Challenges of Paper-Based Reporting and Willingness of Primary Health Care Workers to the Use of Electronic Immunisation Registry in Kaduna State, Nigeria

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Abstract

This study assessed challenges of paper based reporting and willingness of Primary Health Care workers to use Electronic Immunisation Registry (EIR) in Kaduna State, Nigeria. Qualitative approach of In-Depth-Interview (IDI) was employed to obtain information from 50 Officers-In-Charge of PHCs on (i) Time and effort required in reporting paper-based RI data (time spent in completion of RI reporting tools, travel time to LGAs monthly for submission of RI data/report, and waiting time in LGA). (ii) Cost of reporting (stationery cost and transportation cost) and (iii) Security and Storage issues (iv) willingness to be trained and use of EIR for RI data reporting. This study shows that PHCs spend a mean time of 67.7 minutes for the completion of RI data reporting tools, 104.7 minutes for travel to LGA headquaters for monthly submission of reports and 36.5 minutes as waiting time at LGA headquaters. They also spend a mean amount of ₦1,500.50K on stationery and ₦1,340.50K on transportation to the LGA headquaters monthly. In addition, paper-based RI data lacks adequate security and storage. Moreover, PHC workers expressed their willingness to be trained on the use of EIR. In view of the challenges of paper-based reporting systems and willingness of PHC workers to use EIRs as shown in the study, there is a need for the implementation of EIR for efficient RI data reporting.

Keywords: Paper-based reporting, Routine Immunisation data, PHC workers, willingness to use EIR, Kaduna State.

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1. Introduction

Routine Immunisation (RI) programme is the most successful public health strategy for the reduction of morbidity and mortality associated with vaccine preventable diseases among children. RI has recorded success in preventing two to three million infant mortality yearly all over the world (World Health Organisation (WHO), 2018). WHO (2020) reported that nearly one billion children were vaccinated between the year 2010 and 2016 globally, but an estimated 19.4 million children under the age two were unimmunised as many countries are still experiencing low coverage for immunisation especially in Africa including Nigeria.

According to Dolan *et al* (2019), improving RI coverage requires strong insights and oversight of both the target population and the health system through multisectoral efforts. Routine Immunisation coverage is usually used as a performance indicator for immunization programs both at national and international levels. RI coverage data are obtained from both routine Health Information System (HIS) and periodic population-based surveys (Brown, Burton, Gacic-Dobo & Karimov, 2014; Cutts, Claquin, Danovaro-Holliday & Rhoda, 2016).

To track progress and take appropriate actions in achieving the global immunization goal of every child being immunised, valid, reliable, accurate and timely RI data are required at all levels (Dolan *et al*, 2019). Generally, developing countries use routine HIS to calculate RI coverage which is achieved by using the number of vaccines administered to any child seen at the facility in a month as the numerator, divided by the estimated monthly facility target population (annual births/12) as the denominator. This system of calculating coverage ensures that RI is reported for children less than one year and greater than or equal to one year receiving each dose (Burton *et al,* 2009). RI coverage can also be calculated and reported at the facility, district, regional and national levels on monthly, quarterly and annual basis. Although, national RI coverage estimates are usually computed and finalised during national annual joint review processes to allow comparison of administrative data from routine HIS and survey data taking contextual factors into consideration for the final estimate (Brown *et al* 2014; Dolan *et al*, 2019).

Conventionally, RI data in health facilities are collected, managed and reported with the use of paper-based tools, such as tally sheets, registry books and summary reports (Namageyo-Funa, Samuel, Bloland & Macneil, 2018). However, paper-based reporting of RI is often tedious, and time consuming. It also requires higher number of human resource, capital intensive, and is prone to loss of data and records (Bosch-Capblanch, Ronveaux, Doyle, Remedios & Bchir, 2009). There has been an introduction of Information and Communications Technology (ICT) such as Electronic Immunisation Registry (EIR) which has presented new opportunities for accurate collection, timely reporting and efficient use of RI data at individual, local, regional,

national and international levels (Newton, 2015). EIR is a database that contains data on children, immunisation data and record of the vaccines taken by the children. With the use of EIR, children vaccinations are registered online by entering a child's ID into the electronic system through a barcode sticker located on the health card and inputting of the vaccines received. The use of EIR allows for effective monitoring of RI coverage, vaccines, doses, ages, target group, and geographical area. EIRs also supports RI programme by providing timely and precise data for decision making (Danovaro-Holliday, Ortiz, Cochi & Ruiz-Matus, 2014; Newton, 2015; Pan American Health Organization (PAHO) and World Health Organisation Regional Office for American, 2017).

