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Assessing the performance of the family folder system for collecting community-based health information in Tigray Region, North Ethiopia: a capture–recapture study

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ABSTRACT

Objectives To assess completeness and accuracy of the family folder in terms of capturing community-level health data.

Study design A capture–recapture method was applied in six randomly selected districts of Tigray Region, Ethiopia.

Participants Child health data, abstracted from randomly selected 24 073 family folders from 99 health posts, were compared with similar data recaptured through household survey and routine health information made by these health posts.

Primary and secondary outcome measures Completeness and accuracy of the family folder data; and coverage selected child health indicators, respectively.

Results Demographic data captured by the family folders and household survey were highly concordant, concordance correlation for total population, women 15–49 years age and under 5-year child were 0.97 (95% CI 0.94 to 0.99, p<0.001), 0.73 (95% CI 0.67 to 0.88) and 0.91 (95% CI 0.85 to 0.96), respectively. However, the live births, child health service indicators and child health events were more erratically reported in the three data sources. The concordance correlation among the three sources, for live births and neonatal deaths was 0.094 (95% CI −0.232 to 0.420) and 0.092 (95% CI −0.230 to 0.423) respectively, and for the other parameters were close to 0.

Conclusion The family folder system comprises a promising development. However, operational issues concerning the seamless capture and recording of events and merging community and facility data at the health centre level need improvement.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The use of different data sources for comparison is a strength of the study.
⇒ The 2016 Ethiopia Demographic and Health Survey, reflecting some years before the study, may limit its direct comparability in terms of time.
⇒ Which one of the three data sources are more reliable is unknown.
⇒ The causes for erratic records between the three data sources are not investigated.

BACKGROUND

Health information system, is a crucial and interconected component of the six essential and interrelated building blocks of a health system.[1] Reliable and timely health information serves various functions.[2] Individual-level or patient-level data are crucial for clinical decision-making by healthcare professionals, and health facility level data are used to make decisions related to staffing and other resource needs. In addition, population-level aggregated data are important for planing and monitoring the progress towards national and the sustainable development goals (SDGs).[3]

Health management information system (HMIS) has been established in almost all countries[4 5] including Ethiopia.[6] The HMIS consistently gathers real-time data pertaining to health service delivery at the health facility level, which can be useful for decision making on matters related to health facility, evaluations of programmes and policies directly affecting care provided at facilities.

However, the HIMS in Sub-Saharan African countries (SSA) gnerally lack a comprehensive operation at an individual levela on a national basis. Consequently, the HMIS tend to overlook individuals who face barriers to accessing health services, often the population that is most in need of interventions. As a result, information about population health in SSA countries relies on combination of divers sources, such as the Demographic and Health Survey (DHS)[7], local population surveillance sites, such as

INDEPTH[8] and estimates derived from these patchy sources, for example, UN agencies, Global Burden of Disease.[9]

These surveys provide required information for macro-level planning, and monitor the SDGs, yet they are limited in power for subregional-level estimates. As a result, much less is known about the mortality rate and causes of deaths at sub regional level. [10] In addition, their use for planning and timely decision-making is limited by the long period between surveys.[11]

Starting from this basic lack of population-based data, and weak national vital event registration system, Ethiopia has invested in establishing a Community Health Information System (CHIS), in order to collect household and community-level health data relevant for local level planning and monitoring, thereby, complement the facility-based HMIS and oduce a population-level aggregated data for decision-making at regional and national level.[12 13]

The CHIS is based on data recorded in a paper health register (A4 paper pouch), called family folders (FFs). At the outset, all houses within a health post (smallest health facility) catchment area were numbered sequentially with a five-digit unique identifier number and one FF was created for each household. The front and back side of the FF provide information on household characteristics such as availability of latrine, hand washing, waste disposal facility, long-lasting insecticide treated nets, and source of drinking water.

