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Does integration of health survey bring cost effectiveness into evidence generation in post conflict settings of Tigray, Ethiopia?

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Abstract

Background

Evidence generation in healthcare is increasingly hampered due to resource limitations in post conflict settings such as Tigray. As a result, funders are turning to new strategies to maintain cost containment while delivering high-quality evidence gathering. However, the cost effectiveness of integrated health survey in evidence generation in post war crisis remains unclear.

Objectives

The aim of this study was to compare the cost-effectiveness of integrated and unintegrated health survey in generating high-quality evidence in war affected settings.

Methods

To assess the mean cost, the cost of the integrated health survey was compared with the cost of unintegrated surveys. One sample t-test was used to analyze the data. The survey was integrated: 1) methodologically, a mixed cross-sectional design was used; 2) maternal and child health service indicators and COVID-19 vaccination included; 3) suspected cases of obstetric fistula and pelvic organ prolapses were linked to nearby health facilities; 4) data were collected from community and health workers; and 5) various stakeholders provided technical and financial resources. Six zones of the regions were included to get a total of 13,819 households from nineteen districts. A single structured questionnaire with 222 items was used and the data were analysed using R software version 4.3.2.

Results

The integrated health survey achieved a significantly decreased cost in evidence generation, p-value < 0.05. The comparison of cost effectiveness between the integrated and unintegrated health surveys results a t-value of 3.1944 and a p-value of 0.0248, indicates a statistically significant difference in their cost effectiveness. The lower p-value suggests that the observed cost effectiveness from integrated surveys was significantly different from the unintegrated surveys, with a high likelihood that this difference was not due to random chance.

Conclusions

The integrated health survey was likely to reduce cost as opposed to the unintegrated approach. Under resource constraints, doing an integrated survey with high quality would be a cost-effective strategy in evidence generation in post war crisis.

Key words: Cost effectiveness, integration, post war, Tigray

Introduction

Understanding how a war affects a person's ability to access health services is crucial in a post-conflict setting to guide recovery efforts [1]. Armed conflicts endanger communities and seriously harm infrastructure by upsetting transportation, healthcare, and educational systems [2]. The disruption of health services during a war has a devastating impact on vulnerable people, particularly women, children, and the elderly. The lack of access to maternity and child health services, chronic illness treatment, and vaccines preventable disease puts these individuals at higher risk of morbidity and mortality [3,4].

The conflict erupted in November 2020 in the Tigray region of Ethiopia has caused extensive damage to health facilities, depleted medical supplies, and led to the displacement of healthcare workers. Prior to the conflict, the region was able to build a health system that was comparatively more capable of delivering basic medical care and had made notable progress in terms of key indicators for service utilization and access [4]. The war has resulted in more than 70% of health facilities damage and significant number of deaths, extensive internal displacement, and over 70,000 migrants to the neighboring Sudan [4,5].

In the context of war and its aftermath, there is a rise in the number of people in need of healthcare because of the devastation of health infrastructure, the loss of health care personnel, the increased spread of infectious diseases, and the consequences of instability on people's ability to get to healthcare facilities. Because of this, government sectors and their stake holder are in a dire need of evidence, accompanied with the limited resources in hand. For this reason, it is crucial to compile and use research/survey data to produce evidence for a variety of purposes. The top priorities for producing timely evidence are understanding the state of the health system, mapping community problems, identifying urgent health needs, directing and executing action partners, mobilizing resources, and supporting policy makers in making well-informed decisions [6–8].

