Midwife service coverage, quality of work, and client health improved after deployment of an OpenSRP-driven client management application in Indonesia

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Abstract— The quality of maternal and child health services remains suboptimal in most low and middle-income countries (LMIC). Data are routinely collected with paper-based systems but are incomplete, underutilized, and reported as poorly-usable aggregated indicators. Therefore, we developed the Open Smart Register Platform (OpenSRP) application for midwives in Indonesia wherein routine paper registers were transformed into a smart real-time data-driven client management system. The app running on Android tablets was deployed as a matched-pair study in Central Lombok District in 2015-2018 to 30 frontline workers (midwives, nutritionists, and vaccinators) in 10 villages, and compared to workers in 10 matched villages using the routine paper-based system. Preliminary results indicate complete antenatal care (ANC) for pregnant women increased from 55% in the control area to 73% in the OpenSRP area ($p < 0.05$). Moreover, postnatal care (PNC) visits for mothers and neonates increased from 1% in the control area to over 45% ($p < 0.05$) in the OpenSRP area. Maternal and neonatal morbidity and mortality tended to be lower at 27% compared to 8% in the control area. Using the OpenSRP system, health workers can take rapid action to provide better quality service based on data, which resulted in a higher impact on maternal and neonatal health.

Keywords : **Maternal and Child Health, Health Information System, Open SRP, Indonesia, Summit Institute of Development**

1. INTRODUCTION

Indonesia is among the South-East Asian countries where the Maternal Mortality Ratio (MMR) remains high. In 2015, the MMR in Indonesia was nearly 300 per 100,000 live births (WHO et al., 2015). To address this problem, the Indonesian Ministry of Health implemented several programs such as the Safe Motherhood Program in 1990, Making Pregnancy Safer in 2000, and the National Social Security System in 2004. The purpose of these was to ensure that all women receive the care needed for healthy pregnancy and safe delivery (Ministry of Health Republic of Indonesia, 2016). Even though improvement has been observed, maternal morbidity and mortality are still considered immense and high priority problems to be solved.

Effective maternal health care is pivotal for preventing maternal morbidity and mortality. One important components of effective maternal health care is Antenatal Care (ANC) (Campbell et al., 2016). Through primary ANC, women can consult health professionals (midwives or doctors) to receive exams for early detection of problems, receive nutritional supplements and other preventive measures for maternal conditions, and counseling. Prevention of maternal morbidity and mortality through prophylactic care, and early detection and treatment can be done through this system.

The other crucial component quality and coverage of ANC services should be provided by midwives in Indonesia. The number of midwives in Indonesia has increased rapidly after a mass village midwife deployment program was introduced by the government since 1990 (Shankar et al. et al., 2008). However, this deployment was not facilitated with access to a sufficient health information, tools, guidance, and proper training, resulting in an inefficient workflow at the field level, confusion over health indicators at the national level, and a poor quality of collected data. Thus, it presents a strategic challenge for the coordination and data sharing across all levels in the decentralized health system.

The midwives are burdened by the archaic paper-based systems for client registration and tracking. Duplicate and missing data are common due to the isolation between the village-based midwives and the family planning workers. This situation has led to inefficiencies in several sectors, such as inconsistent denominator lists (e.g. women of reproductive age, pregnant women, children <1-year-old) across health workers and time-consuming duplicative paperwork. The front line health workers could be more productive if less time were spent on paperwork. Thus, it decreases the quality of the healthcare and essential service coverage and concurrently increases the health-workers work burden and frustration. Therefore, there is an urgent need for a more integrated health information system to reduce the workload of frontline health workers, and produce real-time, high-quality data to improve health outcomes.