Health cards generated for the mother and their under-5 year child (U5C), and one for each family member above 5 years are also kept inside the FF pouch, used for recording reproductive, Maternal, Neonatal and Child H health (RMNCH) services, illness and treatment provided to individual members of the householdre. The FFs are stored at the local health posts, according to the identifier number for quick retrieval. In general, when taken as a unit, the FF provides a quick yet comprehensive overview of the health services a family is receiving, alongside the household's characteristics.[14 15]

Tigray has a cadre of more than 16 000 female Health Extension Workers (HEWs), 10th grade school leavers who received a 1-year training on the Health Extension Program (HEP), which focuses on health promotion, disease prevention and treatment of common illness. Two HEWs are assigned to each health post, provide HEP for a population of approximately 3500–5000 (living in approximately 1000 households) through static, household visit and community level intervention.

Initially, they were expected to carry the respective household's FF along to each subsequent monthly household visit to update household-level health data and record new information.[16] However, carrying large numbers of bulky folders during the household visit was proved to be a practical obstacle, and the HEWs were given a logbook for recording data during visits, so that they would transcribe the events from the logbooks back into the FFs at the health posts.[13]

The CHIS, therefore, comprises the process in which household and community health data are collected and registered in the FF, and the summary reports made by each health post to their associated health centre on a monthly basis, which in principle, the data source should be the FFs. The CHIS reports are then aggregated and merged with the facility-based data at the health centre and forwarded on to district health offices, and up to the Regional Health Bureau and Ministry of health.

Therefore, after 1-year implementation of the FF-based CHIS, it is important to evaluate its effectiveness and reliability of the contents of the FF. As such, there is nothing that highlights the quality of data more starkly than maternal and child health . Hence, from the perspective of providing reliable community-based data, we assess the contents of FFs and the process by which data can be aggregated upwards through the health system to enable effective planning.

METHODS

The study was undertaken in six randomly selected rural districts of Tigray Region, North Ethiopia, where similar studies have been conducted,[17] namely, Welkayit, Laelay Adiyabo, Tahtay Maychew, Saesi Tsaeda Emba, Hintalo Wajirat and Raya Alamata, each representing the rural administrative zones of the region.

A capture–recapture method[18 1920] were applied as a means of comparing selected indicators captured from the FF and compare with the same data elements collected through household surevey and the HMIS report, thereby providing an understanding of the performance of FFs for collecting community health information.

Patient and public involvement

None.

A total of 134 health posts, managed by 35 health centres in the 6 districts were considered for inclusion in the study. However, 11 health posts that are physically part of their respective health centre, 11 health posts in Welkayit district that had not fully implemented the FF system at the time of the assessment and 13 health posts that did not complete the survey process were excluded, leaving 99 health posts (under 33 health centres), as participants in the assessment.

Relevant indicators defined to cover one year period prior to the study (from 10th November 2014 to 10th November 2015), encompassing 1) demographic data including the total household populatiomaternal, women of reproductive age (15-49 years) (WRA), U5C and live births, 2) child health service indicators, such as,the proportion of live births who received with four or more Antenatal care (ANC) visits, postnatal care (PNC) within 48 hours of birth and the first dose of pentavalent vaccine (PVV) and 3) child health events indicators, such as, stillbirths, neonatal deaths and U5C deaths, were selected for this assessment.

At these 99 health posts, a 1 in 4 sample of the FFs were selected, following the first random FF selected using a lottery method, and included in the assessment. A group of first degree and above graduate health workers from the nearest health centre, who would not routinely work with the FFs, and received a 2-day training on the data collection, abstracted the data elements from the family folder on to specially designed data extraction sheet.

The same staff visited the corresponding households and interviewed the household heads to recapture the same data elements that had already been extracted from the FFs over the study period, without referring to the FF data. Similar data elements extracted from the routine Regional Health Bureau report, of the same 99 health posts over the same time period (covering the complete unsampled population) provided the third data source for comparison.

For the purposes of the current evaluation, a range of parameters was selected for detailed analysis. The PASW Statistics V.21.0 (SPSS) was used to analyze the live births, child health services indicators and child health event indicators. Concordance correlation coefficients as implemented in the Stata concord command[21] were used for comparisons between the three data sources: the FFs, a specifically designed Household survey (HHS), and routine health management information reports made by health centres.