Furthermore, in a such situation the needs are diverse and more representative data is required. Thus, designing large-scale survey, large in terms of scope and sample size and generating timely evidence plays a pivotal role in collecting robust data to inform policies, programs, and interventions. As an option generating evidence with an integrated approach could be the one alternative. Integration in research improve understanding by synthesizing a number of different perspectives and it improve the application or implementation of research knowledge [9]. Along with this, the Demographic Health Survey (DHS) serves as a merely data source for developing countries. The DHS questionnaire addresses the following topics: introduction and survey methodology; housing characteristics and household population; respondent characteristics; marriage and sexual activity; fertility; fertility preference; family planning (FP); infant and child mortality; maternal health care; child health; adult and child nutrition; knowledge, attitudes, and behaviours related to HIV/AIDS; adult and maternal mortality; women's empowerment; violence against women; and female genital mutilation/cutting (FGM) [10].

Considering the viability of conducting DHS every five years and the urgency of the data for understanding the health status of the Tigray region following the signing of the peace agreement in Pretoria in November 2022. The Mekelle University College of Health Sciences (MUCHS), Tigray Health Research Institute (THRI), Tigray Health Bureau (THB), and other key stakeholders jointly launched an integrated survey in July 2023 to identify the behavioral and social drivers (BeSD) of maternal health services and statuses, namely Antenatal visit (ANC), delivery service, postnatal care (PNC), FP, Obstetric fistula (OF), Pelvic Organ Prolapses (POP), and child health services, mainly Integrated Measles Supplementary Immunization Activities (IMSIAs), Routine Immunization (RI), and COVID-19 vaccination campaigns. In this context, the theme of cost and effectiveness is technically adequate and viable to compare the cost of the integrated and unintegrated survey. Cost-effectiveness (CE) compared the costs and effectiveness of two or more program alternatives with similar objectives [11]. As a result, funders are turning to new strategies to maintain cost containment while delivering high-quality evidence gathering. It's still unknown, nevertheless, how cost-effective integrated evidence generation is in post-conflict settings. In light of this, this study aims to compare the cost-effectiveness of integrated and unintegrated health surveys in generating high-quality evidence in conflict affected and resource limited setting of Tigray region, northern Ethiopia.

Study setting and method of survey's integration

Study setting description

The study was conducted in Tigray region, Northern Ethiopia. Tigray borders on the north by Eretria, on the west by Sudan, on the south by Amhara, and on the east by Afar. The region have a total population of 7,969,000 [12]. The region's health

system consisted of two specialized comprehensive hospitals, 14 general hospitals, 24 primary hospitals, 231 health centers, and 743 health posts. The survey was conducted in selected 19 districts of the six zones of the region (excluding western zone for security reasons). Data were collected from August 1 to 30, 2023 [Figure 1].

Methods of survey's integration

Firstly, methodologically the quantitative survey with cross-sectional design, qualitative explorative approach, and review of data from health facilities on the service provision were conducted in parallel fashion. The quantitative data was collected from both community and health facility settings. The quantitative data from the community setting was employed to determine the BeSD of maternal and child health services and COVID-19 vaccination. Also, the health facility data gathered from a health post to a comprehensive specialized hospital to capture information on service provision, identifying challenges in provision of service, and establishing a referral linkage. Hospital health professionals (specialists, general practitioners (GP), nurses, midwives, laboratory technicians, anesthesia, physiotherapists, and dentist), health center (GP, health officer (HO), nurses, midwives, and laboratory technicians), and health post (health extension workers (HEW)) were approached. In addition, qualitative in-depth interviews (IDI), key informant interviews (KII), and focus group discussions (FGD) were conducted with the goal to construct targeted and evidence-informed social and behavioral communication interventions on the COVID-19 vaccination, explore challenges during conducting IMSIAs during the post-war period, and to identify lessons learned in conducting IMSIAs. Also, it aims to investigate the contextual barriers and facilitators to access maternal health services in general and care for women with OF and POP in particular.

