



# Reporta Health: a mobile social innovation for crowdsourcing data on illegal health facilities in Nigeria

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## INTRODUCTION

The WHO advocates for countries to develop Master Facility Lists (MFL) to provide authoritative lists of legal health facilities in each country.<sup>1</sup> Nigeria has developed its MFL and established a Health Facility Registry (HFR) to actively manage this list.<sup>2–4</sup> Despite this effort, there are still several unregistered or illegally operating health facilities across the country.

Between January and June 2019, not fewer than four state governments identified and shut several illegally operating health facilities within their territories.<sup>5–8</sup>

The problem of illegal health facilities remains a pressing issue due to their relatively large number and limited resources to track them. Only 13.4% (2565 out of 20 642) of the patent and proprietary medicine vendor shops surveyed in an earlier study were registered with the regulatory agency.<sup>9</sup> The risks are that many of these illegal health facilities may be providing suboptimal services to their clients such as inappropriate use of antibiotics, abuse of drugs and suboptimal quality of care.<sup>10–12</sup>

Nigeria is a vast country with limited human and financial resources to police for illegal health facilities. Providing an opportunity for the general population to report unregistered health facilities around them could help in prompt detection of these illegal health facilities. When the public are also able to verify duly registered health facilities, they are more likely to access services there. However, engaging the public to report illegal health facilities has been fraught with challenges. The current practice by a regulator requires complainants to

## WHAT ARE THE NEW FINDINGS?

- ⇒ Master facility lists/health facility registries recommended for countries to have by the WHO can be extended to mobile apps to provide location-based services to citizens on health facilities.
- ⇒ Innovative health facility mobile apps can facilitate crowdsourcing of data on illegal health facilities which are difficult to gather in low-income and middle-income countries as proposed in Nigeria.

## HOW MIGHT IT IMPACT ON HEALTHCARE IN THE FUTURE?

- ⇒ Crowdsourced data can reduce administrative costs associated with the identification of illegally operating health facilities thereby improving efficiency.
- ⇒ Publicly available rating of health facilities through the app can influence citizens on which facility to choose for their care and thus force health facilities to improve on quality of care including services that improve client satisfaction.

visit the regulator (situated in the state capital) and complete a form. In doing so, the complainant must provide his or her name and contact information. A senior regulatory officer recounted (during an engagement session) that moles within the regulator often reveal to proprietors of illegal health facilities how they obtained information on their health facilities, leaving the member of the public who volunteered such information at risk of being targeted. Thus, the need to protect whistle-blowers calls for innovative approaches and a policy shift.

Social innovations leveraging mobile phones provide an opportunity to crowd-source and anonymise reporting of illegal

health facilities. To this end, we developed a crowdsourcing mobile app—Reporta Health—to serve this purpose. This paper describes the app and discusses its potential benefits.

## METHODS

We applied the informatics stack framework (ISF) developed by Harold P. Lehmann to describe this social innovation: its vision, components and development.<sup>13</sup> ISF is a heuristic framework that organises informatics concepts in nine stacks of overlapping layers (see online supplemental material) that embodies a systems' thinking approach aimed at translating between perspectives of stakeholders and technical committees.<sup>13</sup> This stack has been previously applied for the same purpose.<sup>14</sup> We also used the social innovation checklist consisting of 17-line items to ensure that this social innovation (Reporta Health) met the needs of a social innovation.<sup>15</sup>

## RESULTS

The Reporta Health components are presented according to the nine layers of the ISF.<sup>16</sup>

### The world

Nigeria is a Federation of 36 states and the Federal Capital Territory. There are three tiers of governance in the country: Federal, State and Local Government. The three tiers have concurrent responsibilities for the health system which are not clearly delineated.<sup>17</sup> The Federal Ministry of Health (FMOH) championed the development of the HFR.<sup>18</sup> The HFR embeds processes for registering, updating and deleting records of health facilities.<sup>19</sup> Reporta Health extends the vision of the FMOH by improving the availability of information on registered health facilities and the services they offer to the general population.