Total population, WRA and U5C were compared between the FF and HHS counts. Since the regional HMIS uses census estimates of population and assumes universally that WRA and U5C comprise 23.5% and 14.6% of total population respectively,[22] no detailed comparison was possible on these population parameters in the HMIS data. The overall estimates for Tigray Region from the Ethiopia DHS 2016,[23] which applied retrospective sample survey methods during the first half of 2016, have also been used for comparison of selected child health coverage, where appropriate.

RESULTS

The analysis dataset comprised a total of 24 703 FFs sampled from 99 health posts, and 33 managing health centres, and the corresponding HHS data. Data were also available for the same 99 health posts, based on the aggregation of their monthly HMIS reports for the same 12-month period, on a non-sampled basis. The locations of the 6 districts and the catchment areas of the 99 health posts sampled within the Tigray Region are shown in figure 1.

As shown in table 1, the total population covered according to the FFs was 120 390, and the corresponding number in the HHS was 114180. Apart from a small number of health posts showing discrepancies, as shown in online supplemental table 1, agreement on overall population between the FFs and HHS was high, with concordance correlation at health post level 0.81 (95% CI 0.74 to 0.88, p<0.001), and at health centre level 0.97 (95% CI 0.94 to 0.99, p<0.001). Figure 2 shows the correlation between total population detailed in FFs and the HHS at health post, health centre and district levels, with the same colour coding by district as used in figure 1.

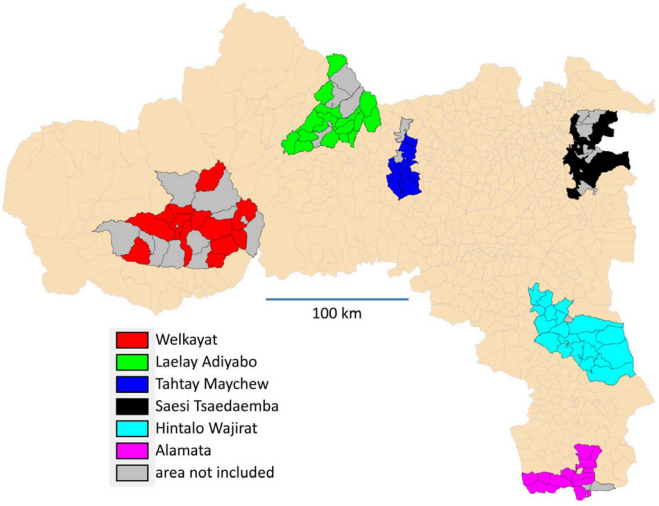

Figure 1 Map showing the six sampled districts in Tigray Region, with shading showing the catchment areas of the 99 surveyed health posts.

More WRA were recorded in the FFs (27 118) than in the HHS (19 192) and fewer U5C recorded in the FFs (11 022) than in the HHS (12 717). The concordance correlation at health centre level for these parameters was 0.73 (95% CI 0.67 to 0.88, p<0.01) and 0.91 (95% CI 0.85 to 0.96, p<0.05), respectively.

Live births during the 1-year period reported in the FFs and HHS were 1101 and 1919, respectively, concordance correlation 0.094 (95% CI −0.232 to 0.420). Live births reported in the FFs and HHS also varied considerably by health centre, seven health centres reported more live births in FFs than in the HHS, and three health centers zero live births in FFs. The live births reported on a non-sampled basis in the HMIS were 10692 of which a 1:4 sample in principle would amount to 2673 (figure 3)

Child health service related to live births, that is, proportion of live births who received four or more ANC during pregnancy, PNC within 48 hours after birth and one dose of PVV, were more erratically reported both in FFs and in the HHS (online supplemental table 2). Overall, 54%, 19% and 66% of live births were reported to have received at least four ANC visits, according to FFs, HHS and HMIS reports, respectively. The live birts who received PNC visits within 48 hours of delivery were 30%, 38% and 47% according to FFs, HHS and HMIS reports, respectively.