Secondly, the survey covered a range of health indicators mainly maternal and child health services and COVID-19 vaccination. On the maternal and child health services, the survey covered a range of maternal health services mainly ANC, delivery service, PNC, FP, OF, POP, and child health service mainly IMSIAs and RI. For the quantitative community setting, data were collected from adults (women and men aged 18 and up) to determine the COVID-19 vaccination acceptance and uptake, and women aged 15 and above for OF and POP to collect information on determining whether the women had OF and/or POP, whether treatment was sought, and the type of treatment sought in addition to the maternal health services utilization if they are eligible. Also, mothers/caretakers with children aged 0-59 months were targeted for IMSIAs to collect data on measle vaccination [6-59 months old children], catchup routine immunization [0-23 months old children], nutritional screening [6-59 months old children], pregnant and lactating women [PLW], Vitamin A Supplementation [6-59 months old children], Deworming [24-59 months old children] and COVID-19 vaccination for caregivers. In keeping with this, mothers/caretakers with children aged 0-23 months were approached to collect data on RI. The RI includes BCG, OPV, PCV, Penta, IPV, Rota, measle, and full immunization coverage.

Thirdly, suspected cases for OF and POP amid the survey were linked with nearby health facilities for confirmation and management/treatment if verified. During the survey women's who were suspected to OF and POP based on the standard questionnaire were linked to the nearby health facility for confirmation and referral if needed. On the top of that, those women who were confirmed for OF were referred to Mekelle Hamlin fistula center. In addition, an expert from Mums for Mums (MfM), Mekelle Hamlin fistula center and MUCHS made a two-round visit for confirmation of women suspected for OF and POP. Also, capacity building was given to staff working at hospital including Obstetrics and Gynecology (OBY-GYN) specialist to handle and mange women with POP under their catchment hospitals. Such activities also in place to reach for all the suspected women with OF and POP that was found in the integrated survey and during campaign of COVID-19 and Human Papilloma Virus (HPV) vaccination campaign that was conducted following the integrated survey to explore more suspected women for OF and POP in the entire region.

Fourthly, data were collected from both community members and health workers. Regarding the data from the community setting, the data for all domains were designed to be collected from eligible participants in each household and all questions were integrated to a single data collection tool. A structured questionnaire was used to collect the quantitative data with questionnaire that contain 222 items on socio-demographic, war-related factors, morbidity, mortality, displacement, malaria, COVID -19 vaccination, ANC, delivery service, PNC, FP, OF, POP, IMSIAs and RI. To collect the data a total of 129 data collectors (114 for the community-based survey and 15 for the health facility survey) with a health profession background (nurse, midwife, or health officer) and 27 supervisors with MPH qualifications were employed. The data was collected using Open Data Kit (ODK) after five days intensive training was

given to the data collectors and supervisors. The questionnaire was pretested in 5% of the study participants. Initially, the tool was developed in English, and then translated to Tigrigna. Furthermore, every attempt was made to keep the generated tool brief and concise in order to capture the stated goal of the investigations.

The community-based survey used a cluster sampling technique to approach the study participants by considering 80% of the Tigray population resides in rural areas. In the beginning, out of the seven zones in the region six zones namely Mekelle, Eastern, Central, Northwestern, Southern and Southeastern were included in the study. The whole Western Tigray and some parts of the Southern, Eastern, Northwestern and Central zones of the region were excluded due to security reason. Then except for Mekelle zone, each zone urban and rural areas was considered during the selection. The ratio for rural to urban in the region is 4:1. By considering the rural-to-urban ratio, 13 rural and 6 urban districts were selected from zones in the region including one sub city/district from Mekelle [Figure 1].

