to motivation as well. The commonalities found in this study and others like it provide a durable outline of ideas to optimize HCW motivation in LMICs.

This is the first study to provide quantified scores of worker motivation among pre-hospital HCWs in a low- or lower-middle income

Table 3
Contextual motivators based on changes after implementation of the continuous quality improvement program.

Improvements in care	Job descriptions
<p>Clinical knowledge:</p> <ul style="list-style-type: none"> • “The research improves knowledge of healthcare providers” • “[After] we had staff meetings, we discussed on how to do things [...] trauma injuries and their management and the other things are diabetes” <p>Resources:</p> <ul style="list-style-type: none"> • “[...] easily know which supplies are important and it helps us in the procurement process” • “The materials for ambulance have also increased and REDCap has helped much in arranging these materials” <p>Accountability:</p> <ul style="list-style-type: none"> • “Someone who filled the file is always there [at the staff meeting] and he has to give every detail” • “[...] we check the fiche [run sheet] and there is information we call the one who has written the fiche and we inform him about the error he has repeated” <p>Data completion:</p> <ul style="list-style-type: none"> • “[...] before REDCap the staff was dodging the files and they were not filling them well” • “[Before] files were incomplete and there were no proper time during staff meetings to discuss the issue. So, the REDCap helped in improving the way files were filled” 	<p>Technological expectations:</p> <ul style="list-style-type: none"> • “One of the difficulties we have here is the problem of internet network” • “Computer skills are a challenge and some [SAMU staff] are shy” <p>Work hours:</p> <ul style="list-style-type: none"> • “This takes time to fill and you know you have to carry the patient in the golden hour” • “At the beginning they were thinking that it is losing their time” <p>Work load:</p> <ul style="list-style-type: none"> • “At the beginning of REDCap [...] they were seeing it as extra work but now they are convinced that they do their job, they have to do a file and enter data in the system” • “It was my first time to see how our work is done; [...] it opened my eyes; after that report we had a staff meeting and we were asking ourselves, ‘is that really what we do?’” <p>Professional development:</p> <ul style="list-style-type: none"> • “Since we had staff meetings [with the CQI], we discussed on how to do things, even informal trainings were done [...] like for] trauma injuries and their management and the other things are diabetes” • “There has been some meetings and trainings [...] about CPR for instance” <p>Team building:</p> <ul style="list-style-type: none"> • “We are different staff and maybe with different skills [...] but we take time and discuss about them together” • “When we are on the field we try to exchange ideas [...] and we may discuss [patient treatment]”
<p>Views on research</p> <p>Patient benefits:</p> <ul style="list-style-type: none"> • “The first persons to benefit from research are the SAMU staff because it adds on some new information and it helps to improve the care they provide” • “The care has improved because of REDCap, because whenever the presentation was saying oxygen is at 40%, we were working to increase the numbers” <p>National pride:</p> <ul style="list-style-type: none"> • “REDCap helps our health sector especially SAMU” • “When the data from REDCap are there, some policies can be made” <p>Personal curiosity:</p> <ul style="list-style-type: none"> • “I know well that when I try to do research I will be more helpful to the service and the country in general” • “[...]it's very important to me, the service and researchers because next time [...] I want to do something for the hospital, I'll come here [to REDCap]” 	<p>Experiences with data</p> <p>Personalization:</p> <ul style="list-style-type: none"> • “Yes, I think that if everyone gets a login it will help them” <p>Feedback:</p> <ul style="list-style-type: none"> • “They [staff meetings] were showing us our weaknesses and the next days, we had to improve” • “We meet in the morning staff and we give feedback on the interventions we did overnight and at that time we discuss on what we can change and what to do to REDCap and improve the quality of our action” <p>Meaning of data:</p> <ul style="list-style-type: none"> • “When someone is giving feedback with evidences, you easily see where there is a gap [...] now I can change” • “With research, you get the feedback [data] and know where to focus”

country. Two previously published studies report HCW motivation scores among hospital staff (including nursing staff, physicians, and allied health professionals) from Kenya, Tanzania, Malawi, and South Africa [8,10]. Compared to the HCWs from these studies, the SAMU staff had higher motivation scores on average, suggesting a high degree of intrinsic motivation. Additional survey questions designed to identify specific sources of motivation revealed that high degrees of commitment to their institution and a strong desire to improve patient care were the two strongest motivating forces. The least significant motivating forces were financial motivation and pressure from supervisors. In fact, although the CQI required additional work on behalf of the SAMU team members, no one at SAMU was paid more to do this work.

These findings may inform those in healthcare leadership at the institutional, regional, and national level to drive changes in healthcare policy, resource allocation, and HCW training. Development of policies and practices that lead to improved worker motivation and job satisfaction is likely to improve HCW retention and thereby strengthen healthcare delivery systems throughout LMICs [15,19–23].

The findings of this study must be interpreted in light of the limitations to the study design. The participants in this study were all employees at a Rwandan pre-hospital emergency medical system in the capital city of Kigali. Given the specific niche of HCWs, our findings may or may not be applicable to other types of HCWs in other settings. Also, Rwanda's unparalleled economic growth and improvements in their healthcare system may create problems for transposition of this work in other LMICs. Our participants came from a wide range of backgrounds and age groups, and previous studies have proven that motivational factors differ between generations and demographics. Interview participants could have held back critical information that they did not feel comfortable disclosing to the interviewer, who worked closely with participants years before this study began. However, we attempted to reduce this risk by using an interviewer with established credibility among study participants prior to conducting the research. Finally, coding and analysis is always informed by the lens of the analyst. To minimize the risk of individual coder bias, we used standardized data collection, and dual coding of all transcripts.