The live births receiving the first dose of PVV according to FFs, HHS and HMIS were 80% and 46% and 159%, respectively. Although vaccine coverage is more usually measured against the population of 12-23 months child, we analysed the coverage of first dose of PVV against the same live birth denominators as used for other parameters, for ease of comparison. Hence, the over report

Table 1 Summary of data captured by the family folder (FF), household survey (HHS) and the Health Management Information System (HMIS) aggregated at district level (health centre level aggregated data is shown in online supplemental tables)

Indicators	Data source	District						
		Welkayit	Laelay Adiyabo	Tahtay Maychew	Saesi Tsaeda Emba	Hintalo Wajirat	Raya Alamata	Total
Demographic data (Number)								
Total population	FF	17534	19995	20556	22471	25975	13859	120390
	HHS	14566	18332	19999	21276	26217	13790	114180
Reproductive age women (15–49 years)	FF	4010	3835	4672	5245	5937	3419	27118
	HHS	2462	2439	3226	4048	4409	2608	19192
Children under 5 years	FF	1946	2098	1349	1906	2527	1196	11022
	HHS	2216	2220	1945	1736	3096	1504	12717
Live births	FF	87	211	174	341	207	81	1101
	HHS	343	213	336	273	544	210	1919
	HMIS	435	1675	1733	2162	2829	1858	10692
Deaths per 1000 live births								
Stillbirth	FF	0.0	14.0	32.3	3.9	0.0	70.3	19.0
	HHS	37.9	10.5	35.8	11.4	13.6	28.7	21.0
	HMIS	9.1	15.8	11.3	16.4	18.7	18.6	13.0
Neonatal deaths	FF	0.0	9.7	22.9	8.8	9.6	24.4	8.0
	HHS	11.7	23.6	21.8	12.3	17.2	14.3	6.0
	HMIS	6.6	5.6	0.0	1.1	2.3	42.7	8.0
Under 5 year child deaths	FF	46.1	28.3	57.5	29.2	38.7	37.3	37.2
	HHS	43.7	98.4	38.8	32.9	49.5	38.1	48.4
Child health service coverage								
% live births with four or more ANC visits	FF	90.4	24.4	29.4	33.5	30.2	29.4	54
	HHS	37.6	18.4	30.2	51.5	46.7	44.2	19
	HMIS	254.6	88.1	84.9	76.6	66.9	66.0	66
% live births received PNC within 48 hours after birth	FF	71.0	16.7	22.1	34.5	32.1	33.6	30
	HHS	20.7	12.8	27.5	50.1	45.7	44.1	38
	HMIS	120.4	56.1	62.9	88.1	73.5	69.6	47
% live births receiving first pentavalent vaccination	FF	148.0	121.0	95.4	82.7	108.3	113.0	80
	HHS	30.3	33.9	40.5	47.8	48.5	49.6	46
	HMIS	588.6	257.8	219.2	256.5	238.2	229.0	159

ANC, Antenatal care; PNC, Post natal care.

seen in the HMIS report could be partially due to the denomination by live births. However, all child health service indicators, were inconsistent and highly variable between data sources at health centre level, thus, the concordance correlations for these parameters, as shown in table 2, were close to 0. In this regard, the reason for lower coverage of child health services in the HHs is not clear. In reality, the coverage of these parameters should have been higher in the HHs report, as most women tend to report the services receive at all levels of the health facility.

In terms of child health outcomes, U5C deaths according to the FFs and the HHS were 41 (37.2 per 1000 live births) and 93 (48.4 per 1000 live births), respectively. Neonatal deaths were scantily reported in the three sources and erratically reflected in the HMIS . The neonatal deaths according to the FF,HHS and HMIS were 13 (31.7% of the U5C deaths), 34 (34.4% of the U5C deaths) and 25 (no U5C deaths report) respectively, translated as neonatal mortality per 1000 live births according to FFs, HHS and HMIS of 8, 6 and 8 respectively. Stillbirths reported in the FF,HHS and HMIS were 21 (19 per 1000 live births), 42 (21 per 1000 live births) and 139 (13 per 1000 live births), respectively. Many health centres also reported zero still births and neonatal deaths in one or more sources and others recorded very low numbers, consequently, there was no meaningful concordance between sources on this parameter, suggesting major deficiencies either in detecting or recording neonatal death events. Details of these mortality rates at health centre level are shown in online supplemental table 3.