An increasing number of developing countries including Nigeria have been implementing EIR to replace paper-based system of reporting RI data at Primary Health Care facilities. However, despite the relevance and importance of EIR, some states in Nigeria especially in North are still using paper-based system for collection, management and reporting of RI data. This study therefore assesses challenges of paper based reporting and the willingness to the use of EIR among PHC workers in Kaduna State, Nigeria.

2. Methodology

2.1. Study setting: The study was conducted in Kaduna State which is ranked 4th by land mass (46,053 km2) and 3rd by population in Nigeria (6,113,503 people) (NPC, 2006). There is a mix of ethnic groups in the state but of dominance are the Hausas. Other groups include Gbagyi, Chip, Bajju, Ham, Atyap, Igbos and Yorubas while Islam and Christianity are the main religious practice. There are over 1,000 Primary Health Care facilities and more than 10 comprehensive health centres in Kaduna State, all of which provide RI.

2.2. Study design: The study employed a qualitative approach of In-Depth-Interview (IDI) to obtain data from respondents for the study.

2.3. Sample size determination: The study sampled 50 Officers-In-Charge (OIC) of RI data in selected PHC facilities using a multi-stage sampling procedure. In Stage 1, stratified sampling technique was used to group Kaduna State into two geographical locations which are Northern and Southern Kaduna; simple random sampling technique was used in stage 2 to select one LGA from each of the geographical locations while in stage 3, proportionate sampling technique was used to select 50 PHC facilities from the two selected LGAs (26 in Zaria and 24 in Kaduna South) and purposive sampling technique was used in stage 4 to select the OIC of RI in the selected PHC facilities.

2.4. Data collection: Permission was obtained for the study from the Kaduna State Ministry of Health before the commencement of the data collection while informed consent was obtained from each participant. A structured IDI guide was developed and used for collection of data in the study. The data collection was conducted by teams of a moderator and note taker. Recording of interview was done after consent was obtained from respondents for backup, quality assurance and control purposes.

2.5. Data analysis: The data collected was sorted, transcribed, coded and analysed using both quantitative and qualitative analysis approaches.

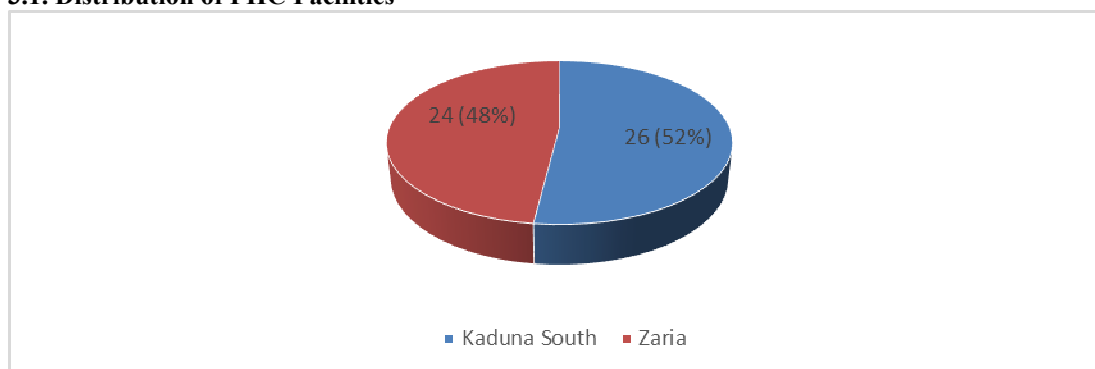## 3. Results
3.1. Distribution of PHC Facilities

Figure 1: Frequency and percentage distribution of selected PHC facilities by LGA

Figure 1 shows that 52% of the selected PHC facilities are located in Zaria LGA with 26 respondents while 48% are located in Kaduna South LGA with 24 respondents.