### Organisations

Regulation of health facilities in the country is the responsibility of the 36 State Ministries of Health, the health department in the Federal Capital Territory and a few national regulatory organisations. These regulatory institutions maintain the list of registered health facilities and expected to update the data in the HFR. The HFR provides information on the distribution of health facilities across states and local governments which is an important factor that shows equity in access to healthcare services.<sup>20</sup> Regulatory institutions are important to the success of the Reporta Health app. They are to be fed the data on suspected illegal health facilities identified, are expected to investigate any report submitted, determine status of the facility, take appropriate action based on the finding of the investigation which can include shutting down erring facilities and provide feedback on the findings of their investigation which is made public. Viable Knowledge Masters (VKM) is a private research and consulting

organisation that developed the Reporta Health mobile app. The organisation developed the first iteration of the HFR in the country and saw an opportunity to extend the services that the HFR can provide through a mobile app and has developed this app to address this opportunity. The project was financed internally by the organisation and its sister non-profit, Viable Helpers Development Organisation.

### Perspective/role

Perspectives on Reporta Health were from members of the public interested in finding well rated health facilities in their neighbourhood and whistle-blowers interested in reporting suspected illegal health facilities to the authorities. Members of the public who are interested in finding health facilities where they can routinely obtain healthcare services or in emergency situations, access nearby healthcare facilities may use Reporta Health to fulfil their goal. In addition, members of the public who are suspicious of the legal status of health facilities may also use the app to transmit their concerns to the regulators. Regulatory officers who have the responsibility to identify, investigate and determine the legal status of health facilities will also be interested in the data reported into Reporta Health by citizens. Perspectives from various users (reporters/citizens and regulators) were collected in iterative sessions where design was carried out and the app represented to the same and sometimes new potential users for their input.

### Goals/function

Goal 1: identify nearby legally registered health facilities

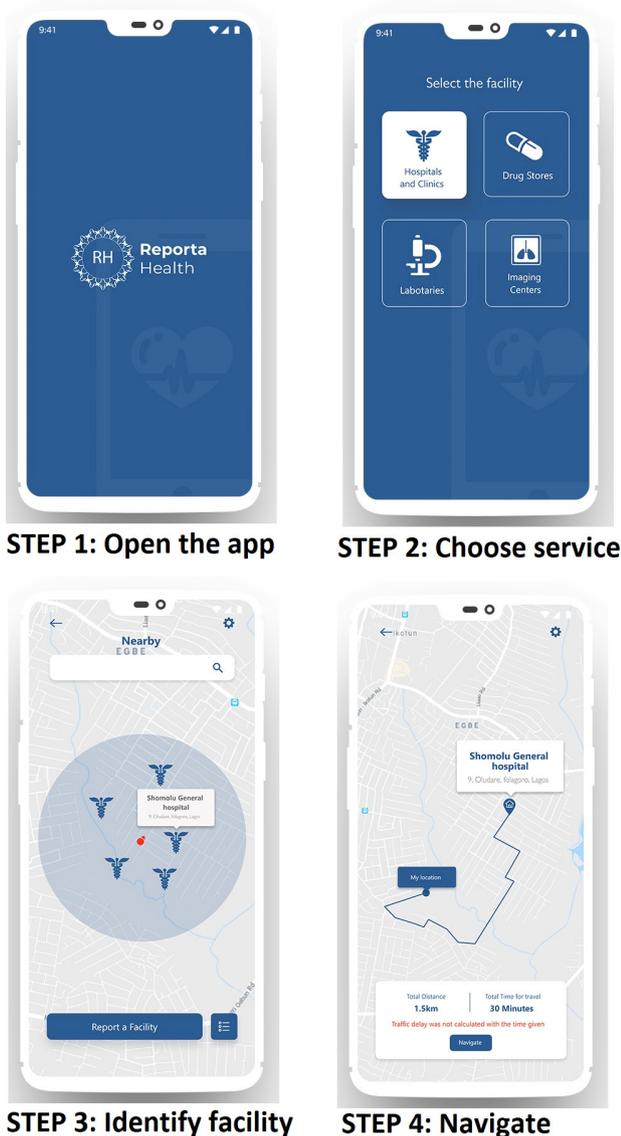
Accessing a list of registered health facilities across the country was previously a challenge. However, the development of an HFR has improved the availability of basic data on health facilities to the public.<sup>21</sup> The HFR is a web app and does not provide location-based services such as nearby health facilities to users. The Reporta Health mobile app on the other hand, addresses this gap and can retrieve the current location of a user, act on this information and provide response to the user based on current location.

