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Appropriation and perceived effectiveness of the eSanteCoM digital tool among Community Health Workers in Burkina Faso: a convergent parallel mixed-methods cross-sectional study

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Abstract

Background. The digitalization of community health is increasingly presented as a lever to strengthen health systems in resource-limited settings, provided that the tools deployed are genuinely appropriated by their users. Within the Minimal Digital Ecosystem (MDE) initiative, Burkina Faso deployed the eSanteCoM mHealth tool among Community Health Workers (CHWs). This study assessed its level of appropriation, perceived effectiveness, and associated factors.

Methods. We conducted a convergent parallel mixed-methods cross-sectional study in May 2025 among 135 CHWs utilizing eSanteCoM across the Ziniaré and Manga health districts. Two binary outcomes were modeled via multivariable logistic regression to estimate adjusted odds ratios (aOR) with 95% confidence intervals (CI): perceived effectiveness (improved data speed and reliability) and regular data utilization for local decision-making. Qualitative responses to open-ended questions underwent thematic content analysis and were integrated with quantitative findings via triangulation.

Results. Most participants were female (52.6%), and literate (97.8%), with 83.5% reporting over five years of service. Perceptions of tool appropriation were high: 98.5% considered it useful, 96.3% deemed it user-friendly, 89.6% felt at ease using it, and 100% expressed overall satisfaction. While perceived effectiveness was high at 79.4%, regular data use for decision-making concerned only 21.6% of CHWs. Perceived effectiveness was independently associated with possessing a suitable smartphone (aOR = 4.88; 95% CI [1.53 to 15.57]), higher digital self-efficacy (aOR = 4.14; 95% CI [1.22 to 14.09]), regular administrative feedback (aOR = 2.97; 95% CI [1.00 to 8.79]), and the Manga health district (aOR = 3.13; 95% CI [1.07 to 9.18]). Regular data use for decision-making was significantly associated with digital self-efficacy (aOR = 3.49; 95% CI [1.22 to 9.97]), the Manga district (aOR = 3.88; 95% CI [1.27 to 11.81]), and material resources (aOR = 3.93; 95% CI [0.81 to 18.98]). Qualitative data highlighted critical needs for reliable device charging, continuous refresher training, and stable financial incentives.

Conclusion. The eSanteCoM tool achieved excellent user acceptability, but a substantial implementation bottleneck restricts routine data utilization for local decision-making. Transitioning from passive adoption to decision-oriented integration requires a multi-pronged strategy addressing hardware security, digital self-efficacy, formative feedback loops, and sustainable CHWs incentives.

Keywords. Digital health, mHealth, eSanteCoM, Community health workers, Appropriation, Implementation science, Burkina Faso.

Introduction

To improve primary healthcare access and quality, Burkina Faso introduced a user-fee exemption policy for pregnant women and children under five, alongside a national network of Community Health Workers (CHWs) supporting formal health facilities. Recruited locally, CHWs provide community-based management of major childhood illnesses, health promotion, maternal and neonatal follow-up, patient tracing, and routine data reporting [1,2]. Positioned at the interface between households and the formal health system, they represent a cornerstone of universal health coverage, but also a point of fragility when tools, supervision, or motivation are lacking.

To address these systematic vulnerabilities, digital health technologies, grouped under the labels of digital health or mobile health (mHealth), are increasingly mobilized to strengthen the health systems in low- and middle-income countries, including support to community health workers [3,4]. When well designed, these tools can improve data completeness, speed, and reliability, guide case management via clinical protocols, facilitate patient follow-up, and support decision-making at both community and peripheral levels [3,5]. Several studies conducted in sub-Saharan Africa demonstrate that, compared with paper-based tools, digital tools reduce diagnostic and data-entry errors, secure data storage, and enhance the quality of care delivered by frontline workers [5–7]. Accordingly, the World Health Organization has issued recommendations on digital interventions for health system strengthening, while emphasizing that technologies are not an end in themselves; rather, their effectiveness depends closely on implementation conditions, human resources, and the maturity of the digital ecosystem [3].

