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Is mobile renewal enough? A qualitative study exploring stakeholders' perspectives on mobile phone-based add-ons for national health insurance uptake in Ghana

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Abstract

Background The Mobile Renewal System (MRS) has increased insurance renewal rates among Ghana's National Health Insurance Scheme (NHIS) subscribers. However, population coverage with active NHIS membership remains insufficient for Universal Health Coverage (UHC) ambitions, especially among informal workers. This qualitative study aimed to explore stakeholders'(technical experts and informal workers) perspectives on the implementation and use of mobile renewal system (MRS) add-on(s) to improve NHIS uptake in Ghana.

Methods Technical experts were interviewed in depth based on their experience and ability to provide information on developing and implementing mobile health technology, and 17 focus group discussions were held with informal workers in Accra and Kumasi between March and August 2022. Thematic analysis was used to identify recurring themes and categories.

Results Participants (13 technical experts and 96 informal workers) suggested several add-ons to improve the use of the MRS. These included reminders to renew, mobile registration of new members, an automatic renewal option, a savings wallet, and a facility locator. These add-ons could potentially encourage more people to use the MRS and further increase insurance uptake. For implementing and utilizing the MRS and these add-ons, reliable technological infrastructure, stakeholder involvement, adequate funding, training, and awareness campaigns were considered crucial. Barriers to using MRS and add-ons may arise from concerns regarding data protection, transparency, and potential taxes on digital transactions resulting in additional costs. In addition, individual factors such as experience with mobile phone transactions and knowledge about insurance influenced participants' willingness to use the MRS and the suggested add-ons.

Conclusion Different mobile phone-based technologies can potentially increase NHIS coverage in Ghana. Implementation should address insurance literacy and build communities' trust in mobile technology.

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Keywords Mobile renewal system (MRS), National health insurance scheme (NHIS), Universal health coverage (UHC) Add-ons, Informal workers, Digital health, Ghana

Introduction

Many low- and middle-income countries (LMICs) are piloting a wide range of digital health innovations in their health systems to achieve Universal Health Coverage (UHC), a fundamental target of the Sustainable Development Goal (SDG) 3.8 [1–3]. UHC implies that all people can access quality health services without financial hardship [4]. Achieving UHC requires reforms of health financing arrangements in many LMICs to ensure that sufficient resources are raised and used to provide financial protection to the population [5].

In Ghana, healthcare used to be financed largely through out-of-pocket (OOP) payments for close to 2 decades until 2003, when the government introduced a National Health Insurance Scheme (NHIS) [6, 7]. These high OOP requirements for healthcare caused financial hardship and posed major access barriers [8–10]. The introduction of the NHIS was intended to remove these financial barriers, offer financial risk protection, and make public healthcare more accessible through public financing of healthcare and abolishing user charges [11].

The NHIS requires a yearly renewal process for all members. Members are categorized into two groups – (1) a premium-paying group and – (2) a non-premium-paying (exempted) group. All informal workers fall under the premium-paying group and must pay both premium and processing fees at the time of renewal. The premiums currently range from GH¢7.00 to GH¢42.00, where lower premiums are charged in poorer districts. There is also a processing fee of GH¢ 8.00. Non-premium payers include minors under 18 years, formal sector workers and pensioners covered by the Social Security and National Insurance Trust (SSNIT), and people with disabilities. They only pay the processing fee. Extremely poor (indigent), pregnant women, and the elderly (everyone 70 years and above) have a full exemption and pay neither premium nor processing fees [2, 12].

The yearly renewal requirement appears to be a significant barrier to achieving higher insurance coverage. Although approximately 80% of the Ghanaian population once registered with NHIS, only 54% of the population has an active membership, with a majority coming from exempted groups, leaving many at risk of catastrophic health expenditure or the inability to access care [13, 14], which undermines the equity orientation of the scheme.

The National Health Insurance Authority (NHIA) introduced the mobile renewal system (MRS) in 2018. With the MRS, individuals can renew their own or others' NHIS insurance by dialing a USSD (Unstructured Supplementary Service Data) short code (*929#) on all mobile networks, providing the required information, and paying their fees through their mobile money (MoMo) account instead of going to the office in person. This technology has reportedly increased its users' likelihood of NHIS renewal by 17.4% [2], but non-renewal rates remain high.

It has been documented that several LMICs with large informal sectors struggle to include informal workers in their public insurance schemes [15, 16]. Potential explanations include the non-availability of funds, forgetfulness, unwillingness to be publicly insured, lack of enforcement, and the absence of formalized structures for an uncomplicated and continuous collection of contributions [2, 17, 18]. Ghana, where more than 80% of the working population are informal workers, is no exception [16, 19, 20]. Informal workers remain strongly underrepresented and comprise only 34% of the active members [21]. Therefore, this study sought to explore the perspectives of technical experts and informal workers on implementing and using mobile phone-based add-ons to enhance NHIS uptake in Ghana, with the border aim of informing policy-making on digital technology for health insurance uptake.

Specifically, this study aims to (1) explore stakeholder perspectives on the use of the NHIS MRS (2) examine the stakeholder's perspectives on appropriate add-ons that could enhance the use of the NHIS MRS (3) examine factors influencing the implementation of the proposed mobile phone-based add-ons and (4) determine the factors influencing the use of the proposed mobile phone-based add-ons.

Literature review

Mobile health (mHealth)

Mobile health (mHealth) interventions, including SMS reminders, mobile applications, and telemedicine, are improving healthcare access in LMICs [22–24]. The widespread adoption of mobile technologies has provided an opportunity to bridge healthcare gaps, enhance service delivery, and improve health outcomes [24, 25]. mHealth interventions have been implemented across various health domains, including maternal and child health, disease surveillance, medication adherence, and health insurance enrollment [26, 27]. In LMICs, where healthcare infrastructure is often limited, mobile phone-based solutions offer innovative approaches to overcoming barriers related to geographical inaccessibility and resource constraints [23]. Studies have shown that mHealth technologies contribute to increased healthcare

utilization, improved disease monitoring, and better health outcomes through timely interventions [24, 26].

Factors influencing the implementation of mHealth interventions

Implementation of mHealth interventions faces several challenges. Infrastructure-related barriers, such as limited internet connectivity and unreliable electricity supply, hinder the scalability of mobile health solutions [28, 29]. Additionally, digital literacy levels and socio-economic disparities influence the adoption and sustained use of mHealth interventions [30]. Ensuring user-friendly platforms and providing adequate training for both healthcare providers and end users is critical for successful implementation [31]. Policy and regulatory frameworks also play a significant role in the sustainability of mHealth interventions. The presence of government mandates and organizational policies can facilitate integration into national health systems, ensuring long-term impact [27, 29]. Moreover, collaboration among stakeholders including policymakers, healthcare providers, technology developers, and end users is essential for designing and deploying effective mHealth solutions tailored to the specific needs of populations in LMICs [25, 29].

Factors influencing the adoption of mHealth interventions

Several factors influence the uptake and continued use of mHealth interventions. Perceived ease of use and usefulness are primary determinants, as users are more likely to engage with digital health tools if they find them convenient and beneficial [32, 33]. Socio-demographic factors, including education level, income, and age, also impact adoption rates [23]. Studies suggest that interventions considering cultural and contextual factors tend to have higher engagement and effectiveness [34]. Trust in digital health platforms is another critical factor. Users must perceive mHealth tools as secure, confidential, and reliable to engage with them meaningfully [22]. Additionally, financial and non-financial incentives have been found to encourage adoption among both healthcare workers and patients [35].