Goal 2: rate and provide feedback on registered health facilities

Ratings of health providers can be an important precursor to health facility selection. Reporta Health provides an opportunity for users to rate health facilities using a 5-star rating system and submit feedback on the services and experiences at health facilities.

Goal 3: report suspected illegal health facility

Identifying illegal health facilities in a vast country can be a challenge. Reporta Health provides an opportunity to crowdsource data on illegal health facilities by enabling users to report anonymously, health facilities that are not listed on the app database.



**Figure 1** Navigating Reporta Health.

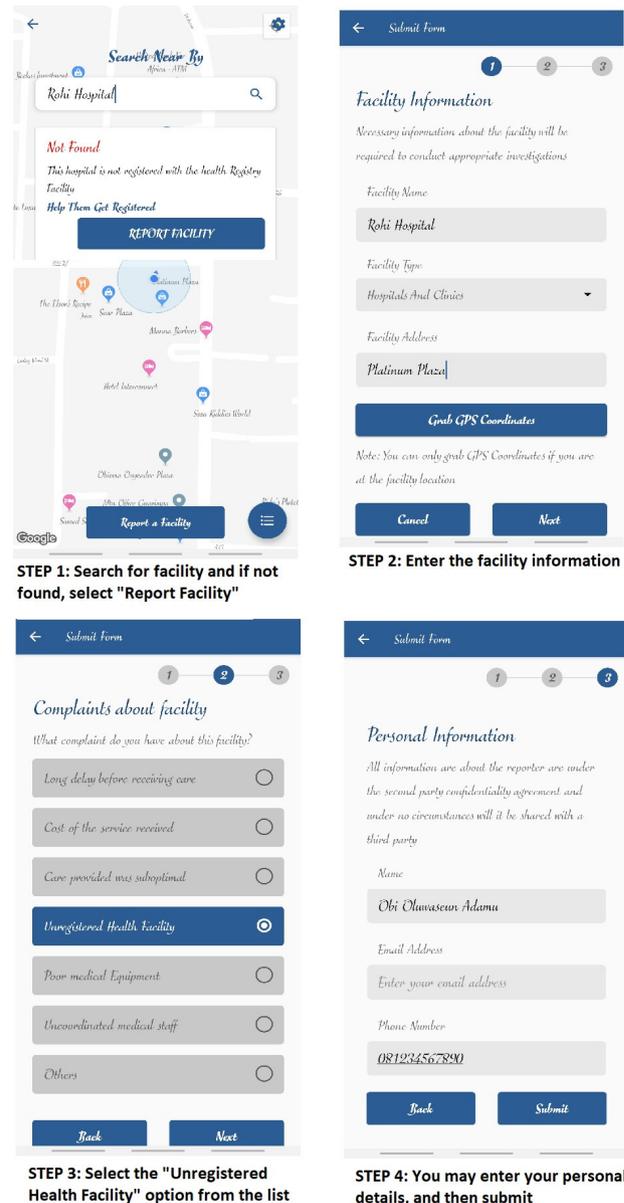
### Workflow/behaviour/adoption

A functional requirements analysis document was developed by the team and iterative meetings held for joint understanding. User experience designs were made and agreed on. Software development and iterative testing was done prior to app release on Google Play. The app requires an active internet service to function. **Figure 1** provides screenshots of the application.