However, Burkina Faso's health system already counts more than a hundred digital applications deployed, including at the community level [8]. These tools are often disparate and operate in silos, which limits their interoperability, increases provider workload, and reduces their impact [8]. This fragmentation of health information systems, widely documented across the continent, contributes to poor data quality and the underutilization of the information produced for decision-making [9]. To address this fragmentation, the Ministry of Health designed the Minimal Digital Ecosystem (MDE) initiative, which aims to deploy a core suite of complementary digital tools within health facilities and among providers in a simultaneous and synergistic approach [10]. The community component of the MDE, called eSanteCoM, is the digital tool intended for CHWs [10].

Yet, the ultimate impact of any digital tool depends less on the technology itself than on how users appropriate it and durably integrate it into their daily practices [11,12]. Appropriation extends beyond one-off adoption; it encompasses effective and repeated use, seamless integration into work routines, and crucially, the use of generated data to guide action. The scientific literature describes a recurrent paradox in mHealth programs, where high declared acceptability frequently coexists with limited actual use, a gap that stems from pre-existing systemic barriers rather than from tool rejection [13,14]. Normalization Process Theory (NPT) offers a lens for understanding this integration, analyzing users' perceived coherence of the tool, their cognitive participation, the collective action required for it to function, and the reflexive monitoring through which actors evaluate and adjust its use [12]. Complementarily, the Non-adoption, Abandonment, Scale-up, Spread and Sustainability (NASSS) framework, emphasizes the complex interweaving of individual, organizational, and systemic factors that condition health technology sustainability [11]. Evaluations across sub-Saharan Africa converge on the decisive role of training adequacy, equipment, power supply, connectivity, technical support, and supervision in securing effective tool use by frontline workers [4–6].

Data remain limited, however, regarding CHWs in Burkina Faso, particularly during the pilot stage of eSanteCoM implementation, where an early understanding of appropriation determinants is crucial to guide scale-up and avoid reproducing the shortcomings of earlier deployments. To bridge this gap, this study aims to assess the appropriation and perceived effectiveness of eSanteCoM among CHWs, and to determine the factors driving regular data use and program efficacy in order to provide actionable levers for community health.

Methods

Evaluated intervention (MDE and the eSanteCoM tool)

The MDE involves the simultaneous deployment of a core suite of eight complementary digital solutions alongside a central indicator dashboard - nine integrated tools in total - specifically designed to foster synergy among the tools across health facilities and care providers [10]. The MDE has been implemented as a pilot phase in the Ziniaré and Ténado health districts since 2023. Its community mHealth component, the eSanteCoM tool, is an Android-based mobile application designed for CHWs and built on the CommCare platform. CommCare is an open-source platform widely used for community programs in resource-limited settings, enabling the configuration of structured forms, decision-support algorithms, and data synchronization to a central server [15]. Consequently, the eSanteCoM tool supports community-level diagnostic and therapeutic guidance, visual aid-driven health promotion and patient education, the tracing of patients lost to follow-up, and systematic community care data collection [10]. The overall evaluation of the MDE is a pragmatic mixed-methods implementation study covering four districts, comparing the intervention districts (Ziniaré and Ténado) with the comparison districts (Manga and Sapouy); a detailed description of this evaluation protocol is available elsewhere [16]. At the time of the survey, eSanteCoM was fully operational among CHWs in the Ziniaré and Manga health districts.