3.2. Time and Effort Required in Reporting Paper-based RI Data

The time required in reporting paper-based RI data was found in the study to be a challenge and was presented from three main perspectives which are (i) time spent in completion of RI reporting tools (ii) travel time to LGAs monthly for submission of RI data/report, and (iii) lag time in LGAs.

3.2.1. Time spent in completion of RI reporting tools

Collation of RI data and completion of facility summary reports as required is very important but the completion of paper based tools is time consuming considering other responsibilities. This results in loss of many hours monthly in performance of this task. The time expended by OICs on completion of tools with RI data is presented in Table 1.

Table 1: Descriptive statistics showing time spent in completion of RI reporting tools in PHCs

S/N	Time spent in filling out RI tools (Mins)	Mid. Point (x)	Frequency of PHC (f)	Percentage (%) of PHC	*Fx*	∑*fx*
1	1 – 60 Mins	30.5	20	40	610	610
2	61 – 120 Mins	90.5	29	58	2624.5	3234.5
3	121 – 180 Mins	150.5	1	2	150.5	3385
	Total		**50**	**100**	**3385**	

x=67.7 Mins

Table 1 shows that 58% of PHCs spent 61 - 120 minutes for completion of RI data collection and reporting tools; 40% spent ≤ 60 minutes (1 Hour) while 2% spent more than 120 minutes (2 Hours) for RI data collection and reporting. On the average, more than an hour (67.7 minutes) was spent daily on completion of RI data collection and reporting tools. In addition, virtually all OICs reported that filling out paper based tools on daily bases was time consuming and tedious.

3.2.2. Travel time to LGAs monthly for submission of RI data/report

The distance of PHCs to LGA headquarters varied across the LGAs. The travel time from facility to and fro from the LGA headquarters as found in the study is presented in Table 2.

Table 2: Descriptive statistics showing travel time to LGAs monthly for submission of RI data/report.

S/N	Travel time to LGAs (Mins)	Mid. Point (x)	Frequency of PHC (f)	Percentage (%) of PHC	*fx*	∑*fx*
1	1 – 60 mins	30.5	8	16	244	244
2	61 – 120 mins	90.5	27	54	2443.5	2687.5
3	121 – 180 mins	150.5	11	22	1655.5	4343
4	181 – 240 mins	210.5	3	6	631.5	4974.5
5	241 – 300 mins	270.5	1	2	270.5	5245
	Total		**50**	**100**	**5245**	

x= 104.7 mins

Table 2 shows that 54% of OICs spent 61 - 120 minutes for travels to the LGA headquarter for the submission of monthly RI data/reports, 22% spent 121 - 180 minutes while 2% spent 241 – 300 minutes. On avaerage, OICs spent 104.7 minutes (about 2 hours) to travel to the LGA headquarters for submission of monthly RI data/reports.

3.2.3. Waiting time at LGA (before being attended to)

Monthly RI records in PHCs were submitted directly to the Local Immunization Officer (LIO) at the LGA headquarters and a formal acknowledgment was obtained. However, these reports were not always "received" immediately, which often result in delays. Waiting time is defined as the difference between the time the OICs officer arrives at the LGA to the time their report is received and acknowledged by the LIO. The main reasons given for the delay by respondents were the unavailability of the LIO in the office at the time of report submission and their being unattended to on time by the LIO because of other responsibilities.

Table 3: Descriptive Statistics showing lag time at LGA for monthly submission of RI records/data.