The health management information system in Indonesia is currently divided into routine and non-routine paper-based systems. The routine paper-based system consists of data collection of demographic and vital statistics including births, deaths, and marriages as well as disease surveillance systems, food, nutrition surveillance systems, and service- or facility-based data records. While the system is underused and unreliable, the non-routine system was implemented to fill the gap e.g. surveys, small studies, and assessments. The examples of such sources include; household surveys (Budiarso and Setyowati, 1991; Wirawan and Linnan, 1994; Mariati et al., 2011), hospital records (Qomariyah et al., 2009) and verbal autopsies (D'Ambruoso et al., 2010). For national estimates, there are national census, Basic Health Survey (Riskesdas), National Household Health Survey (NHHS or SKRT), National Health Survey (NHS or Surkesnas) and Indonesia Demographic Health Survey (IDHS) (Stanton et al., 1997; Stanton et al., 2000; Central Bureau of Statistic et al., 2013; Ahmed et al., 2014). However, unclear divisions and lack of integration across the department in the Ministry of Health and each level of health administration has resulted in ineffective flow and affect the decision and strategy at the national and regional level. Therefore, a digital, rapid, effective, yet reliable system is crucial to improve the current Indonesian healthcare system.

Open Smart Register Platform application (OpenSRP app) is a digital application that has been developed for data collection to help midwives improves their performance and service quality. It is a smart real-time data-driven client management system that allows frontline health workers to electronically register and track the health of their client population. The app also serves to enhance the reporting process and data sharing and coordination between different levels of health care system. It allows not only effective data collection but also client management and clear reporting of workflows into a linked mobile interface. One of the benefits is to shorten the time spent on paperwork, which enables midwives to allocate more of their time on health service and promotion. Moreover, the midwives can update the client information and access the decision tools from a real-time reporting environment, which allow them to execute the needed actions as well as evaluate client outcomes. Importantly, the government can also monitor and evaluate the impact of health programs from such data, and facilitate a more effective and efficient health-related response (evidence-based practice). OpenSRP is currently

being implemented in Indonesia, Pakistan, Bangladesh, and Zambia.
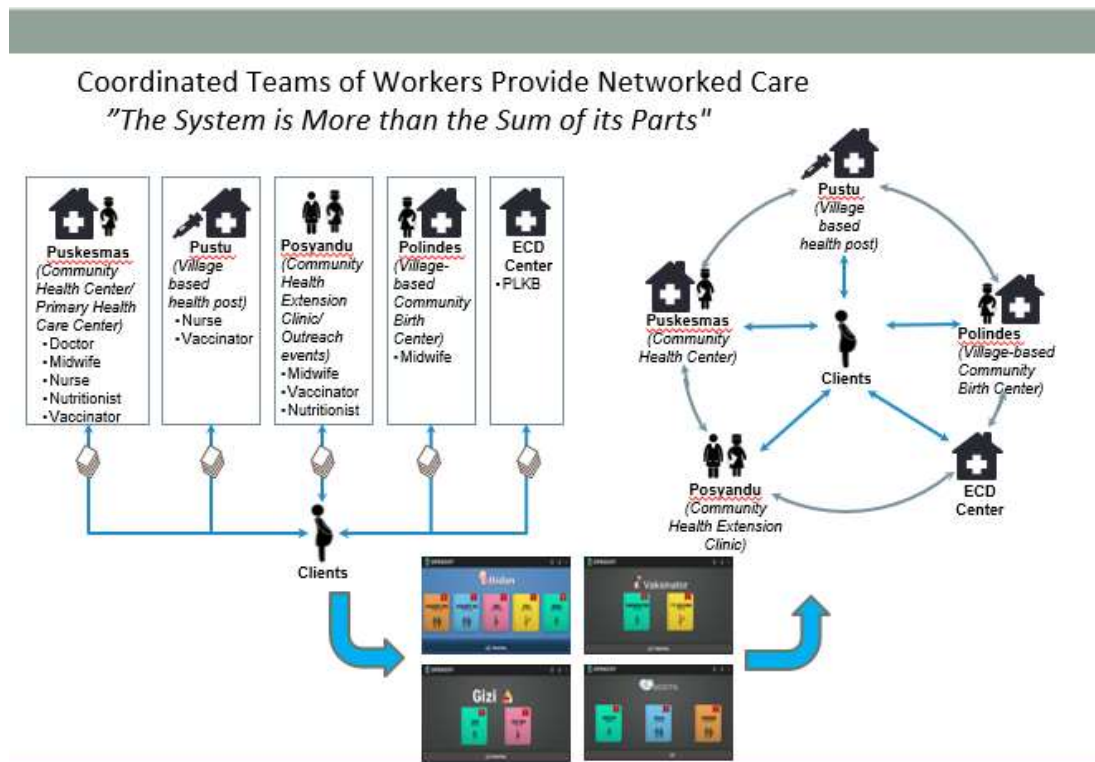