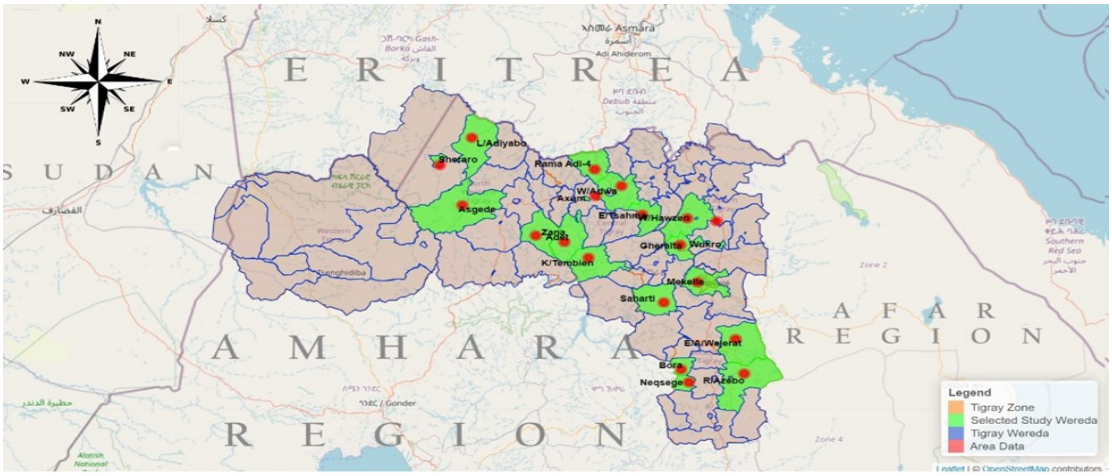

Figure 1: Map of the Tigray region for the integrated survey on behaviors and social drivers (BeSD) of maternal and child health services (ANC, delivery service, PNC, FP, OF, POP, IMSIAs, and RI) and COVID-19 vaccination, 2023.

Moreover, to include a say for the internally displaced people (IDP), 6 IDP sites were included from the zonal town of the region. These were Maychew from the South Zone, Mekelle from the Mekelle Zone, Adigrat from the East Zone, Axum from the Central Zone, and Shire from the Northwest Zone. Since, there was no IDP in the southeast zone, an extra one IDP site were included from Mekelle city. Thus, from each selected district three tabias were selected randomly. In the next step, from the selected Tabia, three kushet were randomly selected. Thus, a total of 57 kushet (51 at the community-level and 6 at the IDP site) were included. As a result, all households in a specified kushet and selected IDP were included. The data collection in the community-setting was started from the farthest household (HH) in the kushet to the nearest HH of the kushet usually nearby the health facilities (health post).

The sample size for this integrated survey was calculated based on Multiple Indicator Cluster Survey (MICS) [13]. These were BeSD of COVID-19 vaccination, maternal and child health service utilization (ANC, delivery service, PNC, FP, OF, POP, IMSIAs and RI). Accordingly, the calculated sample size was 13,819 households (HH) by considering the following parameters.

$$n = \frac{[4\,(r)\,(1-r)\,(f)\,(1.1)]}{[(0.12r)^2\,(p)\,(nh)]}$$

Thus,

- **n** is the required sample size, expressed as number of households, for the key indicator (Penta 3 coverage among children aged 0-11 months during conflict in Tigray region).
- **4** is a factor to achieve the 95 per cent level of confidence
- **r** is the predicted or anticipated prevalence Penta 3 during conflict in Tigray region (Penta 3 Coverage among children aged 0-11 months) =38.9% [14].
- **1.1** is the factor necessary to raise the sample size by 10 per cent for non-response
- **f** is the design effect =3.75
- **0.12r** is the margin of error to be tolerated at the 95 per cent level of confidence, defined as 12 percent of r (12 percent thus represents the relative sampling error of r) =0.12x0.389 =0.04668
- **p** is the proportion of the total population upon which the indicator, r, is based =2.96%=0.296
- **nh** is the average household size =4.4

$$n = \frac{[4\,(0.389)\,(1-0.389)\,(3.75)\,(1.1)]}{[(0.12x0.389)^2\,(0.0296)\,(4.4)]} = \frac{3.9217}{0.0002837959} = 13{,}819 \text{ households}$$