S/N	Time spent in filling out RI tools (Mins)	Mid. Point (x)	Frequency of PHC (f)	Percentage (%) of PHC	*Fx*	∑*fx*
1	1 – 60 Mins	30.5	46	92	1403	1403
2	61 – 120 Mins	90.5	3	6	271.5	1674.5
3	121 – 180 Mins	150.5	1	2	150.5	1825
	Total		**50**	**100**	**1825**	

x= 36.5 mins

Table 3 shows that 92% of OICs spent 1- 60 minutes of waiting time in LGAs during the monthly RI data submission, 6% of OICs spent 61 - 120 minutes while 2% spent 121 - 180 minutes of waiting time in LGAs for the submission and acknowledgement of monthly RI data. A mean waiting time of 36.5 minutes was spent by OICs in LGAs for monthly RI data submission and acknowledgment.

3.3.Cost of Reporting

Findings on cost of reporting were presented as (i) stationery cost and (ii) transportation cost

3.3.1. Stationery cost

In Nigeria, RI standard monitoring tools are procured and distributed by the federal government to states for onward distribution to the LGAs and subsequently the PHC facilities. As a result, the study quantified costs incurred by PHCs in providing stationeries such as the pens, pencils, erasers, sharpeners, correction fluids, markers, exercise books among others for documentation of RI data and reporting tools.

Table 4: Descriptive Statistics showing facility distribution of stationery cost (in Naira) Per month

S/N	Cost of stationery in Naira (₦)	Mid. Point (x)	Frequency of PHC (f)	Percentage (%) of PHC	*Fx*	∑*fx*
1	1 – 1000	500.5	30	60	15015	15015
2	1001 – 2000	1500.5	10	20	15005	30020
3	2001 – 3000	2500.5	4	8	10002	40022
4	3001 – 4000	3500.5	3	6	10501.5	50523.5
5	4001 – 5000	4500.5	1	2	4500.5	55024
6	5001 – 6000	5500.5	00	00	0	55024
7	6001 – 7000	6500.5	0	0	0	55024
8	7001 – 8000	7500.5	0	0	0	55024
9	8001 – 9000	8500.5	0	0	0	55024
10	9001 – 10000	9500.5	1	2	9500.5	64524.5
11	10000 – 11000	10500.5	1	2	10500.5	75025
	Total		**50**	**100**	**75025**	

x= ₦ *1, 500.50K*

Table 4 shows that 60% of PHCs spent ≤ ₦1000 monthly in procuring stationery used for documentation of RI data, 20% spent between ₦1, 001 - ₦2,000 and 8% spent between ₦2,001 - ₦3,000. In other PHCs, 6% spent between ₦3,001 - ₦4,000 and another 2% spent more than ₦10, 000 monthly for the procurement of stationery used for documentation and reporting of RI data. The finding shows a mean cost of ₦1500.50K for stationery across PHCs.

3.3.2. Transportation cost

All PHCs used paper-based sytem for reporting RI data hence, PHC staff (OIC or representative) were required to physically submit hardcopies of RI monthly summary reports to the LGA headquarters for recording. This was accounted for as part of cost for reporting.

Table 5 Descriptive Statistics showing facility distribution of transportation cost (in Naira) Per month

S/N	Cost of transportation to LGAs in Naira (₦)	Mid. Point (x)	Frequency of PHC (f)	Percentage (%) of PHC	*Fx*	∑*fx*
1	1 – 1000	500.5	28	56	14014	14014
2	1001 – 2000	1500.5	15	30	22507.5	36521.5
3	2001 – 3000	2500.5	1	2	2500.5	39022
4	3001 – 4000	3500.5	4	8	14002	53024
5	4001 – 5000	4500.5	1	2	4500.5	57524.5
6	5001 – 6000	5500.5	00	00	0	57524.5
7	6001 – 7000	6500.5	0	0	0	57524.5
8	7001 – 8000	7500.5	0	0	0	57524.5
9	8001 – 9000	8500.5	0	0	0	57524.5
10	9001 – 10000	9500.5	1	2	9500.5	67025
	Total		**50**	**100**	**67025**	

x= ₦ 1340.50K

Table 5 shows that 56% of PHCs spent ≤ ₦1,000 monthly on transportation to LGAs headquarters for RI data submssion, 30% spent between ₦1,001 - ₦2,000; another 8% spent between ₦3,001 - ₦4,000 while ₦2,001 - ₦3,000, ₦4,001 - ₦5,000 and ₦9,001 - ₦10,000 were spent by 2% of PHCs respectively. The findings of the study showed a mean transportation cost of ₦1,340.50K.