Figure 1. Transformation from paper-based system to OpenSRP

This study aims to provide an integrated health platform to improve midwives' workforce efficiencies, data quality, and timeliness of reporting to enhance maternal and neonatal health outcomes.

2. MATERIALS AND METHOD

A. Study Setting and Participants

The study took place in Lombok, a heavily populated Island just to the east of Bali, in the Province of West Nusa Tenggara, with a population of over 3 million people. We selected Central Lombok District, within the Province of West Nusa Tenggara, which covers an area of 39 km2, including 12 sub-districts, 12 urban townships and 112 villages with a population of 856,675. It is a mix of urban and rural areas and largely reflective of the current decentralized health system whereby the responsibility and health funds are managed locally, between the provincial, district and sub-district municipalities.

In Lombok, Reproductive Maternal Neonatal and Child Health (RMNCH) are currently collected using paper-based registries by a network of village-based midwives, who then report to local district level health offices. Family planning field workers (PLKB) and community health facilitators (CHF), who report to local district level health offices and their own department with the Ministry of Planning (MoP), collect additional data. Data is then aggregated and collated at the district level, and reported to the provincial level health offices, and then subsequently reported to the MoH for input into the National health information system. In this manner, Lombok makes an ideal site for the OpenSRP adaptation due to a close long-term relationship with the local government.

The study participants were skilled frontline health workers including village-based midwives (VBMs), nutritionists, and vaccinators who entered data of the targets in OpenSRP. A matched-pair study was conducted in Central Lombok Regency in 2015-2018 to 30 OpenSRP users in 10 villages which were

compared to those in 10 villages using the routine paper-based system (10 village midwives, 10 nutritionists, and 10 vaccinators in both intervention and control locations).

Figure 2. Home screen of OpenSRP-Indonesia

B. Description of OpenSRP

Midwives interact with the OpenSRP application via a provided Android tablet. The OpenSRP app aims to improve the efficiency and effectivity of midwives to deliver those same health interventions as they usually provide to their clients. All data entry is done using the application. To ensure that all clients are enumerated, cloud-based computing is being used. The app provides different digital health registers modeled on the existing paper-based system that midwives use. The app can be used offline and data later synced when an internet connection is available.

The following are the current features in OpenSRP-Indonesia:

1) Smart Register. This feature contains patient records. The user can easily scroll through the list of patients, view relevant medical records in pre-specified column headers. Reminders of health scheduling logic are provided as well based on the information given.
2) Service Mode. This feature contains a set of related services that have been simplified from multiple columns of patient information, sometimes spanning multiple pages to a single smart register screen.
3) Risk profiling and client flags. The app includes profile clients based on their risk status. The high-risk clients are "flagged" in the smart screen, and can be sorted based on the risk status.
4) Scheduling/reminders. The service reminders appear as alerts to the health worker when a client is due for specific service.

