DISEASE **SURVEILLANCE** **MADE** EASY

Integrating social media chatbots with DHIS2 to fast-track case reporting and investigation

Digital Solutions for Disease Surveillance

In order to effectively respond to disease outbreaks and contain epidemics, timely detection and containment of cases are crucial, yet routine disease surveillance systems often lack efficient and scalable reporting tools. The ongoing COVID-19 pandemic has laid bare obvious gaps in disease surveillance, particularly in the private sector, which is the often the first point of care for people seeking fever treatment. For example, an estimated 65% of people in Myanmar and 77% in Laos first seek care for fever in private facilities, confirming the need to further invest in surveillance within this sector. This is particularly the case in malaria elimination settings, where standard protocols require every case to be reported within 24 hours to the local response teams and national health authorities.
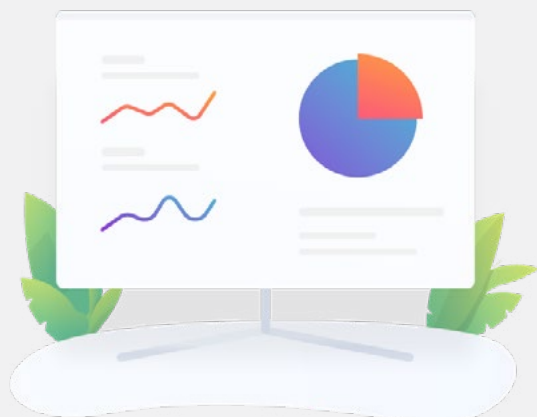
Digital reporting solutions aimed at replacing traditional paper-based reporting mechanisms have been introduced in many countries, but these are generally dependent on substantial investments in training of end-users and in equipment procurement. Even when financial and human resources are available, many mobile data collection solutions present challenges with software maintenance, device compatibility, and user management, and are thus often difficult to deploy at scale in a sustainable manner.

Our Solution: Social Media Chatbots

To overcome these limitations, PSI developed and successfully piloted a novel approach to reporting malaria cases and other disease surveillance data: chatbots built on popular social media platforms such as Facebook.

> A chatbot is a service, powered by automated dialogue rules and sometimes artificial intelligence, that you interact with via a messaging interface.

This simple yet highly innovative approach allows front-line health workers, such as pharmacists and doctors, to use the communication platform that they already use on a daily basis, on their own device, in their own language, and without needing any separate accounts, passwords, or applications. Once connected to the social media account dedicated to the chatbot, the provider starts a conversation through the platform's messaging app, such as Facebook Messenger, and is prompted to answer a series of questions with automated response options, built-in skip patterns, and quality checks.

Reporting a positive malaria case or a suspected COVID-19 case instantly becomes easy, fast, and secure, with minimal training and no extra cost. Just open up Facebook on your phone, type a keyword in the Messenger, and go with the flow: the chatbot will guide you through a series of questions such as the RDT test results, the age and gender of the patient, the village of residence, treatment provided, and any other relevant data points.

Hello

Hello! Are you reporting a positive case?

Yes
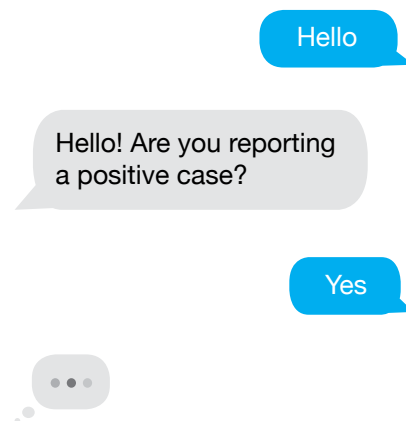
How Are We Using The Bots?

> We currently use two platforms for malaria reporting:
> Facebook Messenger in Laos and Myanmar, and Zalo in Vietnam.

In Laos, we developed a chatbot in late 2019 using Facebook Messenger to report RDT-confirmed malaria cases. As of September 2020, 124 private sector providers (pharmacies, clinics) are registered to use the chatbot for malaria case reporting, including essential data points such as treatment provided, referral issued, village of residence, and there basic patient information. Case reports are automatically uploaded in PSI's DHIS2 database, where previously all data were reported on paper and entered centrally by the M&E team. Our malaria surveillance data are sent every month to the Health Management Information System, which also runs on the DHIS2 software, via a custom app that automatically pushes data to the national HMIS. This ensures that the national malaria program at the Ministry of Health has access to all private sector malaria case reports.

In Myanmar, we are deploying a Facebook Messenger bot for malaria reporting in our extensive Sun Quality Health clinic network following a successful pilot phase.

In Vietnam, we developed a similar chatbot on the Zalo messaging app, which is by far the most popular social media platform in the country. In addition to malaria (in use since May 2020), we recently adapted the bot to accommodate reporting of other fever cases along with a checklist of symptoms. The fever case reports from a network of hundreds of pharmacies and clinics are expected to be used as an additional data source within the country's surveillance system for COVID-19.

How Does It Work?