Study setting

Burkina Faso is a West African nation with an estimated population of 24 million inhabitants as of 2025 [17]. The national health system follows a three-level pyramidal structure. The central level, comprising the minister's office and strategic directorates, ensures governance; the intermediate level consists of regional health directorates, whose number follows the national administrative division, expanded from thirteen to seventeen regions in July 2025 [18]; and the peripheral level is divided into seventy operational health districts [19,20]. This formal structure is supported at the community level by a network of nearly 30,000 Community Health Workers (CHWs) aiming for universal village coverage [2]. Despite recent health system progress, the national epidemiological profile remains heavily burdened by high maternal and child mortality. To address these challenges, the government implemented a user-fee exemption policy in 2016 targeting pregnant women and children under five, though its implementation faces recurring financing constraints and drug stock-outs [21]. Within this landscape, the Minimal Digital Ecosystem (MDE) was developed. The MDE evaluation covers four districts, comparing two purposively selected intervention districts (Ziniaré and Ténado) with two comparison districts (Manga and Sapouy) [16]. Selection criteria established by the Ministry of Health included baseline security conditions, distance from Ouagadougou, and urban-rural characteristics [16]. The present study focuses specifically on the Ziniaré and Manga districts, where the eSanteCoM tool was deployed among CHWs during the survey. Notably, the deployment of eSanteCoM within the Manga district, originally designated as a comparison district, constitutes methodological contamination. Geographically, the Ziniaré health district is located in the Bassitenga province (formerly Oubritenga) within the Oubri region (formerly Plateau-Central) [18]. Bordering the capital, it managed 74 public health facilities in 2024. Conversely, the Manga district serves as the administrative hub of the Zoundwéogo province in the Nazinon region (formerly Centre-Sud), located approximately 100 km south of

Ouagadougou, and contained 49 facilities in 2024. Both study sites are characterized by a predominantly rural, agropastoral economy. In these areas, the isolation of multiple health catchments drastically worsens during the rainy season, representing a critical contextual determinant of CHW working conditions.

Study design

We conducted an analytical, convergent parallel mixed-methods cross-sectional study, wherein the quantitative and qualitative strands were executed simultaneously, analyzed independently, and subsequently integrated during the interpretation phase [22]. This convergent design is ideally suited for evaluating intervention appropriation; it quantifies the prevalence and determinants of user perceptions while leveraging qualitative data to elucidate the underlying mechanisms and the subjective meanings workers attribute to their experiences. This study is embedded within the broader mixed-methods evaluation framework of the MDE, which combines quantitative and qualitative strands in a sequential explanatory design [16]. Fieldwork was conducted in May 2025 across the Ziniaré and Manga health districts, where eSanteCoM had been fully deployed among CHWs.

Population and sample

The study population comprised CHWs operating within the Ziniaré and Manga health districts. For the broader MDE evaluation, 16 health facilities were selected from each of these two districts. The survey aimed to exhaustively recruit all available eSanteCoM users present at the selected facilities during the data collection visits. Consequently, the analysis of appropriation determinants focused on a subsample of 135 CHWs who reported active tool usage, out of 137 surveyed in total, given that experience-related items were restricted to active users. Conversely, CHWs from the Ténado and Sapouy districts were excluded from this

analysis because the application had not yet been deployed there, leaving no usage patterns to assess.

Data collection

Data were collected via face-to-face interviews by trained personnel using a structured questionnaire and recorded digitally. The instrument comprised closed-ended items assessing sociodemographic characteristics, perceptions, implementation determinants, and outcomes, alongside open-ended questions targeting implementation barriers, sustainability conditions, and general feedback. The questionnaire design was grounded in existing digital health evaluation frameworks and Normalization Process Theory, utilizing its four core dimensions to guide the selection of explored domains [12]. The questionnaire was developed specifically for this study and had not been published or used elsewhere, and the open-ended questions were embedded within the same instrument. The full English version of the questionnaire is provided as Additional file 1. Prior to fieldwork, interviewers underwent standardized training covering the study protocol, data collection software navigation, and ethical research conduct.

Variables and measures

Two binary outcomes were defined a priori. The first, perceived effectiveness, assessed the worker's perception of improved data speed or reliability attributable to the tool. This variable was coded as 'yes' if the CHW reported observing such improvements, and 'no' otherwise. The second outcome, regular data use, reflected the systematic utilization of tool-generated data to guide decision-making. It was coded as 'yes' when the worker reported consistent data use, and 'no' for less frequent usage. In line with the conceptual framework, these two outcomes aimed to distinguish the perceived benefit of the tool from its practical integration into decision-making logic. In accordance with Normalization Process Theory (NPT), 'perceived effectiveness' specifically denotes a perceived benefit for data quality, representing the