Theoretical perspective

This study is underpinned by the PNE framework focusing on predisposing factors, need-related factors, and enabling factors (PNE factors) to guide policymakers in implementing, sustaining, and scaling up mobile health interventions for non-communicable disease management in SSA [36] The framework categorizes contextual factors of health service utilization into three key domains:

Predisposing factors

These include demographic characteristics, social norms, and perceptions that influence individuals' willingness to engage with mHealth interventions. Predisposing factors, such as government policies, healthcare provider perceptions, and socio-cultural attitudes, influence adoption, with regulatory gaps and resistance from providers posing challenges [36, 37].

Need-Related factors

These relate to individuals' perceived or actual health service needs that drive engagement with mHealth solutions. Factors such as healthcare access gaps and uninsured populations highlight the demand for mHealth solutions, particularly for chronic disease management and health insurance renewal [2, 27, 36, 38].

Enabling factors

These refer to the availability of resources that facilitate access to mHealth interventions. Existing literature suggests that technological infrastructure, financial sustainability, and stakeholder collaboration, affect scalability, with network coverage, funding, and interoperability being key constraints [36, 37, 39].

Methodology

Study design

This exploratory qualitative study adopted a phenomenological design to explore technical experts' and informal workers' views on implementing and using MRS add-ons to improve NHIS uptake in Ghana. This approach was chosen for its ability to capture detailed insights into participants' experiences, perceptions, and suggestions [40, 41].

The study applied a qualitative approach and collected data through in-depth interviews (IDIs) and focus group discussions (FGDs). In-depth interviews were conducted with technical experts, providing detailed information on individual and organizational factors influencing the implementation and potential use of the add-ons. FGDs were held with informal workers to comprehensively understand their experiences, perceptions, and suggestions regarding the MRS, encourage discussion, and capture diverse perspectives on NHIS add-ons.

Study settings

As part of a broader transdisciplinary research project exploring the potential of mobile phone-based interventions to improve insurance coverage in major African cities, (the ReachUHC project), our study in Ghana was conducted in Kumasi and Accra, two major urban centers selected for their socio-economic diversity and relevance to the NHIS, Kumasi, situated in the Ashanti Region, is Ghana's second-largest city, with a population exceeding

two million residents as of the 2021 census. The metropolis encompasses nine sub-metropolitan districts: Asokwa, Bantama, Kwadaso, Manhyia, Nhyiaeso, Oforikrom, Suame, Subin, and Tafo. As a significant commercial hub, Kumasi offers diverse employment opportunities across formal and informal sectors. The city has key healthcare facilities, notably the Komfo Anokye Teaching Hospital and numerous public and private clinics. Residents benefit from substantial access to electricity, potable water, and mobile network coverage. Twi remains the predominant language spoken in the area [42].

Accra, the capital city of Ghana, is located in the Greater Accra Region and serves as the nation's economic and administrative center. According to the 2021 census, the Accra Metropolitan District spans 20.4 square kilometers and has a population of 284,124 inhabitants. The metropolis is divided into six sub-metropolitan districts: Ablekuma South, Ashiedu Keteke, and Okaikoi South. Accra hosts major healthcare facilities, including the Korle Bu Teaching Hospital. The city enjoys widespread access to electricity, water, and mobile networks; however, certain informal settlements face challenges in service delivery. The predominant languages in Accra reflect its cosmopolitan nature, including Ga, Twi, and English [42].

Study population and sampling

The study population consisted of two groups:

Technical experts

Technical experts were purposively sampled. We chose this sampling method as it is appropriate for identifying and selecting individuals or groups who are especially knowledgeable about or experienced in the subject matter [43]. A list of institutions and experts was retrieved from the NHIA at the project inception meeting organized in March 2022 at the NHIA's headquarters in Accra, Ghana. This includes the Ministry of Finance (MoF), Ministry of Health (MoH), Controller and Accountant General's Department (CAGD), Bank of Ghana (BoG), Telecommunication agencies (MTN Ghana, Vodafone Ghana, and Airtel Tigo), Emergent Payment Ghana Limited (EP-GH), and selected departments/units within the NHIA headquarters. Selected individuals were mainly departmental directors, deputy directors, and unit heads (managers). These technical experts allow the researchers to tap into their expertise in implementing similar interventions. Technical experts with at least six months of relevant experience in their line of work were included, however, those who were unavailable during the study, medically unfit, or unwilling to participate were excluded.

Informal workers

Informal workers were recruited using a mix of purposive and convenience sampling techniques based on their age, gender, availability, and willingness to participate in the study [40, 44]. The communities were purposively selected based on high percentages of informal workers and different ethnic majorities. This was to ensure that diverse opinions and perspectives on the appropriateness of the add-on and factors influencing the implementation and use of proposed add-ons are captured and considered during their development and implementation.

Adults (18–69 years) engaged in informal sector work and residing in Greater Accra or Ashanti Region were included in the study. However, informal workers who are voluntary SSNIT contributors, medically unfit, or unwilling to participate were excluded.

Data collection

Data collection occurred from March to August 2022. IDIs were conducted face-to-face in professional settings where key technical experts operate except for one, which was conducted via Microsoft Teams and lasted between 35 and 60 min. FGDs ranged from 45 to 70 min and were mainly organized in local meeting areas, mosques, churches, and shops across three selected communities in the Kumasi and Accra metropolises. These locations were chosen to enhance accessibility and encourage open discussions in familiar environments.

For IDIs and FGDs, the design and development of the semi-structured interviews were guided by Opoku et al.'s PNE framework [36]. Opoku's framework combines Andersen's Behavioral Model (focusing on predisposing, enabling, and need-based factors) and Davis's Technology Acceptance Model (emphasizing perceived usefulness and ease of use) and offers a comprehensive lens for understanding individual and system-level factors. Their frameworks incorporate contextual and user-centered perspectives, making them a robust guide for examining factors influencing the implementation and use of MRS add-ons [36].

The interview guides were designed to address the following key questions:

1. What are the stakeholders' perceptions of using the NHIS MRS in Ghana?
2. What additional future (add-on(s)) could improve the use of the NHIS MRS in Ghana?
3. What factors could influence the implementation of NHIS MRS add-ons in Ghana?
4. What factors could influence the adoption and use of the NHIS MRS add-ons in Ghana?

The qualitative team agreed to discontinue additional interviews after realizing that the three last interviews,

both from the IDIs and FGDs, did not add any new ideas to the data, meaning data saturation was reached [45]. All interviews were audio recorded using a tape recorder and notebooks for field notetaking.

Data management and analysis

The audio recordings of interviews and FGDs were transcribed verbatim. A trained postgraduate research assistant translated interviews conducted in Twi or Hausa into English during transcription. Two researchers (FI and MAK) validated the transcriptions for accuracy.

Thematic analysis was conducted using ATLAS-ti 22, combining deductive and inductive approaches. Deductive analysis followed the Predisposing factors, Need-related factors, and Enabling factors of the PNE framework, applying predefined codes to identify relevant patterns. Inductive analysis allowed for discovering emerging themes beyond the framework through open coding. The process involved familiarising ourselves with the data, generating and grouping codes and refining themes to reflect participants' views accurately.

Quality assurance

FI and AN prepared the first draft of the interview guide used for data collection. It was jointly reviewed with RW, VS, KAM, DO, EOD, MAK, LN, MS, and WQ. The interview guide was pre-tested in Asokore Mampong municipality with two IDIs and one FGD. Minor adaptations were made after pretesting to ensure clarity. Researchers received training on qualitative data collection methods, including moderation of FGDs and conducting IDIs. FI moderated all discussions and interviews, with AN observing and providing logistical support. After the first FGDs, the interview guide was reviewed based on the participant's response to improve understanding and to capture or include new viewpoint(s). The researchers further used probes to elicit a more complete insight or clarification.

Results

Background of participants

We conducted 13 IDIs with technical experts and 17 FGDs involving 96 informal workers from three selected communities both in Kumasi and Accra metropolises. Table 1 summarises the characteristics of the participants. Among the 13 experts interviewed, only three were females; the mean age was 48 years, and 6 of them were managers in their respective units.