Conclusion

SAMU's pre-hospital continuous quality improvement program is a unique example of the positive impact of data feedback to front line providers in order to drive behavior change that improves quality of care. The SAMU staff are a highly motivated cadre for pre-hospital providers and much of their motivation is driven by a high level of institutional commitment and a strong desire to improve the care of their patients. The highly successful implementation of a recent continuous quality improvement program was driven by positive experiences with constant data feedback and a desire to make an impact through research and quality improvement efforts. Regarding future work, lessons learned from this experience may inform similar projects in the effort to develop healthcare human resources and delivery systems required to close the quality gap for injured patients in LMICs. Continual data feedback to frontline healthcare workers is a critical component of successfully implementing quality improvement efforts and deepening clinical knowledge among those working on the front lines of pre-hospital care delivery.

Dissemination of results

Results from this study were shared with SAMU staff leadership and

other participants through an informal presentation, and discussed at staff meetings.

Authors' contributions

Authors contributed as follows to the conception or design of the work: the acquisition, analysis, or interpretation of data for the work; and drafting the work or revising it critically for important intellectual content: HEN: 20%; JWS: 15%; JDD, JMU, IK and SJ 10%; RM and JCB 5%; and RR, TD, SE, YDH and ZM 3% each. All authors approved the version to be published and agreed to be accountable for all aspects of the work. Acknowledgements

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Conflict of interest

The authors declare no further conflict of interest.

Appendix A. Quantitative results with survey questions

No.	Question	Score	Theme
1	These days, I feel motivated to work as hard as I can	4.44	Job satisfaction
2	Working for SAMU makes me feel good about myself	4.58	Organizational commitment
3	I am proud to be working for SAMU	4.61	Organizational commitment
4	I am glad that I work for SAMU rather than other health facilities in the country	4.56	Organizational commitment
5	SAMU leadership really inspires me to do my very best on the job	4.07	Organizational commitment
6	I always complete my tasks efficiently and correctly	4.19	Conscientiousness
7	I am a hard worker	4.44	Conscientiousness
8	I am punctual about coming to work	4.30	Conscientiousness
9	Overall, I am very satisfied with my job	4.35	Job satisfaction
10	I am satisfied with the opportunity to use my abilities in my job	4.29	Job satisfaction
11	I have a variety of duties, tasks, and activities in my job	4.13	Motivational properties of the job
12	I find that my opinions are respected at work	3.73	Supervisory support
13	I am satisfied with the recognition I get for the work I do at SAMU	3.88	Recognition
14	I am satisfied with the personal relationship between my SAMU manager and myself	4.06	Supervisory support
15	I am satisfied with the way my SAMU managers handle the staff	3.63	Supervisory support
16	I feel that my job conditions allow me to perform at high levels	3.91	Motivational properties of the job
17	I am satisfied with the availability of drugs and equipment at SAMU	3.73	Resources
18	I am satisfied with the educational/training opportunities that I get	3.23	Professional development
19	Research is important to make better policies or provide better patient care	4.55	Research/policies
20	Research is important to me personally, for my career	4.41	Research/personal curiosity
21	I work on the REDCap database because I think it will result in better patient care	4.54	Patient care
22	I work on the REDCap database because I think it will help the country of Rwanda	4.46	National improvements
23	I work on the REDCap database because I think I will get paid more money if I do a good job	2.13	Financial incentives
24	I work on the REDCap database because I think I could get fired if I fail to do so	2.36	Supervisory support
25	I work on the REDCap database because I think my peers will think less of me if I do not	2.33	Team work
26	I work on the REDCap database because I think my managers will like me more if I do so	2.13	Supervisory support
27	I work on the REDCap database because it is a good thing to be doing at work	3.58	Conscientiousness
28	I work on the REDCap database because it is easy to do	2.77	Technology
29	I work on the REDCap database, but it is difficult to understand how to use	2.37	Technology
30	I work on the REDCap database because it makes me feel good to do it	3.60	Conscientiousness
31	I work on the REDCap database because it shows the good work SAMU is doing	4.63	Impact
32	I work on the REDCap database because I want SAMU to continue to improve	4.74	Organizational commitment
33	I work on the REDCap database because I think research is important	4.58	Research
34	I work on the REDCap database because I think it will lead to better laws and policies	4.03	National improvements
35	Getting feedback on the "Focus Points" and REDCap completion rates makes me feel good about the work I do	4.35	Motivational properties of the job
36	Getting feedback on the "Focus Points" and REDCap completion rates makes me feel scared that I might be reprimanded by my seniors	2.80	Supervisory support
37	Getting feedback on the "Focus Points" and REDCap completion rates helps me understand why we are doing it	4.33	Impact
38	Getting feedback on the "Focus Points" and REDCap completion rates helps me provide better care to my patients	4.66	Care for patients
39	Getting feedback on the "Focus Points" and REDCap completion rates helps me use the REDCap database better next time	4.29	Technology
40	Getting feedback on the "Focus Points" and REDCap completion rates has led to better use or availability of equipment	3.77	Resources

Scores range from 1 = strongly disagree, to 5 = strongly agree.

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