individual dimension of reflexive monitoring. Sociodemographic explanatory variables included sex (male vs. female) and age, which was collected in completed years and categorized for analysis. Educational attainment was classified into five levels: no formal schooling, primary, lower secondary, upper secondary, and higher education; literacy was coded binarily (literate vs. illiterate). Both the distance between the CHW's residence and their affiliated health facility, and their length of service in the role, were dichotomized using thresholds of five kilometers and five years, respectively. Perceptual variables encompassed perceived usefulness, user-friendliness, ease of use, self-efficacy regarding digital skills, and overall satisfaction. Implementation determinants included the adequacy of the training received, receipt of regular feedback on transmitted data, access to routine supervision or support, availability of a functional smartphone, access to necessary material resources, and the frequency of technical issues. Items measured on Likert scales were dichotomized into a favorable category (grouping the most positive responses) and an unfavorable category (comprising all other responses). 'Don't know' and 'not applicable' responses were treated as missing data.

Statistical analysis

Quantitative analysis. Categorical variables were expressed as counts and percentages, and continuous variables as means and standard deviations. Two obvious outliers - an age of 99 years and a length of service of 108 years - were identified as data-entry errors and recoded as missing data. Bivariate associations between each explanatory variable and the outcomes were first examined using simple logistic regression to estimate crude odds ratios (ORs) and their 95% confidence intervals (CIs). Variables associated at a liberal threshold of $p < 0.20$, alongside variables clinically relevant a priori (sex and health district), were entered into multivariable logistic regression models following a purposeful selection procedure [23]. Adjusted odds

ratios (aORs) and 95% CIs are reported, with statistical significance set at $p<0.05$. Model goodness-of-fit was assessed using McFadden's pseudo-R^2. All quantitative analyses were performed using Stata 16 software (StataCorp, College Station, TX).

Qualitative analysis. Responses to the open-ended questions underwent thematic content analysis conducted in several steps [24,25]. Verbatim responses were compiled, formatted, and read iteratively to achieve deep data familiarity. Coding combined a deductive framework, derived from the core implementation dimensions, with inductive coding of emerging themes. Subsequently, codes were grouped into thematic categories. Qualitative findings were integrated with quantitative results through a convergent triangulation approach, wherein each data source illuminated, nuanced, or contextualized the other [22]. Illustrative quotations originally recorded in French were translated into English for reporting purposes.

Ethical considerations

This study is embedded within the broader MDE evaluation protocol approved by the National Ethics Committee for Health Research of Burkina Faso (Deliberation No. 2023-06-136). All participants provided informed consent prior to enrollment, and all data were anonymized and processed confidentially. Full ethical and administrative details are provided in the Declarations section.

Results

Participant characteristics

A total of 135 CHWs using eSanteCoM were included in the study, evenly distributed between Ziniaré (49.6%) and Manga (50.4%) health districts. The mean age was 38.1 years (Standard Deviation [SD] = 7.9). Regarding sociodemographic characteristics, women represented slightly more than half of the sample (52.6%), and most participants were literate (97.8%). The

cohort reflected a high level of professional stability, with a mean length of service as a CHW of 8.1 years (SD = 2.9), and 83.5% of respondents possessing more than five years of experience in their role. Detailed sociodemographic characteristics and eSanteCoM appropriation indicators are compiled in Table 1.

[Insert Table 1 here]

Level of appropriation and use of eSanteCoM

The majority of CHWs perceived the tool as useful (98.5%), considered it user-friendly (96.3%), and felt at ease while using it (89.6%). Furthermore, universal satisfaction was recorded (100.0%), with a quarter of the sample reporting being 'very satisfied.' This positive reception aligned with training metrics, as 95.6% of workers felt they had received adequate preparation. Perceived effectiveness, defined as an improvement in data speed or reliability, was reported by 79.4% of the cohort. In sharp contrast, the effective integration of these data into decision-making routines was low, with only 21.6% of CHWs reporting regular use of tool-generated information to guide service improvements.