Overall, community kushet had an average of 250 HHs, then it gives an approximate sample of (51 kushet *250 HH= 12,750 HH) then adding 6 IDP site with an approximate of 300 HH per IDP provides an approximate of 1800 HH. Hence, the rough estimate of HH for the survey was 14,550 which almost similar with the calculated sample size using the MICS. However, not all kushet would have an exact of 250 HH and it would be high or less. Therefore, for this purpose we use the calculated sample size that was 13,819 HHs. However, all the parameters of the integrated survey would not have the same denominator as they have different source population. A detail description for each parameter of the integrated survey along with the denominator described in the table below. The participants were recruited from 13,819 HH with the assumption of one woman aged 15 years old and above. For the COVID sub-section, male adults were also included in every fifth HH to maximize representation of male adults in addition to the women participants [Table 1].

Moreover, to approach the study participants for the health facility-based study, the referral path way was followed. Initially, the hierarchy or level of hospitals (comprehensive specialized, general, and primary), health center and health post were considered to select the healthcare facilities; health facilities found in the selected tabiyas and their higher-level referral path way was included. A standard checklist was developed to collect data from health post to comprehensive specialized hospital based on the type of service/parameters. In addition, a total of 1541 health care workers from health post to comprehensive specialized hospital was approached to assess their vaccine intention, acceptance and uptake. Also, a health professional with different profession and working area were interviewed to collect information on the service they provided (ANC, delivery service, PNC, FP, OF, POP, IMSIAs and RI) [Table 1].

For the qualitative study, participants were purposively selected based on their eligibility criteria using maximum variation techniques to represent the views and experiences by sex, residence, as well as adults from host community versus IDP. FGD participants were kept being homogeneous in typical sociodemographic characteristics to balanced contribution of each participant in the discussion and to avoid dominance of a single or few participants. Key Informant Interviews (KII) were selected based on their wealth of information on the topic because of the professional role/responsibility. A semi-structured guides for the focused group discussions (FGD), in-depth interview (IDI) and KII informants was developed by experts from multidiscipline. The experts identified main questions and probing questions to be asked subsequently. The probing and follow-up questions were designed to uncover new insights, clarification on already raised points, and completion of listed opinions or experiences. Trained data collectors approached participants for discussion and interviews and identified appropriate place nearby to their living or working area for interview to enable the privacy of the participant was kept confidential and recording was possible without disturbance. For the FGD a total of 8-12 discussant were identified by keeping homogeneous for basic characteristics (sex, residence, occupational status and community/religious role). The FGD participants were given participants' ID from (code 1 to code 12), to avoid naming of themselves and other discussants while they reflect opinion. Each FGD lasted a maximum of 90 minutes, and a minimum of 45 minutes for the IDI and KIIs. FGDs, IDIs and KIIs were audiotaped along a field note annotated to each discussion/interview [Table 1].

Table 1: - Description of source population, and sample size for the quantitative (community and health facility) and qualitative data per services/parameters.

Parameter	Source population	Sample size		
		Community based Quantitative data	Health facility (HF) based Qualitative data	Qualitative data
COVID-19 vaccination	• Adult women and men • Health workers • Health facilities	• 16,800 (13915 women and 2885 men) • 1541 health workers	• 85 HF (Health post to comprehensive specialized hospital)	• 6 GFD • 7 IDI • 6 KII
POP	• Women age of 15 years and above	• 13,915	• 51 HF (Health post to comprehensive specialized hospital)	• 7 IDI • 7 KII
OF	• Women who ever gave live births	• 12803		
Maternal Health service	• Women of reproductive age group (15-49 years)	• 10,654		• 4 FGD • 4 IDI • 5 KII
IMSIAs	• Children aged 0-59 months	• 9044	• 72 HF (Health post to primary hospital)	• 4 FGD • 3 IDI • 5 KII
	• Households (HH) with children aged 0-59 months	• 7060 HH		
RI	• Children aged 0-23 months	• 3211		

Fifth, more importantly, technical, and financial resources were mobilized from diverse stakeholders. The integration consisted of Tigray health Bureau (THB), academic and research institutions staffs from Mekelle University College of Health Sciences (MUCHS) and Tigray Health Research Institute (THRI)), and key partners in the field (Mums for Mums, Tigray Filed Office of UNICEF, World Health Organization, UNFPA and Amref Health Africa). TRHB was supposed to oversee the overall process, mobilize resources, to provide structural support including committing human power to data collectors via its structure. MUCHS and THRI were responsible to lead the technical aspect of the research while the remained actors funded the survey.