Of the 96 participants in the FGDs, 50 were from the Kumasi metropolis, 53 were males, and they had, on average, four dependent individuals. Of the participants, 86 had ever registered for the NHIS, of which 33 were inactive, and 3 were unsure (active or inactive) of the state of their current insurance status.

Stakeholder views on the use of the MRS

Both informal workers using the MRS and the technical experts in the study perceived two key benefits of the MRS. The first was improved convenience in renewing NHIS membership, subsequently increasing renewal

Table 1 Participants' main characteristics

Technical experts		**(*n* = 13)**	
Age, (in years) mean (range)		48 (40–59)	
Gender			
Male		10	
Female		3	
Years working in the institution, mean (range)		12 (0.8–29)	
Role			
Director		4	
Deputy director		3	
Manager		6	
Informal workers			
Place of residence	**Accra (*n* = 46)**	**Kumasi (*n* = 50)**	**Total (*n* = 96)**
Age, (in years) mean (range)	39.5, (19–68)	39. 4, (18–66)	39.3 (18–68)
Gender			
Male	22	31	53
Female	24	19	43
Number of dependents mean (range)	3.4 (0–30)	4.8 (0–20)	4.1 (0–30)
Insurance status			
Active	24	26	50
Inactive	12	21	33
Unsure (Don't know)	2	1	3
Non - registered	8	2	10

rates. Convenience includes a simpler and more efficient renewal process that is constantly available to individuals. This has enhanced access to renewal by reducing travel costs and waiting time.

> *"Formerly we used to travel long distances and queue at the various registration centres for renewal and new registration. With the introduction of the phone renewal approach, you can sit in the comfort of your home and do it without any stress."* ***(FGD-Anloga)****.*
> *Renewing a NHIS card has been made easy and less expensive. You don't have to travel and pay transportation fares to and from any of the NHIS district offices to have your insurance renewed. You can do it wherever you are without hassle. The NHIA has seen an increase in renewals year in, year out".* ***(IDI-012E)***

While informal workers and technical experts particularly from NHIA agreed that the MRS has improved convenience, the latter group reported an additional benefit: higher satisfaction with daily work due to decreased workload and reduced office congestion.

> *"... unlike before, you found people crowded and struggling to get their cards renewed for them. Now it's easy, you can renew in the comfort of your home. So, there is no congestion in our offices"* ***(IDI-004I)****.*

Add-ons with the potential of enhancing the use of the mobile renewal system

During the discussions, the participants raised many ideas for MRS add-ons to promote NHIS uptake and renewal rates. In addition, the research group asked for participants' opinions on a savings wallet that could facilitate savings for NHIS renewal. These add-on ideas are illustrated in Fig. 1 (below).

Participants from both study sites and representatives of different stakeholder organizations shared insights on these Add-on(s). These include reminders for the expiry date and the need to renew, mobile registration (currently not possible digitally), automatic renewal of NHIS policy, a savings wallet to save and pay your renewal premiums, and a facility locator.

Reminders

Before the introduction of the MRS, NHIS subscribers received physical cards with printed start and expiry dates, which served as convenient reminders for annual renewal. This ensured that individuals were aware of their insurance status and could plan for timely renewal.

However, after implementing the MRS, subscribers no longer receive physical NHIS cards, eliminating the printed expiry date reminder. As a result, it has become more challenging for them to keep track of their insurance status. Now, subscribers must actively check their expiry date by dialing a USSD code and following

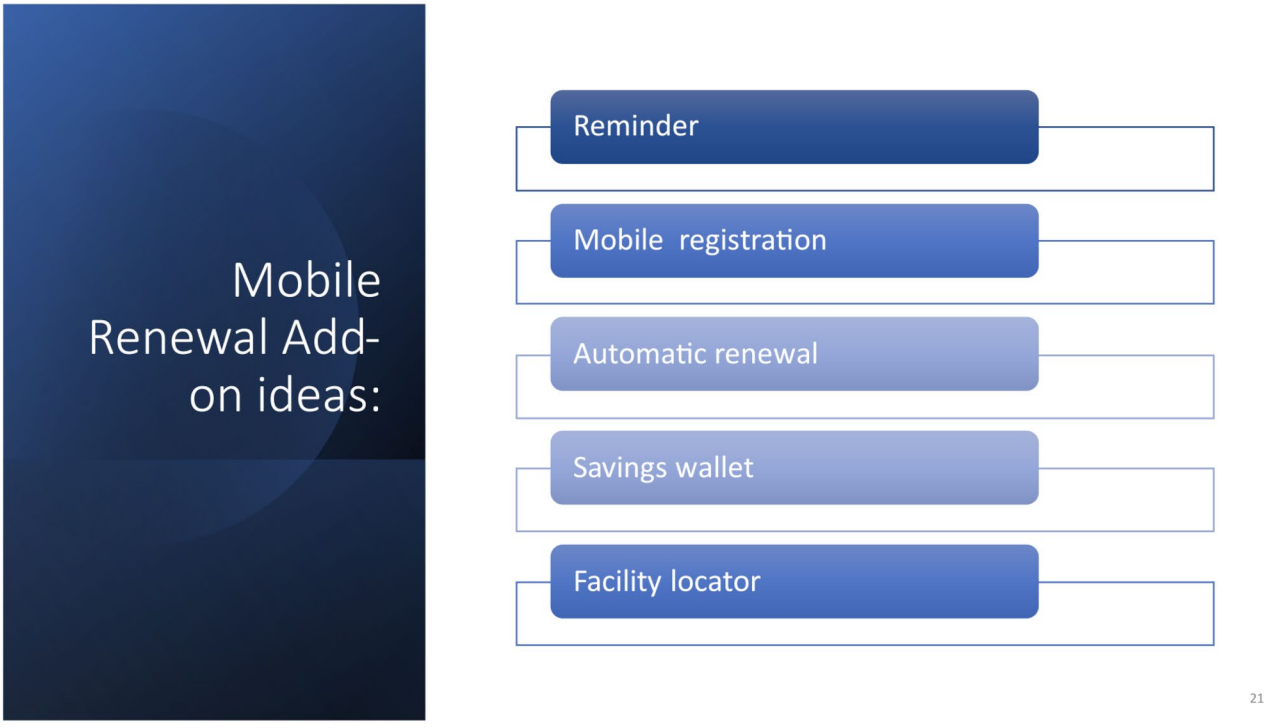

Fig. 1 Mobile renewal add-ons ideas

prompts. In practice, many individuals only realize their insurance has expired when they attempt to access healthcare services.

While the MRS has streamlined the renewal process by making it digital, its lack of a built-in reminder mechanism creates a barrier to timely renewal. This challenge is evident in Kumasi and Accra, where participants emphasized the need for renewal reminders. In Kumasi, participants highlighted how the absence of physical NHIS cards has increased the likelihood of forgetting renewal dates post-MRS implementation.

> *"... the date for the renewal escapes us [subscribers] because it is not available when you use the phone to renew your insurance. (**FGD-Anloga).***

They proposed reminders as a solution to bridge this gap. Similarly, participants in Accra echoed these sentiments, emphasizing the convenience of reminders to ensure timely renewals.

> *"So, they should remind us by sending us a message that by this date our insurance will expire. That can help a lot of us to renew on time. "**(FGD – Nima)**.*

Stakeholder organizations, including NHIS offices, supported this idea, stating that reminders could reduce lapsed memberships and improve renewal rates.

Mobile registration

To become an NHIS member, first-time registrants must visit the NHIA office in person, take a picture, and provide socio-demographic information such as name, date of birth, marital status, phone number, and community of residence.