Factors associated with perceived effectiveness

In the multivariable logistic regression analysis (conducted on 120 observations with a McFadden's pseudo-R^2 of 0.26), four factors emerged as independent determinants of perceived effectiveness: possession of a functional smartphone, higher digital self-efficacy, receipt of regular feedback, and residing within the Manga health district (Table 2). Conversely, the crude association observed between female sex and lower perceived effectiveness (OR = 0.28) was attenuated and lost statistical significance after adjusting for confounding variables (aOR = 0.45; p = 0.18).

Table 2: Factors associated with perceived effectiveness of eSanteCoM tool: logistic regression (n = 120)

Factor	Crude OR (95% CI)	p	aOR (95% CI)	p
Functional phone or tablet (yes vs no)	6.29 (2.36 to 16.73)	<0.001	4.88 (1.53 to 15.57)	0.007
Regular feedback (yes vs no)	2.58 (1.04 to 6.41)	0.040	2.97 (1.00 to 8.79)	0.050
Digital self-efficacy (yes vs no)	5.13 (1.79 to 14.70)	0.002	4.14 (1.22 to 14.09)	0.023
Female sex (vs male)	0.28 (0.10 to 0.75)	0.011	0.45 (0.14 to 1.43)	0.176
Manga district (vs Ziniaré)	3.91 (1.50 to 10.14)	0.005	3.13 (1.07 to 9.18)	0.038

OR: odds ratio, aOR: adjusted odds ratio, CI: confidence interval

Adjusted model includes all factors listed; p values from Wald tests. Statistical significance set at $p < 0.05$

Factors associated with the regular use of data in decision-making

The multivariable model for regular data use (conducted on 115 observations with a McFadden's pseudo-R^2 of 0.16) revealed that this outcome was independently associated with both higher digital self-efficacy and residing within the Manga health district (Table 3). The availability of material resources demonstrated a strong association in the bivariate analysis but was reduced to borderline statistical significance after multivariable adjustment. Sex exhibited no significant association with regular data use in either the crude or adjusted models.

Table 3: Factors associated with regular use of data for decision-making: logistic regression (n = 115)

Factor	Crude OR (95% CI)	p	aOR (95% CI)	p
Manga district (vs Ziniaré)	4.47 (1.54 to 12.93)	0.006	3.88 (1.27 to 11.81)	0.017
Digital self-efficacy (yes vs no)	3.59 (1.36 to 9.44)	0.010	3.49 (1.22 to 9.97)	0.019
Material resources available (yes vs no)	4.93 (1.08 to 22.39)	0.039	3.93 (0.81 to 18.98)	0.088
Female sex (vs male)	0.67 (0.28 to 1.64)	0.384	1.04 (0.38 to 2.87)	0.938

OR: odds ratio, aOR: adjusted odds ratio, CI: confidence interval

Adjusted model includes all factors listed; p values from Wald tests. Statistical significance set at $p < 0.05$

Facilitators of and barriers to eSanteCoM appropriation

Thematic analysis of the open-ended responses identified key facilitators and barriers that elucidate and contextualize the quantitative findings.

Perceived facilitators. The first thematic cluster focused on enhanced data security and preservation. Participants emphasized that physical paper forms were highly susceptible to tearing or loss, particularly during the rainy season, whereas the digital system ensured durable data storage and streamlined retrieval. As one CHW highlighted: *"The paper version can tear or get lost, whereas with digital it is easier to preserve the data."* Furthermore, the speed and automation of report transmission were widely praised. CHWs noted that reporting frequencies shifted from a monthly to a weekly cadence, eliminating the need for physical travel to health facilities. One respondent observed: *"With paper, data were sent monthly, but with the tablet it has become weekly."*

A second cluster centered on clinical decision support and health promotion. Numerous CHWs described the application as an intuitive clinical guide that directed diagnosis, therapeutic management, and maternal-neonatal follow-up, while simultaneously preventing data-entry errors. One participant explained: *"The application guides us toward better diagnosis and treatment than paper methods,"* while another noted: *"When there is an error, the phone flags it, whereas paper does not."* Additionally, embedded illustrative images were highly valued for community-level educational sessions, serving as essential memory aids that strengthened CHW capabilities. A CHW remarked: *"eSanteCoM guides us a lot with illustrative images; the population understands better and it makes our work easier."*

Perceived barriers. Conversely, logistical and infrastructure deficits presented substantial constraints. The most prominent barrier related to unstable power supply and limited smartphone battery life. CHWs frequently reported devices shutting down mid-activity,

directly undermining home visits and educational sessions. One worker confided: *"My concern is about the battery, where in the middle of a talk the phone switches off."* Another expressed worry about being unable *"to finish the activity before the phone's battery runs out."* Consequently, requests for reliable charging solutions—such as power banks or solar kits—were ubiquitous.