3.4. Security and Storage Issues

Data Security and storage was also found to be a challenge of paper-based RI data in the study. This process includes protection of files, databases, and records from destruction/damage and restriction of unauthorized persons by adopting a set of controls, and techniques that identify the relative importance of different datasets, their sensitivity, regulatory compliance requirements and application of appropriate protections to secure the data. Study respondents reported exposure of paper based tools to damage by water, fire, insect, mal-handling, tearing, loss and misplacement as some of the main data security and storage challenges experienced with paper-based reporting.

3.5. Willingness of PHC Workers to be Trained on the Use of EIR

Table 6: Descriptive statistics on EIR knowledge and willingness for training and use among PHC workers

S/N	Items	YES (%)	No (%)	Total (%)
1	Are you aware of any PHC that uses EIR for IR data reporting in this LGA?	1 (2)	49 (98)	50 (100)
2	Do you know how to use EIR for IR data reporting?	4 (8)	46 (92)	50 (100)
3	Is EIR being used in your facility?	0 (0)	50 (100)	50 (100)
4	Have you received any training on EIR?	3 (6)	47 (94)	50 (100)
5	Do you wish to be trained on use of EIR?	50 (100)	0 (0)	50 (100)
6	Will you use EIR if introduced in your facility?	50 (100)	0 (0)	50 (100)

Tables 6 illustrates EIR knowledge and willingness for training among PHC workers. The table shows that 98% of the respondents affirmed that no PHC in their various LGAs uses EIR for RI data reporting, 92% does not know how to use EIR for IR data reporting while all (100%) do not use EIR for IR data reporting in their facilities. The table further shows that 94% of the respondents has not receive training on EIR while all (100%) of the respondents are willing to be trained and use EIR in their facilities.

4. Discussion

This study assesses challenges of paper based reporting and the willingness to the use of EIR among PHC workers in Kaduna State, Nigeria. The findings of the study showed that PHCs spent an average of 3 hours 28 minutes for the completion of reporting tools (paper based), travel time from PHCs to LGA and the waiting time spent in LGAs for monthly submission and acknowledgement of RI data. This is average 172 hours of service delivery lost every month resulting from paper based reporting system. The time lost on paper based reporting by 50 health facilities can be used to provide health services by 2 health workers for 5 hours 20 minutes daily for a whole month if paper based reporting system is replaced with EIR. This is because the use of EIR will reduce time and efforts in reporting RI data to appropriate authorities. EIR functions to aggregate, analyse and transfer facility-level RI data to appropriate authorities for decision-making to improve the effectiveness of immunisation services (PAHO, 2017). The findings of the study are in line with Nguyen, Vu, Dao, Tran and Nguyen (2017) who reported that paper-based method of reporting RI data is time demanding, ranging from time taken for input of data, data checks, data analysis and time required for travels to regional office for monthly submission of the data. The study finding is also in agreement with Mott (2018) who reported that electronic based reporting of RI data saves time for health workers compare to paper-based reporting.

In addition, the study shows that on average, PHCs spent an average of ₦3,000.00K monthly on cost of reporting associated with stationery and transportation. These funds could be used for other facility needs, if a more cost-effective means of reporting RI data such as EIR is adopted in PHCs. Although, implementing EIR is capital intensive, maintenance and recurrent cost is, however, usually low. In addition, if government scales up the implementation to every region, this will reduce recurrent, management and maintenance cost. This finding is in line with Amarasiri and Dorabawila (2018) who reported that management of paper-based reporting of health records is costlier than electronic system of reporting due to cost of stationery and cost of transportation. The study also supports Pan American Health Organisation and World Health Organisation (2019) in a review of what works to improve immunization data from Low- and Middle-Income Countries (LMIC) in which it is reported that paper-based reporting of is difficult and costly to manage due to transportation of paper-based data from facility to district levels and costs associated with the process.