Figure 3. Risk Flag and Schedule Features of OpenSRP-Indonesia

C. Data Analysis

There were several types of data collected from the target population in the field and with OpenSRP used by clinic workers, including the number of ANC visits, ANC with four visits, delivery assisted by a skilled provider, PNC visit for mother, PNC visit for the neonate, full vaccination at 1-year, and mortality ratios per live births (maternal and neonatal). The data from the field were collected by the field staff by conducting an interview with all those targets (sampling process) while the data from the OpenSRP were entered by midwives via application in their tablet.

OpenSRP population coverage (OPC) was calculated based on the number of targets recorded in OpenSRP and the total sampling of the target population. The numerator is the sampling data of the target population were then matched with those in OpenSRP data. The matching process was done systematically by three different individuals based on several demographic variables such as village, identity card number, and the name of the husband, education level, and date of birth. First, each individual did the single matching from sampling data to OpenSRP data based on those variables. The result of the single matching was compared by other individual and the results will be considered as final matched. The denominator is the number of sampling data for the target population.

OPC was compared with the number of targets entered in the paper-based system from the control area. The numerator is the number of sampling data that matched with data entered in the paper-based system; the process was similar to the aforementioned matching process. The denominator is the number of sampling data from the control area. P-value was calculated based on the Mantel-Haenszel Test for proportion.

3. RESULTS AND DISCUSSION

Based on the population-based sampling process conducted in the intervention and control areas, there were 447 pregnant women, 1,428 postpartum women, 228 neonates. After the matching process of the sampling data with the OpenSRP data, the coverage of ANC visit in the intervention area were 328, in PNC mother were 642, and PNC children 68. In control areas, there were 573 pregnant women, 1,493 postpartum women, 224 neonates. After the matching process from sampling data to paper-based register, the coverage of ANC Visit in intervention area were 312, in PNC mother were 7, and PNC children 7.

Table 1 shows the number of population coverage in the intervention and control areas of Thrive OpenSRP Indonesia, 2017-2018. The sampled columns refer to the number of data entered. Overall, there was an increase in coverage for several indicators (ANC, PNC Mother, PNC Children, Vaccination, and Skilled Attendance) in the intervention area, with the range of 2% to 44.5%. Complete antenatal care (ANC) for pregnant women increased from 55% in the control area to 73% in the OpenSRP area (p<0.05). Moreover, postnatal care (PNC) visits for mothers and neonates increased from 1% the control area to over 45% (p<0.05) in the OpenSRP area. Maternal and neonatal morbidity and mortality were also much lower at 27% compared to 8% in the control area. Furthermore, unskilled attendance (6.6%) percentage in the intervention coverage area was lower than the control area (unskilled attendance 8.6% and Death 2.7%) respectively.

This is the first example of a grass-roots de novo development and impact assessment of a digital application specifically designed to facilitate the full scope of work of a government health worker engaged in RMNCH activities. Using the OpenSRP system, health workers can take rapid action to provide better quality service based on the data which resulted in a higher impact on maternal and neonatal health.

With few exceptions, the function of existing digital health solutions are either limited, too customized orunscalable or not interoperable with national-level health information systems. A government-owned and operated, the enterprise-grade solution is needed to connect frontline health workers to the national

health information systems. This scheme could enhance health service delivery, increase accountability, and generate real-time data to improve monitoring and evaluation.

Table 1. Comparison of Using Open SRP Register (intervention) vs. Paper-based Register (Control) in Percentages for Every Coverage

Coverage	Intervention			Control		
	Sampled	Covered	%	Sampled	Covered	%
ANC	328	447	73.4	312	573	54.5
PNC Mother	642	1428	45.0	7	1493	0.5
PNC Children	68	228	29.8	7	224	3.1
Vaccination	628	2120	29.6	320	2186	14.6
Skilled attendance	682	730	93.4	638	698	91.4
Unskilled attendance	48	730	6.6	60	698	8.6
Deaths	11	1428	0.8	40	1493	2.7

Figure 4 shows the comparison of impact using OpenSRP and paper-based system. The data shows significant impact on the increase of coverage of ANC visits, skilled birth attendance, PNC and decrease in deaths in OpenSRP compared to those entered in paper-based register.