Connectivity limitations and software malfunctions introduced further technological friction. Participants experienced internet disruptions, data synchronization failures, and software freezes that halted application usage, forcing them to revert to paper notebooks or seek immediate assistance from their head nurse. A CHW recalled a *"locking of the application during talks,"* which forced him *"to continue with the notebook."* Operational disruptions were exacerbated by software updates deployed by central administrators without clear communication, leaving CHWs unprepared for interface modifications.

Finally, financial incentives and role-related constraints emerged as critical threats to sustained tool integration. Financial motivation delays and perceived increases in workload were frequently linked, with one CHW stating: *"Too much unpaid salary does not motivate the use of these tools."* Program sustainability was also compromised by broader systemic barriers, including a lack of adequate transportation means, geographic isolation during the rainy season, and the need for continuous refresher training. Lastly, micro-social friction was reported within communities, where some households perceived CHW visits as intrusive or driven by personal interest, thereby complicating health promotion efforts.

Discussion

This evaluation demonstrates that the eSanteCoM tool achieved robust appropriation among CHWs in Burkina Faso regarding user acceptability. The digital tool was overwhelmingly perceived as useful, user-friendly, and satisfying to operate. While nearly eight out of ten

CHWs perceived the tool as effective in improving data speed and reliability, only one in five reported regular data utilization for local decision-making. Multivariable analysis identified having a functional smartphone, higher digital self-efficacy, routine administrative feedback, and geographic health district as independent determinants of perceived effectiveness. For regular data use, digital self-efficacy and the health district emerged as significant predictors, alongside the borderline significance of material resources. This asymmetrical pattern exemplifies a classic implementation bottleneck typical of early-stage digital health rollouts, where surface-level user buy-in far outpaces the structural integration of technology into clinical decision-making routines [5,14].

The gap between near-universal adoption and the limited regular use of data to improve services is therefore a central finding of this study. This echoes a well-documented paradox in the mHealth literature, where high declared acceptability frequently coexists with low functional tool usage. Reviews of mHealth implementation in resource-limited settings attribute this contrast less to individual technology rejection than to pre-existing systemic deficiencies in health information governance and institutional workflows [14,26]. For instance, a South African pilot leveraging the CommCare platform demonstrated a similar disconnect, showcasing actual system utilization rates that fell significantly short of the frontline workers' highly favorable perceptions [13]. Consequently, the core challenge shifts from securing passive tool acceptance to fostering the active translation of collected data into actionable clinical insights. Within the framework of NPT, this transition represents the "reflexive monitoring" dimension, which fundamentally relies on functional feedback loops and structured organizational support, components that are currently under-resourced in this setting [12]. The widespread failure to utilize data for localized decision-making should therefore be interpreted as an organizational system immaturity rather than an individual failing of the CHWs.

A pivotal finding is the prominent role of digital self-efficacy, which was the sole modifiable individual factor independently associated with both perceived effectiveness and regular data use. This underscores that a worker's subjective cognitive confidence conditions effective technology integration far more than mere material access to hardware. This is consistent with empirical evidence from rural India, which demonstrated that a healthcare worker's level of application mastery predicts care quality and clinical experience substantially better than the simple provision of devices [27]. Crucially, the attenuation of the effect of sex after adjusting for digital confidence supports this interpretation; the gender gaps observed in our crude analysis stem from structural disparities in digital literacy and confidence rather than an intrinsic gender-related effect. This aligns with the documented gender digital divide in Burkina Faso, where smartphone ownership and digital access remain restricted for women, particularly in rural communities [28,29]. Approaching digital platforms with less prior technological exposure, female CHWs face lower initial digital self-efficacy rather than an inherent disadvantage, emphasizing the need for targeted gender-sensitive training models to support less confident frontline workers [28]. Furthermore, the significant associations found with functional smartphones and material resources confirm that the user experience remains anchored in tangible infrastructure. This quantitative finding strongly converges with our qualitative data, where battery depletion and the absence of reliable power sources emerged as critical operational barriers.