Step 1: User starts the Reporta Health app which then displays icons for four types of health facilities it is designed to manage:

Step 2: the user selects one of the four types of health facilities, the app automatically retrieves the current global positioning system (GPS) coordinate in the background, feeds this information to the server and the server responds by sending back information on nearby health facilities.

Step 3: Nearby health facilities are visible to the user as points.



**Figure 2** Reporting Health Facilities. GPS, global positioning system.

Step 4: The app is integrated with Google Map and facilitates navigation.

If a user is around a health facility and starts the app, it is expected that the health facility point shows up on the screen if registered. If this does not happen, then there are two possible scenarios: the database may not contain the GPS coordinate of the facility, or the facility is not registered with the appropriate regulatory agency. In the first scenario, the user can go a step further to type the name of the facility in the search box. If the health facility falls in this category, then the name of the health facility and other details are visible. However, if this also does not happen, then the facility is not registered, and the user is prompted to report the facility to the authorities through the app. To facilitate reporting, a dialogue box appears with the

'Report' button (as seen in [figure 2](#) step 1) to kickstart this process.

Step 2 ([figure 2](#)): The report process includes a geotagging button that retrieves the GPS coordinate of the user location after the user confirms they are around the facility.

Step 3 ([figure 2](#)): The app also provides for easy reporting on complaints and rating of the services provided by registered health facilities. If a user searches for a registered health facility and selects this facility, the dialogue box that shows up on the screen permits the user to also click on a button to report issues or rate this registered health facility. The user is provided a form to select from a list of possible complaints on the facility and rate the services provided.

Step 4 ([figure 2](#)): On the last page of the report form, the user is permitted to optionally provide his or her name, email address and phone number which can be used in providing them feedback after investigation of any report. Once submitted, the information is saved to the database and the Reporta Health admin is alerted of the new report. The Reporta Health app is available for download in Google Play.<sup>22</sup>

#### Information system

One important information system that is integrated with Reporta Health is Google Map. Google Map is a web mapping service developed by Google and leveraged by Reporta Health for navigational assistance. Another information system planned to be integrated with the Reporta Health database is the country's HFR for live updates on active health facilities.

#### Modules

- ▶ Identification of nearby health facilities.
- ▶ Searching by name or service offered.
- ▶ Rating and providing feedback on registered health facilities.
- ▶ Reporting health facilities not on database.

#### Data/information/knowledge/wisdom/algorithms

The MFL in Reporta Health was retrieved from the FMOH in an MS Excel file at the start of the project. The data are specific to the type of facility being examined (Hospital, Laboratory, Pharmaceutical premises or Imaging centre). However, some administrative data are similar across board. Specific service information on the health facility type depends on the facility class being examined.

#### Technology

The Reporta Health service is deployed on a cloud server and runs on the LEMP (Linux, Nginx, MySQL and PHP) stack. The user facing application is an Android app built with React Native. The LEMP stack provides different applications together as a bundle which facilitates ease of deployment on the server. Data are exchanged between the server and the app in form of JavaScript Object Notation files while

data transfer is done using the representational state transfer methodology. This is provided in the form of Application Programming Interfaces. Reporta Health collects unique device identifier of any mobile device used in engaging with the app. This device identifier is subsequently used in analysing and for controlling transactions.

#### DISCUSSION

The ISF lays bare Reporta Health, connecting the broad overarching world of the health system governance and national priorities (World) with the rudiments of the software and programming language used in developing the app (technology). It is aimed at addressing an issue that affects the quality of healthcare service provided to the population. With the wide penetration of smart phones in the country, this social innovation aims to increase access to information on registered health facilities to the population for informed decision making and seek their assistance in eliminating quackery.