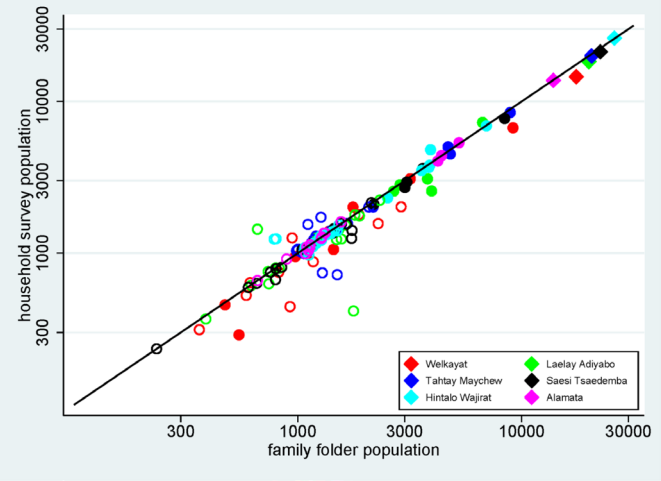

Figure 2 Population analysed as detailed in FFs and the HHS at health posts (open circles), health centres (full circles) and districts (diamonds) levels, against the line of equivalence. FF, family folder; HHS, household survey.

DISCUSSION

The FF -based CHIS is implemented for the first time in SSA, therefore, assessment at the early stages of implementation is important for understanding the strengths and weaknesses of the system so far. However, it was not clear from this assessment of the FF in relation to the HHS and HMIS reports made by the 99 surveyed health posts, as well as to wider comparisons with 2016 Ethiopian Demographic and Health susrevy (EDHS) estimates for Tigray Region, that any one source of information was obviously more reliable than others. Equally, there was no approach that failed consistently across all the parameters that were analysed.

Agreement on overall population demography data, between the FFs and HHS was high. The initial enumeration of households at the inception of the FF was rigorously undertaken through house-to-house visits, and the FFs were physically taken to each household and completed in direct contact with the households, which probably led to the close agreement seen between thedemographic data calculated from the FFs and the HHS. The slight discrepancies on WRA and U5C recorded in the FFs and the HHS could possibly be as a result of uncertainty around the age bounds.

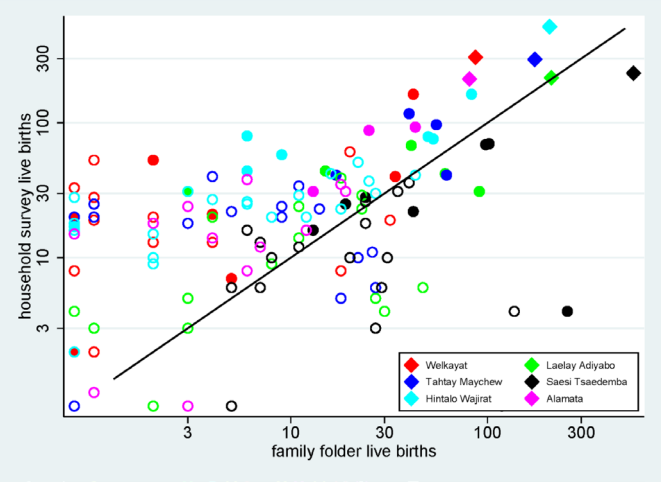

Figure 3 Numbers of live births, as detailed in FFs and the HHS at health posts (open circles), health centres (full circles) and districts (diamonds) levels, against the line of equivalence. FF, family folder; HHS, household survey.

The remaining parameters, including the live births, child health coverages and child health events were erratically reported and notably varry between the three data sources at health center level, hence there was no meaningful correlation in these parameters.