Technical experts particularly noted the challenges associated with first-time NHIS registrations, as they require physical visits to NHIA offices. Experts proposed that enabling mobile registration through the MRS could simplify the process, increase convenience, and improve accessibility. Respondents in Kumasi and Accra highlighted busy schedules (time) and travel costs for first-time registrants, especially in peri-urban areas, as a challenge and agreed that it could be beneficial.

> *"... you would want people who don't have cards, who have never joined the NHIA. You want them to also have a very easy and convenient way, just like the renewal, to come on as first-time registrants to do the registration on the phone." **(IDI- 005I)**.*

Automatic renewal

Participants who are technologically illiterate or face literacy challenges reported greater difficulties in renewing their NHIS with the MRS independently than those with more digital or literacy skills, making them more reliant on others for renewal.

Technical experts emphasized that an automatic renewal feature would benefit subscribers particularly those with technological or literacy challenges and demanding schedules. They highlighted that linking automatic renewal to mobile money (MoMo) could further reduce human dependencies in the renewal process compared to the current system.

Participants in Kumasi and Accra acknowledged that automatic renewal could improve retention more than the manual approach. Still, they stressed the importance of stronger consent mechanisms and seamless integration with mobile money platforms to minimize the risks of errors or unauthorized transactions.

> *" If you have money in your Momo account, there should be an automatic renewal something that will automatically "kick in", so that will remove the "human factor" and the problem with "I don't know how to do it" will be a thing of the past" **(IDI- 007E)**.*

Savings wallet

The value and benefit of a savings wallet add-on generated mixed opinions across regions and organizations. Participants from Kumasi and Accra expressed limited interest in the savings wallet, noting that NHIS premiums were already affordable, making additional savings mechanisms unnecessary. Technical experts admitted that most subscribers could afford the premiums without the need to save specifically for renewals; however, they were quick to add that a savings wallet could benefit low-income earners by allowing them to accumulate funds gradually.

> *"Our premiums are quite low. People pay as low as 22 cedis. And this is not an amount that I will see people trying to save towards" **(IDI- 001I)**.*
> *"It will be quite a useful intervention, you know we have a category of members who fall within the indigent group and they don't pay anything at all so with them it is understandable but you know there is always a thin line between the indigents and some other who are not. So if implemented, it will be helpful" **(IDI-002I)**.*

NHIS facility locator

Both informal workers and technical experts acknowledged the comparative value of a facility locator add-on to the MRS, with participants highlighting its potential to improve the visibility of NHIS-accredited providers more effectively than the current system.

Technical experts emphasized the need for a tool to better direct subscribers to pharmacies and clinics within their communities, making access to services more immediate. Similarly, participants in Kumasi noted that a locator could enhance the accessibility of NHIS services and more clearly demonstrate the scheme's practical benefits compared to the existing approach.

As the range of accessible providers becomes more visible, the NHIS could be perceived as more useful and comparatively more worthwhile for enrollment than in its current form.

> *"A feature that would direct me to all the NHIS-accredited providers within a radius... of your locality.... like NHIS accredited pharmacies where I can just walk to... and then I'll get the medicine for, for free"* ***(IDI- 0011)****.*

Factors influencing the implementation of the add-ons

Participants mentioned several factors they believed could influence the implementation of the proposed add-ons. These are shown in Fig. 2 (below);

Infrastructure

Participants, mainly the technical experts, believed that the smooth functioning of mobile technology operations relies heavily on a strong and reliable database server to store, process, and transfer information. Implementing an add-on(s) might require expanding the technological infrastructure to accommodate the increased workload due to the introduction of the add-on(s). This improves internet stability and avoids delayed response or feedback on transactions or renewal processes. Participants expressed that upgrades and or expansion of technological infrastructure are key to ensuring a seamless renewal process.

> *"Again, for the implementation stage, do we have the needed resources in place infrastructure-wise, if there is the need to expand, we should do that to avoid interruptions of workflow."* ***(IDI- 008E)****.*

Institutional readiness

Institutional readiness regarding the availability of experts and funding was seen as a critical predisposing factor that could hinder the implementation process.

Availability of expert

The participants highlighted the significance of having information technology (IT) experts who can develop the add-on tool and provide regular maintenance services. These experts could further train the NHIA staff to understand the system's functioning.

> *"Involving IT experts is crucial; their role is crucial in developing and maintaining the intervention. Our guys, I mean the MIS (Management Information*

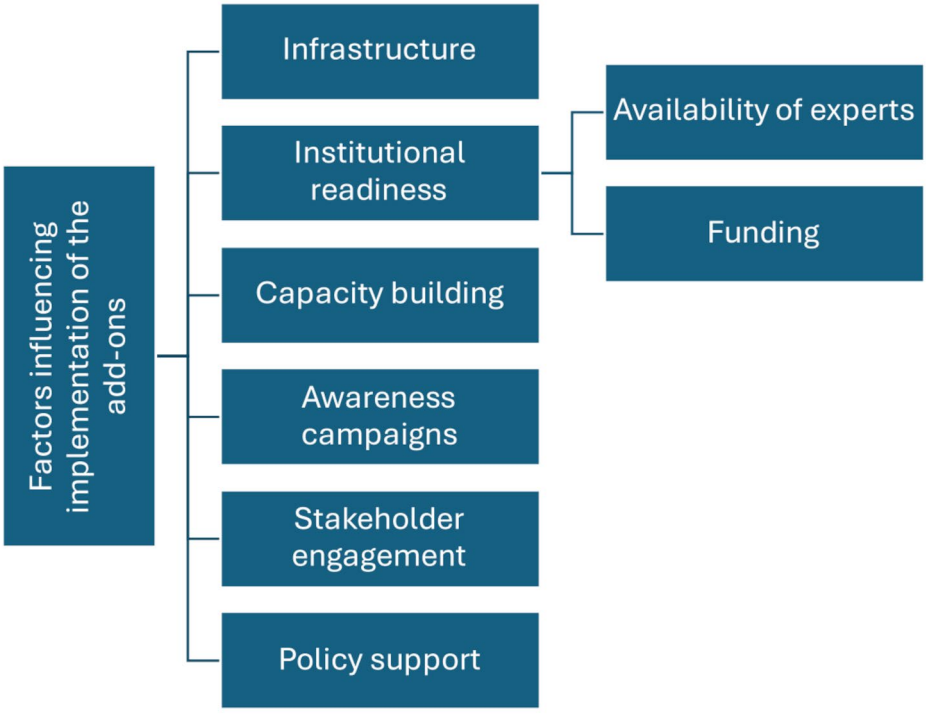

Fig. 2 Thematic framework of factors influencing implementation of Add-ons

Systems) team is good, and I know they can support" ***(IDI-06I)****.*

Funding

The informal workers and the technical experts agreed that allocating enough funds to develop the add-on(s) and further ensure financial stability by including the add-on(s) in the national funding schemes and using long-term contracts is important. Financial security enables long-term planning of all necessary activities, such as meetings and community engagements with technical experts, implementors, and potential users. Moreover, it allows awareness-raising campaigns after deploying the add-ons among end-users. These activities were perceived as costly but as critical milestones necessary to develop successful, appropriate, and acceptable add-on(s).

"... it all depends on who is funding the project [the add-on tool(s) development], and how deep the person's pocket is; if funding is available, I think 80% of the challenges will be solved, the rest is people" ***(IDI-002I)****.*

"Again, working on projects like this requires adequate funding through the entire process. Lack of funds means I mean it can affect the success, of this project like you can not do it halfway. so non-availability of money you know will affect it greatly" ***(IDI007E)****.*

Capacity-building

Participants, especially the technical experts, emphasize the need for capacity-building programs for NHIS staff to improve their technical competence to develop and implement add-ons successfully and, if necessary, resolve technical issues as they arise during and/or after deployment of the add-ons.