Our findings highly align with the broader mHealth literature in resource-limited environments, which consistently identifies hardware quality, stable power supply, reliable connectivity, continuous training, technical support, and formative supervision as structural pre-requisites for effective digital integration [4–6]. Sub-Saharan African implementations reports highlight that digital tools achieve sustainable routine use only when paired with localized hands-on training, seamless alignment with pre-existing workflows, and responsive technical support to

resolve routine software freezing [6]. The gap between adoption and data use also echoes the NASSS framework, which underscores that technology institutionalization requires the concurrent alignment of individual, organizational, and systemic dimensions [11]. Moreover, the significant district-level effect observed for the Manga district across both outcomes likely reflects localized variations in supervision quality, managerial leadership, and peer team dynamics, factors frequently cited as critical modifiers of community health programs. This underscores the need to thoroughly document localized managerial practices to extract transferable lessons for national scale-up.

In terms of public health implications, these results argue for a scale-up strategy for eSanteCoM built around several complementary levers, to be activated simultaneously rather than sequentially. It is important first to secure equipment and power infrastructure by providing CHWs with functional smartphones and sufficient material resources, including decentralized charging solutions such as power banks and solar panels. Strengthening the CHWs' skills and digital self-efficacy, through repeated, hands-on, in person training or tailored tutorials, alongside localized proximity support prioritizing the least assured workers, appears equally decisive, since digital self-efficacy is the common factor behind perceived effectiveness and data use. In addition, systematizing administrative feedback loops on transmitted data and ensuring routine formative supervision are critical to foster the operational shift from passive data collection to genuine information utilization for local decision-making, thereby reactivating the currently missing reflexive loop. Documenting and disseminating the best-performing organizational practices would offer additional institutional support to this dynamic. Furthermore, sustaining frontline worker motivation through the timely and predictable payment of financial allowances emerges as a fundamental condition for long-term sustainability widely expressed by the CHWs themselves, serving as a cross-cutting determinant of lasting engagement. Beyond superficial technology adoption, the ultimate

challenge for the eSanteCoM rollout is therefore to build the systemic conditions required for sustainable, decision-oriented routine use.

Strengths and limitations. To our knowledge, this study is among the first to empirically document the appropriation of a community mHealth tool among CHWs in Burkina Faso. Utilizing a convergent parallel mixed-methods design grounded in NPT significantly strengthens the validity of our findings [12,22]. Integrating qualitative narratives successfully contextualizes the statistical models, providing a robust empirical foundation for actionable policy recommendations.

However, some limitations must be acknowledged. First, the cross-sectional nature of the data precludes any causal inferences regarding the observed associations. Second, certain perceptual variables exhibited a distinct ceiling effect due to near-unanimous positive reporting, thereby constraining statistical power. In addition, the reliance on face-to-face, self-reported data introduces potential social-desirability bias. Future large-scale evaluations should pair self-reported perceptions with objective back-end usage logs from the digital platform.

Conclusion

The eSanteCoM community mHealth tool achieved strong initial appropriation and high user acceptability among CHWs in Burkina Faso, driven by positive frontline perceptions of its effectiveness in enhancing data quality. However, transforming this passive adoption into sustained routine data utilization for local decision-making requires a coordinated, multi-pronged approach. Stakeholders must simultaneously address foundational infrastructure (hardware and power logistics), individual capabilities (digital self-efficacy), operational workflows (administrative feedback and formative supervision), and systemic retention factors, specifically the timely disbursement of financial allowances. Validated by both quantitative modeling and qualitative narratives, these concurrent levers offer an empirical

roadmap to guide the national scale-up of the eSanteCoM mHealth tool, ultimately strengthening community health and accelerating progress toward universal health coverage.