Despite of the inconsistency, the child health indicators recorded in the FF are more close to the EDHS 2016 estimate for Tigray. For instance, the live births wererecorded more consistently in the FFs (1101 live births, amounting to 4.0% of WRA, than in the HHS (1919 live births, amounting to 9.8% of women). According to the 2016 EDHS report, 5.0% of WRA in Tigray was pregnant at the time of the survey. Similarly, the FF and EDHS reported the live births who received at least 4 ANC (54% vs 55.8%), PNC within 48 hours (30% vs 31.2%) and first dose of PVV (80% vs 92.3) respectively. In this regard, the reason for lower coverage of live births who received at least four ANC and first dose of PVV in the HHS is not clear. In reality, the coverage of these parameters should have been higher in the HHS report, as most women tend to report the services received at all levels of the health facility.

The U5C mortality per 1000 live births estimated from the FF (37.2) and HHS (8 were lower compared with the 2016 EDHS estimate at 43/1000 live births for Tigray Region.[18 19] This aligns with prior researchs,which suggests that the reports provided by community health workers frequently underestimate neonatal and U5C deaths by 28%–80% and births by 55-70%, respectively.[24 25]

However, he most striking inconsistencies between the three data sources, were related to stillbirth and neonatal death reporting. Neonatal deaths were also scantly reported in the three data sources (less than 8 per 1000 live births) compared with the 2016 EDHS estimate for Tigray region at 34 per 1000 livebirths. In contrast, the post neonatal child deaths (1month-4 years) per 1000 live births reported in the (FF 25.4) and HHS (21.4) were consistent with the 2016 EDHS estimate at 25 per 1000 live births for Tigray Region. This suggests that the lower overall U5C mortality rate etimated from the FF and HHS is primarily attributed to the underreporting of neonatal deaths.

Irrespective of the FF process, events around births and neonatal deaths are very culturally sensitive events in many parts of Ethiopia, restricting mourning over the loss of newborn and discussion among the family or divulging such information to outsiders. [26 27] We also acknowledge the HEWs, being nominated from the same community, may be influenced by cultural norms that contribute to concealing the occurance of newborn babies losses, often leading to the underestimation of neonatal deaths.

Table 2 Concordance correlations between various parameters from FFs, HHS and regional Health Information Management System (HMIS), for catchment areas of 33 health centres

Parameter	Comparison	Concordance correlation	95% CI
Total population	FF versus HHS	0.966	0.943 to 0.989
Reproductive age Women	FF versus HHS	0.733	0.667 to 0.878
Children under 5 years age	FF versus HHS	0.906	0.852 to 0.961
Live births	FF versus HHS	0.094	−0.232 to 0.420
% of live births with four or more ANC visits	FF versus HHS	−0.013	−0.232 to 0.207
	FF versus HMIS	0.064	−0.246 to 0.374
	HHS versus HMIS	−0.043	−0.170 to 0.084
% of live births with postnatal visit within 48 hours	FF versus HHS	0.074	−0.220 to 0.621
	FF versus HMIS	0.069	−0.222 to 0.360
	HHS versus HMIS	0.137	−0.030 to 0.304
% of live births given dose of pentavalent vaccine	FF versus HHS	−0.026	−0.120 to 0.068
	FF versus HMIS	0.010	−0.191 to 0.210
	HHS versus HMIS	0.011	−0.021 to 0.043
Neonatal deaths per 1000 live births	FF versus HHS	0.109	−0.220 to 0.439
	FF versus HMIS	0.058	−0.285 to 0.401
	HHS versus HMIS	−0.046	−0.394 to 0.303
Stillbirth per 1000 live births	FF versus HHS	0.111	0.120 to 0.239
	FF versus HMIS	0.158	0.135 to 0.401
	HHS versus HMIS	0.146	0.312 to 0.503
Under 5 years child deaths per 1000 live births	FF versus HHS	0.258	0.235 to 0.501

FFs, family folders; HHS, household survey.