Furthermore, paper-based reporting of RI data lack adequate data security and storage as shown by findings from the study. This is because paper-based method of reporting is prone to loss, misplacement, damage by fire, water, insects among others. On the other hand, evolution and advancement of EIR has proven effective for storage, retrieval and timely reporting of RI data between facilities and appropriate authorities. This finding is in support of Nsubuga, Luzze, Ampeire, Kasasa, Toliva and Riolexus (2018) who reported that paper-based records of RI are prone to data security and storage challenges such as misplacement of records, damage of records by insects, water or fire. The finding of the study is also in line with Bosch-Capblanch, Ronveaux, Doyle, Remedios and Bchir (2009) who reported that paper-based reporting of IR data system lack appropriate data storage and security mechanisms. Hence, lack of quality IR data for decision making.

The study also shows that PHC workers in Kaduna state are willing to be trained and use EIR for RI reporting. Routine Immunization data reporting is a major issue in developing countries including Nigeria. However, EIR is recommended by international agencies for effective reporting of RI data. The knowledge and attitude of health workers are important for effective use of EIR (Seymour, Werner, Mwansa, F.D; Bulula, Mwanyika, Dube, Taliesin & Settle, 2019). It is interesting to know that this current study reveals the willingness of PHC workers (100%) for training and use of EIR. The finding of the study corroborates Adeleke, Salami, Achinbee, Anamah, Zakari and Wasagi (2015) where health workers desired to be trained and utilise electronic

information technology for data reporting. The finding of the study also corresponds with the findings of Gour and Srivastava (2010) which reports desire of health workers on electronic health information system training and utilisation at PHC facilities in India.

5. Conclusion and Recommendations

Findings from the study established that PHCs employ paper-based system for reporting RI data and this is associated with specific challenges including time and effort required in reporting paper-based RI data, cost of reporting and security and storage issues. The study also shows poor knowledge of PHC workers and unavailability of EIR for RI data reporting in Kaduna State. However, all the respondents indicated interests to be trained on EIR and the use. Hence, the need for the implementation of EIR in PHC facilities for efficient RI reporting.

Based on the findings of the study, the following recommendations are made:
1. Advocacy to government for adoption of EIR in PHCs for RI reporting.
2. Government should procure and implement EIR for RI data reporting to replace paper-based reporting in PHC.
3. Capacity building should be provided for PHC workers on the use and maintenance of EIR.

References

Adeleke, I. T., Salami, A. A., Achinbee, M., Anamah, T. C., Zakari, I. B., and Wasagi, M. H. (2015) 'ICT knowledge, Utilisation and Perception among Healthcare Providers at National Hospital Abuja, Nigeria', *American Journal of Health Research*, 3(1-1), 47-53. DOI:10.11648/J.AJHR.

Amarasiri, H.A.D.B., and Dorabawila, S.S.K.B.M. (2018) 'Does Electronic Medical Records make cost benefits to non-profit seeking health care institutes?' *International Journal of Scientific and Research Publications*, 8(5), 159-166.

Bosch-Capblanch, X., Ronveaux, O., Doyle, V., Remedios, V., and Bchir, A. (2009) 'Accuracy and quality of immunization information systems in forty-one low income countries', *Tropical Medicine* and *International Health*, 14 (1), 2-10.

Brown, D., Burton, A., Gacic-Dobo, M., and Karimov, R. (2014) 'A comparison of national immunization programme target population estimates with data from an independent source and differences in computed coverage levels for the third dose of DTP containing vaccine', *World Journal of Vaccines*, 4(1),18–23.

Burton, A., Monasch, R., Lautenbach, B., Gacic-Dobo, M., Neill, M., Karimov, R., Wolfson, L., Jones, G., and Birminghama, M. (2009) 'WHO and UNICEF estimates of national infant immunization coverage: methods and processes', *Bulletin of World Health Organisation*,   87, 535–541.