OpenSRP Indonesia / Active Deployments:
Golden Generation first tranche of villages: 146 OpenSRP users in 112 Villages, 500,000 pop, and 15,000 annual pregnancies
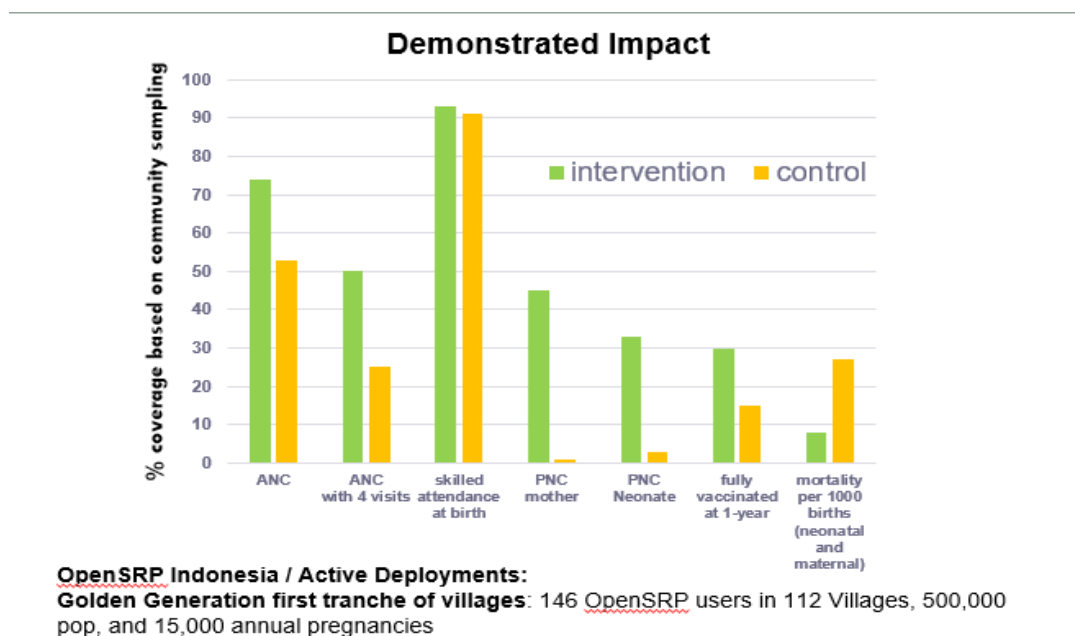
Figure 4. Impact on OpenSRP usage compared to paper-based system

OpenSRP is an open source platform, which allows governments and technology partners to easily adapt content and functionality to health workers' needs. The modular design of OpenSRP enables easy access for the inclusion of existing modules, content, and functionality needed for each setting. OpenSRP is intentionally designed for end-users, which is evident in the positive feedback received from health workers and their ability to easily pick up and start using OpenSRPin their daily work. Health workers enjoy using the platform as it is intuitive, and simplifies their workflows. Moreover, the application improves the communication between health workers and their clients – especially as a reminder for clients when their health services are due. There were also reports about the efficiency of the application on how it saves time and effort spent on administrative tasks. This allows the health workers to focus their time on providing care for clients. OpenSRP empowers health workers with an easy-to-use and user-friendly technology that allows them to have strong impact in the community.

4. CONCLUSION

The ability to provide a quality and timely care through the use of OpenSRP led to an increase of ANC and PNC visits from 55% in the control area to 73% in the OpenSRP area and from 1% in the control area to over 45% in the OpenSRP area, respectively. The maternal and neonatal morbidity and mortality tended to be lower at 27% in the intervention area compared to 8% in the control area. These promising preliminary results have prompted a more robust study to determine the statistical significance of the impact on a larger population.

5. ACKNOWLEDGEMENT

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