Misunderstanding of the correct classification between stillbirths and neonatal deaths among health professionals could be another explanation for the under reporting of neonatal deaths. For instance, the still births reported in the FF (19/1000 live births) and HHS (21/1000 live births) is nearly twice of the 2016 EDHS estimate 11.8 per 1000 live births for Tigray region [28]. This misclassification issue has been reported by a study condcuted in malawi as well.[29]

Acknowledging the cultural influences and the potential misunderstanding of classification, underreporting of neonatal deaths is not unexpected, yet efforts to improve methods and enhance the capacity of health workers to reliable ascertainment of these crucial events is vital from a health system perspective.[30]

A further challenge seen in this assessment is the accuracy with which aggregated HMIS data reflect community-based events registered in FFs. Although in principle the HMIS monthly reports should reflect both facility and community numbers, it appears that child health services are substantially under-reported in the HMIS, and live births receiving first-dose PVV fairly consistently exceed the number of births. This must either reflect incomplete counting of births or some degree of double-counting of services administered. A weakness of this study is that the 1:4 sampling of FFs at each of the 99 health posts makes direct comparisons between FF and HMIS numbers impossible. However, it is clear in many instances that HMIS numbers are not signifcantly different far from the FF orHHS numbers.

This observation aligns with the findings of revious data envelopment study, which at reported disparities between community-based and facility-based events in Tigray Region[31] and other parts of the country.[32] A studies conducted in India also suggest that health workers have a tendency to conceal low performace by under reporting child deaths and over reporting child health service intake as a major reason.[33] Regardless of the reason, this suggests the necessity for a careful consideration in integrating community-based data (originating from the FF system) with facility-based data (health centres and hospitals) to ensure that events are counted only once in aggregated reports.

The results of this study also showed that, while the health posts seemed able to adequately use the logbooks as source data for submitting their aggregated monthly HMIS reports, transcription from the logbooks to the FFs was quite sporadic in some cases. The practical obstacles around the transcription process may be a significant weakness of the CHIS, especially considering that if the information on the FF is out of date it cannot be used to

streamline the workflow of the HEWs and tailor health education to each household as originally intended.

The wide range of responsibilities to reach each household and difficulty to manually manage the large amount of data has been also reported as major obstacles of recording events in a timely fashion.[32 34 35] Welkayit district is the most geographically challenging and sparsely populated area covered in this study. Live births were particularly erratically recorded in the FFs, totalling only 87 for the whole district, vs 343 in the HHS. This in turn will also have affected the reliability of parameters denominated by live births for Welkayit district. The finding that the most geographically challenged area appeared to have particularly poor data in FFs possibly reflects a link between logistic challenges faced by HEWs and the quality of data in FFs.

The country is actively engaged in addressing these issues associated with the FF programme. The use of tablet technology was piloted nationally in 1000 health posts (including 41 of the 99 health posts analysed here) and underway of expansion. Efforts are also under way in Tigray to move from paper based to an electronic record keeping system and the HMIS/CHIS at district health office and above level is digitalised. Recognizing the importance of digital solutions in strengthening primary health care services in low and middle-income countries[36],it is hoped that direct electronic capture of data on the tablets during household visits will go some way to avoiding non-transcription of data into the FFs, as well as aggregation errors in compiling the monthly HMIS reports at health post level. However, the introduction of new technology is not always trouble-free. Thus, the improvements gained, and challenges need to be comprehensively evaluated, in the overall process of making HMIS a bottom-up system that reliably and consistently reflects population health at all levels.

CONCLUSION

The FF based CHIS and the large cadre of HEWs, who are primarily responsible for its operation comprise an exciting and promising development in a situation where otherwise no community-based health data are routinely recorded. The family folder-based CHIS has the potential to be a crucial tool for evidence based planning and monitoring progress towards the UN SDGs at all levels of the health system . However, there are significant obstacles which still need to be overcome to improve the functionality of the system. In particular, adressing operational issue of capturing events and recording them seamlessly within the records of the relevant household needs to improve. Further work is needed to capture sensitive events such as neonatal deaths reliably. Current considerations around digitalising the FFs are important but need to be evaluated very carefully before being scaled up.

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