"Our staff from the MIS are good, but we should take advantage of this and train our staff well enough for the development of this intervention, they should be part of the team so that later if there are problems which needs an experts attention, our own people will be able to handle them internally" (IDI003I).

Awareness campaigns

Participants agreed that awareness must be created, and potential users must be taught about the MRS's existence, usefulness, and how to use it and the add-on(s). Learning how to renew the NHIS policy may boost an individual's confidence and increase their willingness to use it and any add-on(s).

*"They have to make a lot of noise in terms of awareness about the intervention. They must visit people in their homes and marketplaces to teach them how to use it step by step to help them use the tool"****(IDI013E).***

Stakeholder engagement

Technical experts across various organizations emphasized the need for engagement with broader stakeholders (potential users, telecommunication agencies, policymakers, developmental partners, and implementors) to ensure that an acceptable intervention is developed. This inclusive approach allows those designing interventions to understand the needs of people, identify ways to address them, and ensure that the interventions (solutions) are developed to meet their needs. This could further promote ownership and utilization by potential users.

" It's not just you designing the program. You need to seek the opinion from the users and other relevant institutions for their inputs, then after development test it out to make sure that it is an acceptable product to them" ***(IDI- 002I)****.*

Policy support

Most technical experts deemed obtaining approvals from regulatory bodies for implementing the intervention, particularly the savings wallet, a significant factor. Concerns were raised about a public agency's legal and practical ability to collect and store the NHIS premiums. This could hinder its implementation.

"Collecting money from clients is a source of public funds. Is the money being held by NHIA or where is the money being kept? There should be a policy implication, so maybe a change of, uh, law or something. You can't just go ahead and implement. And the policy should link with maybe, um, financial administrative Act". ***(IDI- 003I)***

Factors influencing the use of add-ons

Participants identified several factors that may influence the use of the MRS add-ons. These factors are depicted in the Fig. 3 (below).

Experience with mobile phones and transactions

Participants generally noted that experience with mobile phone transactions can either facilitate or hinder the use of new interventions, depending on whether the experience was positive or negative. A positive experience, such as having access to a mobile phone and being skilled in its use, may enhance an individual's intention to adopt and use an add-on. Familiarity with other mobile phone

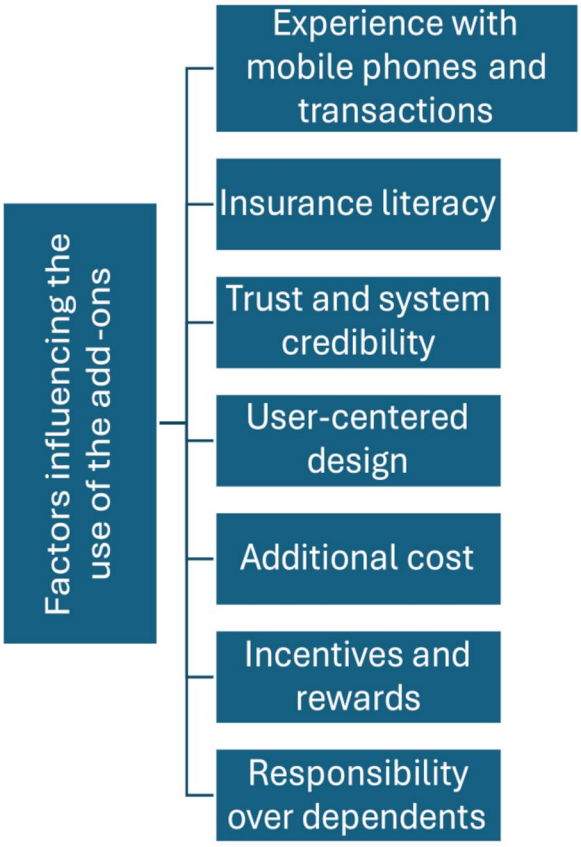

Fig. 3 Thematic framework of factors influencing the use of add-ons

platforms for transactions such as MoMo reduces potential concerns or hesitancy to use the MRS and add-ons.

> *"If I can use my phone for other purposes like sending messages, transferring money from my MoMo account, once I already know how to use the phone, it will help me to use the new intervention" **(IDI-005I)**.*

Likewise, past negative experiences such as having fallen victim to mobile payment fraud, reduced trust in adopting any form of digital payment such as the savings wallet. Trust plays a significant role when it comes to digital payment adoption and use, as expressed by a technical expert:

> *"If you've ever been a victim of mobile money fraud, that alone is enough to prevent you from trusting such initiative [saving wallet]. Experience with fraudsters will deter people from using it" **(IDI-010E).***

Insurance literacy

Technical experts perceived insurance literacy, which includes understanding the role of insurance in spreading the risk of the cost of illness over time and across people, as an important factor that may increase subscribers' willingness to keep their NHIS active and utilize the MRS and add-ons.

> *"... Some people will tell you, 'I don't fall sick', such people will not opt for the insurance, let alone to renew, or use any intervention [mobile tool]. But those who know the benefits of health insurance and understand the concept [of insurance] would use it" **(IDI- 004I)**.*

Trust and system credibility

Participants raised concerns about safeguarding their details and sensitive information, such as names, addresses, financial records, and other private data after subscribing to digital platforms. It was considered important to protect users' information from unauthorized access by scammers, which may result in identity theft and financial fraud. This was particularly relevant for tools that involve engaging in digital transactions, such as online purchases, banking, MoMo transactions, or any electronic interactions involving sensitive information exchange.

Participants reported that clear and transparent communication regarding how their data is collected, processed, stored, and shared by mobile transaction apps, companies, and the government may enhance users' likelihood of adopting and utilizing digital platforms. Participants emphasized the importance of being informed about mobile insurance renewals and savings transactions. Receiving information from NHIA felt empowering, giving participants control over their personal information and savings. Transparent communication and documentation were important to increase users' trust and confidence in using the MRS and could influence the adoption of the add-ons.

> *"Give them [users] receipts through text messages that 'you have this amount in there'. This may help people to decide to use it if they believe that there is no "kuululu" [fraudulent activities] anywhere". **(IDI-004I)***
>
> *"They should put more security in such a way that no one can use either your insurance card number or any information from the insurance card to withdraw your money or use your money". **(FGD -Moshie Zongo)***

User-centered design

Participants reported difficulties when attempting to complete the renewal procedure on their own, including the inability to read and understand the instructions and not being acquainted with using mobile phones. Therefore, the MRS and add-ons should be user-friendly and simple for those not experienced with mobile phones.

The idea of changing it into a smartphone app to enrich the user experience was welcomed. Still, participants quickly suggested that developers should maintain the USSD form of the existing MRS, which works on all kinds of phones, including non-smartphones [yam phones], and upgrade it with additional functionalities to make it simple and easy for subscribers to use. Arguments considered that this ensures that the MRS is not restricted to only a few with smartphones and access to an internet connection.

> *"What this brings to mind is internet issues, the development should be done for everybody to be able to use. Meaning it can be done as an App requiring the internet and smartphones. We should also consider the other group of people in rural areas with poor internet connectivity and probably have a "Yam phone" [non-smart phone]. So, we should not restrict it, it should be usable on both USSD and App." **(IDI- 008E).***
>
> *"The system should be simple and easier for people to follow. Should be concise and easy for everyone whether you are well-educated or not, so that you can do it yourself". **(FGD- Nima)***

Additional cost

Currently, using the MRS to renew an NHIS membership requires that the premium needs be paid digitally through the MoMo account. The introduction of electronic transaction user fees (e-levy) could negatively affect mobile payment utilization due to perceived additional charges on use. This could hinder the acceptance and utilization of mobile payment services, affecting the use of the MRS and the savings wallet.