Identifying illegal health facilities is not an easy task and using technology to achieve this requires innovative approaches. The Reporta Health app provides an opportunity for how a technological innovation can contribute to reducing the time to detection of illegal health facilities in a country. In addition to the potential to aid the prompt detection of illegal health facilities, there are several secondary benefits that the app provides. It has the potential for saving costs associated with the traditional approach of patrolling streets to identify illegally operating health facilities which is human and material resource intensive. This is possible because GPS coordinates crowdsourced through the app will take the regulators to the precise location of the facility for their regulatory visit. However, investigating after reports are received will still require physical visits. Crowdsourced GPS coordinates from other projects has been described to be reliable, accurate and useful by governments for decision making.<sup>23</sup> Reduction in costs is an important benefit that has been reported in a systematic review that examined the benefits of crowdsourced data on health projects.<sup>24</sup> Although this claim still requires further empirical investigation.

This social innovation also eliminates the risk associated with moles in regulatory agencies who leak intelligence information to violators. Removal of this risk will increase the chances of cooperation from more members of the public to join the crowdsourcing or whistle-blowing initiative. It also eliminates the need for informants travelling to the ministry to report any violations. The time to travel and travel costs can be a deterring factor to reporting violators, a cost eliminated by the app. Furthermore, proprietors of unregistered health facilities who observe that their institution is not listed on the app and may be disadvantaged from being selected by potential clients may be prompted to

formally register (if they have the right academic qualifications) and become listed on the app.

Identifying health facilities nearby in emergency situations can be a challenge, especially when in an unfamiliar territory without public emergency response services. The search feature in the app makes it easy to search for health facilities nearby and be guided with the aid of a Google Maps feature to the location. This can reduce the time to care in emergency situations. The utilisation of Google Maps also helps with traffic navigation.

This social innovation enables users to rate health facilities and provide feedback based on the service they received during care. The cumulative average score is then displayed on the page of the health facility on the app. This average score can influence other app users to decide whether to seek care at a health facility or otherwise. Public display of the score can drive healthcare providers to improve their services since they are aware that feedbacks can influence the number of clients who opt to receive care at their health facility in the future, having a toll on their revenue. Furthermore, Reporta Health can be a very important communication tool in government-owned health facilities where the administrators are usually not at the site of the facility.

Crowdsourced data on hospital ratings has been shown to correlate with patient satisfaction and quality of care indices scored by the regulators in the USA.<sup>25 26</sup> Thus, the wide adoption of Reporta Health can provide a de facto quality measure on health facilities in Nigeria in the absence of a formal national health facility quality scoring process. While the anonymous nature of crowdsourced data holds risks because of targeted defamation of a health facility, it provides an important opportunity for the health facilities to hear from their clients. To address this risk, we have embedded processes that limit the contribution of a single device on the rating of a health facility within a period.

### Limitations

The app requires that users have continuous access to internet to access the active database list of facilities and to also provide feedback on the app. Many areas in Nigeria still have limited internet or low bandwidth and this can affect the adoption and use of the app in such locations. We also are yet to secure a government commitment which has prevented our testing of the idea with great results. However, we have seen some interest in the use of the app from public citizens who have responded on its promise and have started making submissions on health facilities. The report statistics on the website is not being updated actively now and it is dummy data because the process of getting a formal relationship with the state governments that regulate the health facilities is yet to be concluded. This has been the most challenging part of roll-out of the innovation. This social innovation is incomplete without the loop being completed through

government investigation. VKM on its own cannot declare that a health facility is illegal because, the list might just be incomplete.

### CONCLUSION

Reporta Health offers a rich and innovative opportunity to crowdsource data to identify and eliminate illegal health facilities in Nigeria. It contributes an important dimension to action on social innovations in health through crowdsourced data. Its wide adoption can certainly turnaround decision making process for the selection of health facilities by the population. However, there is a need to raise awareness of its benefits which can rapidly drive its adoption. There is also an active need to integrate the app with the national HFR so that the list of health facilities is continuously updated. Its application can be easily extended to other countries with similar issues of illegal health facilities and a comprehensive MFL/HFR. Future work following successful adoption of the Reporta Health app by the government will include user experience evaluation and cost-effectiveness analysis in the identification of illegal health facilities.

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