Cutts, F. T., Claquin, P., Danovaro-Holliday, M. C., and Rhoda, D. A. (2016) 'Monitoring vaccination coverage: defining the role of surveys', *Vaccine*, 34(35), 4103–4109.

Danovaro-Holliday, M., Ortiz, C., Cochi, S., and Ruiz-Matus, C. (2014) 'Electronic immunization registries in Latin America: progress and lessons learned', *Revista   Panamericana de Salud Pública*, 35(5-6), 453-457.

Dolan, S. B., Carnahan, E., Shearer, J. C., Beylerian, E. N., Thompson, J., Gilbert, S. S., Werner, L., and Ryman, T. K. (2019) 'Redefining vaccination coverage and timeliness measures using electronic immunization registry data in low and middle-income countries', *Vaccines,* 37(13), 1859-1867.

Gour, N. and Srivastava, D. (2010) 'Knowledge of computer among healthcare professionals of India: a key toward e-Health. *Telemedicine and e-Health'*, 16(9), 957-962. doi:10.1089/tmj.2010.0049.

Mott, M. (2018) *Evaluation of the better immunization data initiative-mid-term report*. Bill and Tanzania: Bill and Melinda Gates Foundation.

Namageyo-Funa, A., Samuel, A., Bloland, P., and Macneil, A. (2018) 'Considerations for the development and implementation of electronic immunization registries in Africa', *Pan African Medical Journal*, 30, 81. doi:10.11604/pamj.2018.30.81.11951.

Newton, T. (2015). *Intervention Spotlight: Electronic Immunization Registry*. PATH.

Nguyen, N.T., Vu, H.M., Dao, S.D., Tran, H.T., and Nguyen, T.X.C. (2017) 'Digital immunization registry: evidence for the impact of mHealth on enhancing the immunization system and improving immunization coverage for children under one year old in Vietnam', *mHealth [Internet]*, 19, 3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5547172/.

Nsubuga, F; Luzze, H; Ampeire, I; Kasasa, S; Toliva, O.B. & Riolexus, A.A. (2018) 'Factors that affect immunization data quality in Kabarole District, Uganda' *PLoS ONE,* 13(9), e0203747. https://doi.org/10.1371/journal.pone.0203747.

Pan American Health Organisation PAHO. (2019) *Immunization data: evidence for action. A realist review of what works to improve data use for immunization, evidence from low and middle-income countries*. Washington, DC: PAHO.

Pan American Health Organization (2017). *Electronic immunization registry: practical considerations for planning, development, implementation and evaluation.* Washington, DC*:* PAHO. *http://iris.paho.org/xmlui/handle/123456789/34865.*

Pan American Health Organization and World Health Organisation Regional Office for American (2017) *Electronic Immunization Registry: Practical Considerations for Planning, Development, Implementation and Evaluation.* U.S.A: Pan American Health Organization. https://iris.paho.org/bitstream/handle/10665.2/34865/9789275119532_eng.pdf#:~:text=Electronic%20immu nization%20registry%20%28EIR%29%20Confidential%2C%20populationbased%20information%20syste m,group%2C%20and%20geographical%20are a%2C%20and%20yields%20results%20.

Seymour, D., Werner, L., Mwansa, F.D., Bulula, N., Mwanyika, H., Dube, M., Taliesin, B., and Settle, D. (2019) 'Electronic Immunization Registries in Tanzania and Zambia: Shaping a Minimum Viable Product for Scaled Solutions', *Frontiers in Public Health,* 7, 218. doi: 10.3389/fpubh.2019.00218.

World Health Organisation. (2020) *Immunization coverage*. World Health Organisation. https://www.who.int/news-room/fact-sheets/detail/immunization- coverage.

World Health Organization. (2018) *Health Topics: Immunization*. World Health Organization. https://www.who.int/topics/immunization/en/.

World Health Organization. (2016). *Global Immunization Coverage Sustained in the Past Five Years*. WHO. http://www.who.int/immunization/newsroom/press/.