> *"Right now, what will prevent me from using the savings wallet is the charging system on it. I am referring to the recent e-levy charges imposed on our digital transactions" (**FGD- Korle Gonno**).*

Incentives and rewards

Participants, mostly the informal workers, recommended offering incentives, such as discounted renewal fees or loyalty rewards, as a means of promoting consistent use of the add-ons

> *Giving us a discount for group renewal will be good. Let me give you an example, if I have 10 children and I want to renew each child's insurance, they should create a system where the head of the family should be given a discount. That will encourage us. **(FGD-Moshie Zongo).***

Responsibility over dependents

Participants who were responsible for others, such as family members – children, spouses or parents, or other acquaintances – reported that financial responsibility and health status increased the awareness and willingness to lower financial risks associated with the costs of illness. That included taking low-risk or prudent decisions and safeguarding the financial protection of their dependents' needs and risks, including healthcare. A dedicated savings wallet or account potentially relieves the economic burden of the family head and/or guardians since it allows incremental savings toward NHIS renewal, as expressed by the participants below.

> *" I cater for four people, and they all have health insurance, and they all must renew at the end of the year. And it will be a huge amount and I may find it difficult to just pay it outright. Then if the savings are there it can help me to just pay"**(FGD - Korle Gonno)**.*

Discussion

This study benefited from methodological triangulation, combining in-depth interviews and focus group discussions, which enhanced the credibility of the findings. This is the first study to apply qualitative research methods to explore the perspectives of target groups (technical experts and informal workers) regarding the factors influencing the use of MRS and potential add-ons, including ideas and thoughts that researchers could not anticipate [2, 46].

Our findings provide valuable insights: Technical experts and informal workers perceived the MRS as useful and efficient. They further agreed that the introduction of add-ons could make NHIS membership more accessible and convenient, suggesting possible features that could achieve this goal. In general, technical experts' responses centered on what is needed to successfully develop and implement the add-ons, likely due to their roles and years of experience in their work. Technical experts considered the need for the MRS and add-ons as a given, while informal workers reflected on their own needs regarding these tools and the NHIS. Informal workers focused on the safety and convenience of the add-ons at no additional cost to users. Security safeguarding their personal information and money was also highlighted as crucial for adopting mobile phone

technologies, as it potentially strengthens users' trust, confidence, and satisfaction with the digital tool.

Perceived benefits of MRS

Our findings suggest that technical experts and users experienced improvements in the renewal process due to the MRS. This result is consistent with studies that have emphasized the benefits of mobile technology in overcoming barriers to health insurance coverage in LMICs [2, 22, 47]. Our study participants reported reduced renewal-related expenses, time, congestion, and workload at NHIS district offices, which are in line with findings from studies conducted in Malaysia [48] and Kenya [17]. It is, therefore, likely that new add-ons could potentially reduce barriers for users which prevent timely renewal.

Enhancing the MRS through Add-ons

Numerous studies have shown the benefits of using technology in general, particularly mobile phone technology, to promote the timely utilization of healthcare services in LMICs. For example, sending reminders improves patients' adherence to healthcare service schedules (vaccination, review appointments) and medication [49, 50]. Our findings support that introducing a reminder system to renew insurance may also effectively promote timely renewals of NHIS membership in Ghana. These findings are aligned with research that highlights the importance of mobile technology in reducing administrative burdens and simplifying the insurance renewal process for users [11]. The suggestion of incorporating a dedicated savings wallet as an add-on to encourage planning and saving for insurance renewals is supported by evidence that shows that access to mobile money accounts could facilitate health insurance uptake among self-employed individuals [3, 17]. Our participants mentioned that having a savings wallet add-on could help particularly vulnerable populations gradually save money towards insurance renewals for themselves and/or other dependents. Such a feature may be more important for other countries where premiums are higher and less affordable than in Ghana [51].

Although not directly linked to the study's main objective, the proposal for an NHIS facility locator add-on has the potential to improve access to healthcare services [52]. The newly identified add-ons might be relevant for other countries, especially LMICs with similar health insurance systems, to further simplify their enrollment and re-enrollment processes and improve the uptake of health insurance and access to healthcare. It is worth noting that the NHIA, through the MyNHIS app, has indeed introduced mobile registration and the facility locator, further enriching the user experience.

The theoretical perspective adopted in this study emphasizes three key domains: Predisposing Factors, Need-Related Factors, and Enabling Factors. Our findings align with these domains in the following ways:

Predisposing factors

Involving key stakeholders such as implementation agencies, policymakers, developers, and potential users can enhance the relevance and usability of the add-ons. This aligns with studies emphasizing the importance of stakeholder engagement in digital health implementation [22, 53–56]. Additionally, users' confidence in mobile health solutions is influenced by their experiences and positive interactions encourage adoption, while negative experiences foster distrust [57, 58]. Therefore, ensuring reliability, security, and ease of use is critical for successfully implementing mobile-based health solutions.

Need-related factors

The effectiveness of mobile health interventions depends on user-centric design, awareness campaigns, and technical support. Previous research highlights that ease of use and education significantly impact the adoption of digital tools [55, 56, 59, 60]. Simple add-ons such as reminders, automatic renewal, mobile registration, savings wallet, and facility locator are more likely to be widely adopted, particularly by individuals with limited technological literacy. Additionally, the discussion of the potential negative impact of the additional costs resulting from e-levy on potential users' adoption of the add-ons is consistent with previous findings indicating perceived additional charges on mobile payment transactions as a deterrent to customers' adoption of a digital tool [61]. It is important to note that there is a misconception or misunderstanding of the e-levy policy among participants. Available documents from the Ghana Revenue Authority (GRA) website indicate that transactions on governmental platforms are exempted from e-levy [62]. Misconceptions about such policies highlight the need for targeted awareness campaigns to educate potential users on cost implications and the benefits of maintaining NHIS membership.

Enabling factors

Adequate infrastructure and sustainable funding are key enablers for implementing and maintaining mobile health solutions. Our findings reinforce existing literature identifying financial constraints as a major challenge to digital health interventions [56, 63]. To address this, collaboration between governments, international organizations, and the private sector is crucial for long-term sustainability. Additionally, following the WHO's recommended data protection and security policies [22] is essential for fostering trust and ensuring compliance with regulatory requirements [22, 37, 48, 57, 64]. Strengthening Ghana's data protection regulations can further

support the implementation of mobile-based NHIS add-ons while ensuring user privacy and security.

Conclusion

Using a qualitative approach, we explored technical experts' and informal workers' perspectives on implementing and using mobile renewal system (MRS) add-ons to improve NHIS uptake in Ghana. We concluded that experience with mobile phones, user-centered design, insurance literacy, and trust in the NHIS system shaped stakeholders' views on using the proposed add-ons. Institutional readiness in terms of availability of experts and funding, capacity building and awareness campaigns influenced implementation feasibility. Factors like incentives, rewards, and responsibility for dependents facilitated adoption, while additional cost and policy support may pose challenges.

Implications for policy and practice

The successful implementation of MRS add-ons for NHIS renewal requires addressing key policy and practice considerations. Strengthening trust and system credibility through transparent communication and data security measures is essential for adoption. User-centered design - simplified interfaces can improve usability and inclusivity. Additionally, incentives and rewards may encourage uptake, while stakeholder engagement is crucial for needs assessment, development, and implementation. These insights can inform policymakers, developers, and program implementers in designing and implementing MRS add-ons to improve NHIS uptake.

Beyond Ghana, LMICs can learn from Ghana's example of using technologies to encourage the adoption and renewal of health insurance. Qualitative studies like this one may help identify facilitators and barriers to applying digital solutions for public health insurance coverage in other countries and support the implementation of policies and strategies tailored to these countries' unique circumstances and needs.