The client-side messaging platform is connected to DHIS2 in a way that data reported to the bot are automatically pushed as events to a cloud-hosted DHIS2 instance. The chatbot flow is defined using a configuration file and each of the questions is mapped to the corresponding data element in a DHIS2 program or dataset, using a .json dictionary. The bot itself is a web service in node.js runtime environment, which can be hosted either on-premise within the instance or in a cloud computing environment
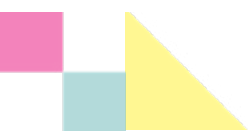
such as Microsoft Azure or Amazon Web Services. The chatbot uses the bot framework SDK that can publish the same workflow in other messaging platforms. A library that defines the chatbot's workflow logic enables the extraction and transformation to structured data pushed to DHIS2 through API calls. Incoming data are instantly sent to DHIS2 but are also stored in a file system with logs hosted in a separate cloud middleware which can be accessed by local system administrators. The .json files include error messages and submitted payloads according to status (successful submissions and failures). This prevents data loss in the event of connectivity issues or conflicts coming from the DHIS2 instance, making it possible for local system administrators to navigate all issues and re-submit relevant data to the
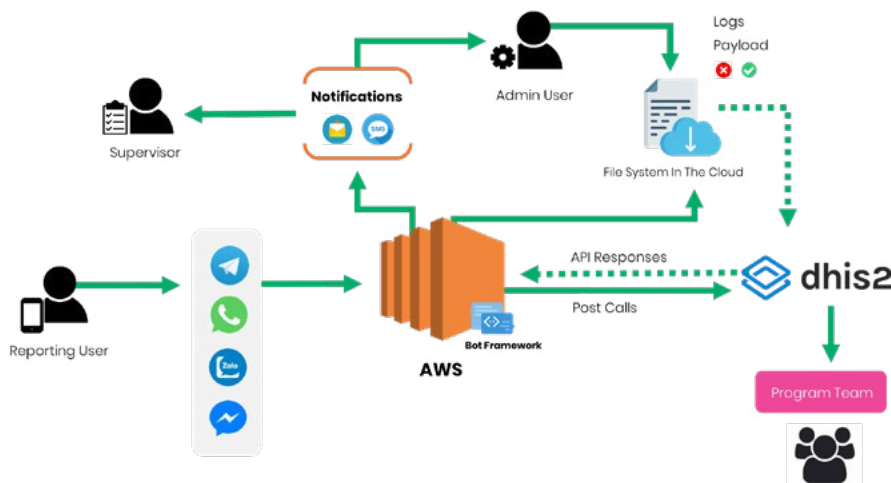
The connection between the messaging platform and DHIS2 is enabled by mapping the provider's social media account with the corresponding DHIS2 organisation unit, i.e. the pharmacy or clinic. Data collected through the chatbot can be sent to multiple programs and even simultaneously to different DHIS2 instances, making it easy to share the same records with the Ministry of Health and implementing partners.

The chatbot engine that is used to define the workflow with response options, skip patterns, and data validation strategies can be expanded for more advanced functionality, such as fuzzy matching based on extensive lookup tables. This may be useful, for example, when needing to report the village of residence in a structured manner: users can enter the village name as free text and will be asked to validate their choice against a number of possible matches based on a predefined match score. Email or SMS notifications may be sent to supervisors or other field staff when data submissions trigger a specific alert threshold, e.g. when a positive malaria case is reported.

Early Lessons Learned

> While still early in the process, it is clear that the use of social media chatbots for mobile reporting is feasible and offers several advantages.

- Users reported a strong preference for the new reporting mechanism compared to "traditional" mobile reporting tools such as DHIS2-connected data collection apps, especially as the chatbot works through a familiar messaging channel on their own devices.

- The automated prompts in local language make it easy to report data.

- This is particularly relevant in settings where reporting frequency is low, as users don't need to remember how to navigate a complex digital form

- Training can be done over the phone (e.g. using WhatsApp) or in person by field staff or during meetings with providers.

- Digital reporting mechanisms should include a range of options that are context-appropriate and that allow for providers to use a platform that most easily facilitates timely and complete reporting. While the Facebook and Zalo bots are accepted where they have been rolled out, it is important to note that there is no "one size fits all" solution and that options should be tailored to accommodate other preferences, which may include mobile data collection apps, SMS, or even sending pictures of manually completed paper forms – something that is often forgotten when designing digital solutions.

- The bots do not yet remove the need for in-person case notification to the local health authorities who are responsible for case investigations, but they enable easy and fast reporting. Data are thus more rapidly available and open up the potential to improving the detection and containment of epidemics by central and local surveillance and response teams.

- Large networks of providers still require active user account management by central teams and DHIS2 system administrators, who need to ensure that new users get swiftly enrolled and that the social media user IDs are mapped against the DHIS2 organisation units.

> On balance, our experience shows that these social media chatbots connected to powerful information management systems such as DHIS2 have the potential to change the way that we collect data. They provide health service providers with additional options to rapidly report disease surveillance data to the government, in a user-friendly and low-cost manner.

Future Developments & Next Steps

What's next? Pending further user insights, we may develop chatbots on other social media options such as WhatsApp or Viber to provide end-users with a range of choices. We are actively working on expanding our malaria reporting chatbots to other diseases. In Laos and Myanmar, we will pilot the inclusion of other notifiable diseases as part of our overall disease surveillance strengthening activities in support of the respective Ministries of Health - enhancing the countries' ability to respond to outbreaks in a timely and effective manner.

The chatbots connected to DHIS2 are highly flexible and customizable for each country context and have the potential to be applied to other simple mobile data collection needs. Besides case reporting, this also includes aggregate reporting of activity reports and stock levels: in Laos, our network of private clinics and pharmacies will soon start reporting monthly volumes of malaria RDTs used along with key stock indicators for essential medicines (so far this process was entirely paper-based, with manual data entry in our DHIS2 instance).

Future iterations will also incorporate reminders for providers who see very few cases or have not submitted reports. Likewise, we may prompt them to submit "zero case" reports as these allow for accurate assessments of completeness of reporting. Automated SMS or email notifications based on case reports will be used to instantly inform local health authorities of notifiable disease events in their area.

Ultimately, the social media chatbots connected to DHIS2 complement traditional reporting mechanisms by providing health care providers with easy-to-use and low-cost alternatives. We expect that wide-scale adoption of chatbots will result in more timely and more comprehensive disease surveillance data that are fully integrated in the national HMIS, rendering outbreak detection and response more efficient.

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