Data quality control

As data quality control, the data collectors and supervisors were trained adequately, and regular supervision was put in place throughout the data collection period. A regular check-up for completeness and consistency of data was made in the field on daily basis. Paper-based items were transferred to the mobile-based application, which ensured a skip pattern. The application was user-friendly, allows control of the allotted time for a questionnaire, and enables the immediate transfer of collected data to the server and reduces error and time during data entry. Information technology (IT) professional and principal authors were assigned to assure the quality of data at the Mekelle University's server. The qualitative data was collected by experienced personnel by following strictly procedures during data collection, analysis, and interpretation of the data to ensure trustworthiness.

Data analysis

Descriptive statistics was performed based on the nature of variables. Mean and standard deviation was used to describe continuous variables and frequency and percentage was performed to describe categorical variables. The analysis was used a 95% confidence interval (CI) and p-value < 0.05 was used to declared statistically significant. After conducting data management and assessing the necessary assumptions, one sample t-test was performed to determine the cost effectiveness for doing research between integrated and unintegrated health survey types. The unintegrated survey cost includes the estimates for; 1) Assessment of IMSIAs during post-conflict period: achievements, challenges and learnt experiences; 2) ending the burden of POP and OF using a combined intervention in Tigray region, northern Ethiopia; 3) maternal health service utilization (ANC, delivery service, PNC, and FP); and 4) behavioral and social drivers of COVID-19 vaccination among adults and health workers. The routine immunization (RI) was included in the IMSIAs. The average budget consumption for the integrated survey was computed by dividing the total budget by the number of survey categories conducted i.e. IMSIAs, COVID-19, MCH, and OF and POP. Finally, the result of cost-effectiveness of the integrated and unintegrated survey was described with t-test, degree of freedom (*df*), p-value, the mean value of the unintegrated survey and adjusted risk with its 95% CI. R software version 4.3.2 was used to analyze the data.

Results

Budget description of the integrated versus and unintegrated survey

The mean cost of the integrated health survey was compared against the unintegrated or independent surveys. For the integrated survey, it costs 11,275,467 ETB to answer the objectives of behavioral and social drivers (BeSD) of maternal and child health services (ANC, delivery service, PNC, FP, OF, POP, IMSIAs and RI) and COVID-19 vaccination. Likewise, the total budget estimation for the unintegrated survey was 33,107,918 ETB with an average budget estimation of 8,276,980 ETB. The mean difference among the integrated and unintegrated surveys showed a difference of 5,458,113 ETB. In the unintegrated survey, 6,754,550 ETB was allocated for the IMSIAs survey, 7,941,780 ETB for the COVID-19 survey, 5,276,543 ETB for the maternal and child health (MCH) survey, and 13,135,045 ETB for the OF and POP survey. In unintegrated surveys, the largest budget was directed towards the ending the burden of POP and OF using a combined intervention, reflecting its broader scope or higher resource requirements compared to the other surveys. The COVID-19 survey also receives substantial funding, likely due to its critical importance and the extensive measures required for pandemic management. In contrast, the measles and MCH surveys receive comparatively lower allocations of budget, which may reflect either fewer anticipated costs or a different scale of operations [Table 2].