Limitations, and future research

This study has some limitations that should be considered when interpreting the findings. Despite these limitations, the study provides essential insights into add-ons with the potential of improving Ghana's NHIS uptake. It further provides a guide to the design and its implementation. First, the scope of this study was limited to the selected communities in Kumasi and Accra metropolis. As a result, the findings described may not represent the perspectives of the entire society as they are rather indicative, and potentially, further factors may influence the use of mobile technology for insurance renewal or uptake. Since qualitative studies do not seek representativeness, quantitative research could complement our findings by quantifying the importance of each facilitator or barrier found here, among a representative sample of the population to assess the prevalence of each theme and category.

Second, translation difficulties and cultural sensitivity might have influenced some of the participants' responses from the Ga-speaking communities since the interviewer did not share a common language or culture with those interviewed. Yet, the research group was supported by translators to mitigate this limitation. Third, ex-ante opinions and perspectives might change after the implementation of the add-ons. It would be interesting to conduct a longitudinal study to examine the lasting impact of the MRS and the add-ons and track changes in attitudes, adoption rates, and usage patterns over time providing insights into the sustainability and effectiveness of these interventions. Finally, other population groups like formal workers, may be facing different challenges. Since this group was out of the scope of the current work, they could be analyzed as part of a follow-up study.

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Author contributions

All authors have contributed to the following: Study design: FI, AN, LN, DO, EOD, WQ, RW, VS, and KAM; data analysis: FI, RW, VS, KAM, AN; manuscript preparation: FI, RW, VS; and critical review of the manuscript: FI, RW, VS, AN, MAK, MS, LN, DO, WQ, and KAM. All authors approved the final manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

Ethical approval for this study was obtained from the Committee on Human Research Publication and Ethics of the Kwame Nkrumah University of Science and Technology (Ref: CHRPE/ AP/272/24). We ensured privacy and anonymity throughout the study by not collecting or using participant's names, titles, or contact information for analysis. All participants were informed of the study's aims, benefits, and potential risks before they voluntarily agreed to participate, following the Declaration of Helsinki. Consent to participation was captured through written or fingerprint-based signatures. The data obtained from the participants was securely stored on a password-protected laptop.

Consent for publication

Not applicable.

Competing interests
The authors declare no competing interests.

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References

1. Lagomarsino G, Garabrant A, Adyas A, Muga R, Otoo N. Moving towards universal health coverage: health insurance reforms in nine developing countries in Africa and Asia. Lancet. 2012;380(9845):933–43. 1.
2. Nsiah-Boateng E, Musah M, Akuamoah CD, Asenso-Boadi F, Andoh-Adjei FX, Boye BO. Effect of mobile phone-based health insurance contribution payment system on retention of coverage in the National health insurance scheme in Ghana: an evaluation study. BMC Health Serv Res. 2023;23(1):239.
3. Obadha M, Colbourn T, Seal A. Mobile money use and social health insurance enrolment among rural dwellers outside the formal employment sector: evidence from Kenya. Int J Health Plann Manag. 2020;35(1):e66–80.
4. World Bank. Universal Health Coverage Study Series (UNICO). Available from: https://www.worldbank.org/en/topic/health/publication/universal-health-coverage-study-series
5. Anjomshoa M, Akbari Sari A, Takian A. Assessing progress in the National health financing system towards universal health coverage in Iran: a mixed-method study protocol. Health Res Policy Syst. 2021;19:1–8.
6. Singh K, Osei-Akoto I, Otchere F, Sodzi-Tettey S, Barrington C, Huang C, Fordham C, Speizer I. Ghana's National health insurance scheme and maternal and child health: a mixed methods study. BMC Health Serv Res. 2015;15:1–3.
7. Alhassan RK, Nketiah-Amponsah E, Arhinful DK. A review of the National health insurance scheme in Ghana: what are the sustainability threats and prospects? PLoS ONE. 2016;11(11):e0165151.
8. Domapielle MK. Adopting localized health financing models for universal health coverage in low and middle-income countries: lessons from the National health insurance scheme in Ghana. Heliyon. 2021;7(6).
9. Meessen B. The role of digital strategies in financing health care for universal health coverage in low-and middle-income countries. Global Health: Sci Pract. 2018;6(Supplement 1):S29–40.
10. Waddington CJ, Enyimayew KA. A price to pay: the impact of user charges in Ashanti-Akim district, Ghana. Int J Health Plann Manag. 1989;4(1):17–47.
11. Boaheng JM, Amporfu E, Ansong D, Osei-Fosu AK. Determinants of paying National health insurance premium with mobile phone in Ghana: a cross-sectional prospective study. Int J Equity Health. 2019;18:1–9.
12. Amporfu E. Equity of the premium of the Ghanaian National health insurance scheme and the implications for achieving universal coverage. Int J Equity Health. 2013;12:1–9.
13. Andoh-Adjei FX, van der Wal R, Nsiah-Boateng E, Asante FA, van der Velden K, Spaan E. Does a provider payment method affect membership retention in a health insurance scheme? A mixed method study of Ghana's capitation payment for primary care. BMC Health Serv Res. 2018;18:1–1.
14. NHIA clarifies issues raised. by a ranking member of the parliamentary select committee on health. [Internet]. [cited 2024 Apr 17]. Available from: https://www.nhis.gov.gh/News/nhia-clarifies-issues-raised-by-the-ranking-member-on-the-parliamentary-select-committee-on-health-5391
15. Vilcu I, Probst L, Dorjsuren B, Mathauer I. Subsidized health insurance coverage of people in the informal sector and vulnerable population groups: trends in institutional design in Asia. Int J Equity Health. 2016;15:1–29.
16. Koto PS. An empirical analysis of the informal sector in Ghana. J Developing Areas 2015 Apr 1:93–108.
17. Kirika LK. Role of mobile money transfer on the rate of premium remittance of health insurance from Self-Employed Nhif members in Kenya: A case study of Nhif Meru branch. Eur J Social Sci Stud. 2018 May 26.
18. Hallidu M, Sumaila I. Determinants of nonrenewal of National health insurance (NHI) membership cards among healthcare workers in the Kintampo North municipality, Bono East Region of Ghana.
19. Akazili J, Chatio S, Ataguba JE, Agorinya I, Kanmiki EW, Sankoh O, Oduro A. Informal workers' access to health care services: findings from a qualitative study in the Kassena-Nankana districts of Northern Ghana. BMC Int Health Hum Rights. 2018;18:1–9.
20. Baah-Boateng W, Vanek J. Informal workers in Ghana: A statistical snapshot. WIEGO Stat Brief No. 2020;21.
21. NHIS active membership ranking Female category tops. [Internet]. [cited 2024 Mar 18]. Available from: https://www.nhis.gov.gh/News/nhis-active-membership-ranking-female-category-tops-5283
22. World Health Organization. Digital technologies for health financing: what are the benefits and risks for UHC? Some initial reflections, Geneva: World Health Organization. 2021 [cited 2024 Apr 17]. Available from: https://www.who.int/publications-detail-redirect/9789240031005
23. Kabongo EM, Mukumbang FC, Delobelle P, Nicol E. Explaining the impact of mHealth on maternal and child health care in low-and middle-income countries: a realist synthesis. BMC Pregnancy Childbirth. 2021;21:1–3.
24. Knop MR, Nagashima-Hayashi M, Lin R, Saing CH, Ung M, Oy S, Yam EL, Zahari M, Yi S. Impact of mHealth interventions on maternal, newborn, and child health from conception to 24 months postpartum in low-and middle-income countries: a systematic review. BMC Med. 2024;22(1):196.
25. Mehl G, Labrique A. Prioritizing integrated mHealth strategies for universal health coverage. Science. 2014;345(6202):1284–7.
26. Chandrasekar A, Warren E, Free C, Mbogua J, Curtin E, Gazeley U, Wong G, Church K, McCarthy O. mHealth interventions for postpartum family planning in LMICs: A realist review. PLOS Global Public Health. 2024;4(7):e0003432.
27. Agarwal S, Perry HB, Long LA, Labrique AB. Evidence on feasibility and effective use of mH health strategies by frontline health workers in developing countries: systematic review. Tropical Med Int Health. 2015;20(8):1003–14.
28. Leonard E, de Kock I, Bam W. Barriers and facilitators to implementing evidence-based health innovations in low-and middle-income countries: a systematic literature review. Eval Program Plan. 2020;82:101832.
29. van Olmen J. Implementation barriers for mHealth for non-communicable diseases prevention and management in low and middle-income countries: a survey among implementers.
30. Chib A, van Velthoven MH, Car J. mHealth adoption in low-resource environments: a review of the use of mobile healthcare in developing countries. J Health Communication. 2015;20(1):4–34.
31. Free C, Phillips G, Watson L, Galli L, Felix L, Edwards P, Patel V, Haines A. The effectiveness of mobile-health technologies to improve health care service delivery processes: a systematic review and meta-analysis. PLoS Med. 2013;10(1):e1001363.
32. Davis FD, Perceived, Usefulness. Perceived Ease of Use, and User Acceptance of Information Technology. MIS quarterly. 1989.
33. Venkatesh V, Morris MG, Davis GB, Davis FD. User acceptance of information technology: toward a unified view. MIS Q. 2003 Sep;1:425–78.
34. Sondaal SF, Browne JL, Amoakoh-Coleman M, Borgstein A, Miltenburg AS, Verwijs M, Klipstein-Grobusch K. Assessing the effect of mHealth interventions in improving maternal and neonatal care in low-and middle-income countries: a systematic review. PLoS ONE. 2016;11(5):e0154664.
35. Muller N, McMahon SA, De Neve JW, Funke A, Bärnighausen T, Rajemison EN, Lacroze E, Emmrich JV, Knauss S. Facilitators and barriers to the implementation of a mobile health wallet for pregnancy-related health care: A qualitative study of stakeholders' perceptions in Madagascar. PLoS ONE. 2020;15(1):e0228017.
36. Opoku D, Stephani V, Quentin W. A realist review of mobile phone-based health interventions for non-communicable disease management in sub-Saharan Africa. BMC Med. 2017;15:1–2.
37. O'Brien N, Li E, Chaibva CN, Gomez Bravo R, Kovacevic L, Kwame Ayisi-Boateng N, Lounsbury O, Nwabufo NF, Senkyire EK, Serafini A, Surafel Abay E. Strengths, weaknesses, opportunities, and threats analysis of the use of digital health technologies in primary health care in the Sub-Saharan African region: qualitative study. J Med Internet Res. 2023;25:e45224.
38. Stephani V, Opoku D, Otupiri E. Determining the potential of mobile phone-based health interventions in Kumasi, Ghana. Ghana Med J. 2020;54(2):88–92.