Declarations

Ethics approval and consent to participate. This study is part of the MDE evaluation protocol, which was approved by the National Ethics Committee for Health Research (Comité d'Éthique pour la Recherche en Santé, CERS) of Burkina Faso (deliberation No. 2023-06-136). Administrative authorization for data collection was also obtained from the Ministry of Health. Prior to data collection, all participants were fully informed of the nature, purpose, duration, and methods of the study, as well as their right to decline participation or withdraw from the study at any time without any consequence. Written informed consent was obtained from all literate participants. For non-literate participants, witnessed verbal consent was obtained. All procedures were conducted in accordance with the principles of the Declaration of Helsinki.

Consent for publication. Not applicable. The manuscript contains no individual identifying data, and the illustrative quotations are reported anonymously.

Availability of data and materials. The datasets generated and analyzed during the current study are not publicly available because they form part of the ongoing MDE evaluation. However, they are available from the corresponding author upon reasonable request, subject to a data use agreement to ensure compliance with ethical standards and to protect participant confidentiality.

Competing interests. The authors declare that they have no competing interests.

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Authors' contributions., IK, DZ and JAK designed the study. IK and YK supervised the data collection and conducted data analysis under the supervision of DZ. IK drafted the manuscript, and JAK, YK, RK, OS, ST, RN and DZ critically revised it. All authors read and approved the final version of the manuscript.

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Table 1 : Sociodemographic characteristics and perceptions of community health workers regarding the eSanteCoM tool (N = 135)

Variable	Category	n (%)
Sex	Male	64 (47.4%)
	Female	71 (52.6%)
Age group	≤30 years	25 (18.7%)
	31-40 years	58 (43.3%)
	41-55 years	50 (37.3%)
	≥56 years	1 (0.7%)
Educational level	Primary	46 (34.1%)
	Lower secondary	77 (57.0%)
	Upper secondary	9 (6.7%)
	Higher (university)	1 (0.7%)
	Other	2 (1.5%)
Literacy	Literate	132 (97.8%)
	Illiterate	3 (2.2%)
Home-to-facility distance	Less than 5 km	72 (53.3%)
	More than 5 km	63 (46.7%)
Length of service as CHW	≤5 years	22 (16.5%)
	>5 years	111 (83.5%)

Health district	Ziniaré	67 (49.6%)
	Manga	68 (50.4%)
Perceives the tool as useful	No	2 (1.5%)
	Yes	131 (98.5%)
User-friendly / easy tool	No	5 (3.7%)
	Yes	130 (96.3%)
Confidence in own digital skills	No	72 (53.3%)
	Yes	63 (46.7%)
At ease using the tool	No	14 (10.4%)
	Yes	121 (89.6%)
Satisfaction level	Satisfied	99 (73.3%)
	Very satisfied	36 (26.7%)
Adequate training	No	6 (4.4%)
	Yes	129 (95.6%)
Training deemed sufficient	No	31 (24.0%)
	Yes	98 (76.0%)
Suitable smarphone	No	27 (20.0%)
	Yes	108 (80.0%)
Material resources available	No	34 (26.4%)
	Yes	95 (73.6%)
Regular supervision / support	No	5 (3.7%)
	Yes	130 (96.3%)
Regular feedback	No	41 (31.8%)
	Yes	88 (68.2%)
Refresher training or ongoing support	No	46 (34.1%)
	Yes	89 (65.9%)
Frequent technical problems	No	30 (22.2%)
	Yes	105 (77.8%)
Tool requires extra effort	No	90 (67.7%)
	Yes	43 (32.3%)
Perceived effectiveness (improved speed / reliability)	No	26 (20.6%)
	Yes	100 (79.4%)
Regular use of data for decisions	No	91 (78.4%)
	Yes	25 (21.6%)

CHW: community health worker, n: number of respondents, %: proportion of respondents
Percentages are calculated on the number of valid responses for each variable; totals may differ from 135 because of missing data

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Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Supplementaryfile1CHWquestionnaire.docx