39. Gyamfi A, Mensah KA, Oduro G, Donkor P, Mock CN. Barriers and facilitators to electronic medical records usage in the emergency center at Komfo Anokye teaching hospital, Kumasi-Ghana. Afr J Emerg Med. 2017;7(4):177–82.
40. Creswell JW. Qualitative inquiry and research design: choosing among five traditions. SAGE; 2007.
41. Van Manen M. Researching lived experience: human science for an action sensitive pedagogy. Routledge; 2016 Jun. p. 16.
42. Ghana GS. Population and housing census: population of regions and districts. Ghana Statistical Service; 2021.
43. Emmel N. Sampling and choosing cases in qualitative research: A realist approach.
44. Silverman D. Doing qualitative research.
45. Guest G, Bunce A, Johnson L. How many interviews are enough? An experiment with data saturation and variability. Field Methods. 2006;18(1):59–82.
46. Akweongo P, Gadeka DD, Aryeetey G, Sumboh J, Aheto JM, Aikins M. Does mobile renewal make health insurance more responsive to clients? A case study of the National health insurance scheme in Ghana. BMJ Global Health. 2023;7(Suppl 6):e011440.
47. Rosenlund M, Kinnunen UM, Saranto K. The use of digital health services among patients and citizens living at home: a scoping review. J Med Internet Res. 2023;25:e44711.
48. Moghavvemi S, Mei TX, Phoong SW, Phoong SY. Drivers and barriers of mobile payment adoption: Malaysian merchants' perspective. J Retailing Consumer Serv. 2021;59:102364.
49. Eze P, Lawani LO, Acharya Y. Short message service (SMS) reminders for childhood immunization in low-income and middle-income countries: a systematic review and meta-analysis. BMJ Global Health. 2021;6(7):e005035.
50. Gurol-Urganci I, de Jongh T, Vodopivec-Jamsek V, Atun R, Car J. Mobile phone messaging reminders for attendance at healthcare appointments. Cochrane Database Syst Reviews. 2013(12).
51. NHIF Kenya. registration requirements, rates, forms, benefits, and contacts - Tuko.co.ke [Internet]. [cited 2024 Feb 14]. Available from: https://www.tuko.co.ke/268902-national-hospital-insurance-fund-nhif-kenya-registration-rates-card-forms-benefits-contacts.html
52. Shidhaye R. Global priorities for improving access to mental health services for adolescents in the post-pandemic world. Curr Opin Psychol 2023 Jul 13:101661.
53. Bua J, Paina L, Kiracho EE. Lessons learnt during the process of setup and implementation of the voucher scheme in Eastern Uganda: a mixed methods study. Implement Sci. 2015;10:1–8.
54. Ross J, Stevenson F, Dack C, Pal K, May C, Michie S, Barnard M, Murray E. Developing an implementation strategy for a digital health intervention: an example in routine healthcare. BMC Health Serv Res. 2018;18:1–3.
55. Okuzu O, Malaga R, Okereafor K, Amos U, Dosunmu A, Oyeneyin A, Adeoye V, Sambo MN, Ebenso B. Role of digital health insurance management systems in scaling health insurance coverage in low-and Middle-Income countries: A case study from Nigeria. Front Digit Health. 2022;4:1008458.
56. Acquah-Gyan E, Acheampong PR, Mohammed A, Adjei TK, Agyapong E, Twumasi-Ankrah S, Sylverken A, Owusu M, Owusu-Dabo E. User experiences of a mobile phone-based health information and surveillance system (mHISS): A case of caregivers of children under-five in rural communities in Ghana. PLoS ONE. 2022;17(1):e0261806.
57. Zhou L, Bao J, Watzlaf V, Parmanto B. Barriers to and facilitators of the use of mobile health apps from a security perspective: mixed-methods study. JMIR mHealth uHealth. 2019;7(4):e11223.
58. Kelly AE, Palaniappan S. Using a technology acceptance model to determine factors influencing continued usage of mobile money service transactions in Ghana. J Innov Entrepreneurship. 2023;12(1):34.
59. Abebe F, Lessa L. Factors affecting mobile payment adoption by merchants in Ethiopia.
60. Gichuki CN, Mulu-Mutuku M. Determinants of awareness and adoption of mobile money technologies: evidence from women micro-entrepreneurs in Kenya. In Women's Studies International Forum 2018 Mar 1 (Vol. 67, pp. 18–22). Pergamon.
61. Petrova K, Wang B. Retailer adoption of mobile payment: A qualitative study. J Electron Commer Organ (JECO). 2013;11(4):70–89.
62. Ghana Revenue Authority (GRA). Electronic Transfer Levy. [Internet]. [cited 2024 Mar 8]. Available from: https://gra.gov.gh/e-levy/
63. Ezezika O, Gong J, Abdirahman H, Sellen D. Barriers and facilitators to the implementation of large-scale nutrition interventions in Africa: a scoping review. Global Implement Res Appl. 2021;1:38–52.
64. Wang Y, Wu T, Chen Z. Active usage of mobile health applications: Cross-sectional study. J Med Internet Res. 2021;23(12).

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