Table 2: - Budget estimation for the integrated and unintegrated surveys in Tigray region, northern Ethiopia, 2023

Health survey type		# of woredas	Sample size		# of data collectors	# of supervisors	Budget
			Quantitative	Qualitative			
Un-integrated survey	Assessment of integrated measles campaign implementation during post-conflict period in Tigray: Achievements, challenges and learnt experiences	19	9,155 children aged 0-59 months	12 IDI 6 FGD	57	19	6,754,550
	Behavioural and Social drivers of COVID-19 Vaccination among Adults and Health Workers	12	3600 adult people 1200 health workers	36 IDI 16 FGD	26	5	7,941,780
	Ending the burden of obstetric fistula and pelvic organ prolapse using a combined intervention in Tigray region, Northern Ethiopia: Pre-post interventional study	30	3384 women	38 IDI 8 FGD	32	4	13,135,045
	Maternal health service (ANC, delivery service, PNC and FP)	30	3384 women	16 IDI 8 FGD			5276543
	Total cost for the un-integrated survey						*33,107,918*
Integrated survey	Cost for the integrated survey	19	16,800 (13915 women and 2885 men) 1541 health workers	-14 FGD - 21 IDI - 23 KII	129	27	11,275,467
	Cost for the integrated survey						*11,275,467*

Cost effectiveness of budget for the integrated versus and un-integrated Health survey

The comparison of cost effectiveness was done among the average cost of the unintegrated surveys which was 8,276,980 (95% CI 2,839,312, 13,700,000) and the computed average value of the integrated survey which was 2,818,867 ETB. The mean difference among the integrated and unintegrated surveys showed a difference of 5,458,113 ETB. At 95% level of confidence, we have tested whether the average cost of the integrated survey was significantly different with that of the un-integrated survey. The test revealed a t-value of 3.1944 with a p-value of 0.0248 that indicates a statistically significant difference in their cost effectiveness. The lower p-value suggests that the observed cost effectiveness from integrated survey was significantly different from those of unintegrated surveys, with a high likelihood that this difference was not due to random chance. The positive t-value of 3.1944 supports the conclusion that integrated surveys offer greater cost effectiveness, likely due to efficiencies in resource use and cost savings from combining multiple survey components. This significant finding highlights that the integrated survey was more economically advantageous, justifying their implementation over unintegrated surveys, which require more extensive financial outlays for separate operations [Table 3].].

Table 3: Estimated one sample t-test coefficients to show the cost-effectiveness of the integrated and un-integrated survey in Tigray region, Ethiopia, 2023

Variables	t-test	P-value	Mean	Standard error	Standard deviation	95 % CI	
						Lower	Upper
Budget for the unintegrated survey	3.1944	0.0248	8,276,980	1,708,644	3,417,288	2,839,312	13,700,000

Discussion

The integrated survey that was aimed to collect data with multiple indictors using a very limited resource was cost effective as compared with the unintegrated survey. The integration survey collect data from randomly selected of 19 districts. The data was collected from community, health facility and internally displaced people (IDP). Integration was done in terms using different health indicators, setting (community and facility-based data), technical experts, and funding partner.

The fiscal requirements and priorities of the various health surveys are reflected in the different budget allocations. This study demonstrated that the integrated survey was cost effective when compared to the unintegrated survey. The total estimated budget allocated, 33,107,918 ETB for the unintegrated surveys and 11,275,467 ETB for the integrated survey, reflects the different scopes and levels of complexity of the two survey types. Based on its significantly larger budget, the unintegrated survey seems to entail more extensive budget cost. This could be due to a greater variety of activities, more logistical needs, or more time consuming in collecting data. On the other hand, because it has a smaller budget, the integrated survey probably makes use of resources already in place or it combines several survey components in one integrated survey. This allocation demonstrates a strategic budgeting where the integrated surveys are managed more cost-effectively through streamlined processes, while larger investments are made in more complex or expansive surveys. This implies that in a place like the Tigray region, which was discovered to be in a post-conflict state, the generation of data through an integrated survey while upholding the research principle would be timely and essential for developing health policies.

Furthermore, when comparing the integrated survey to unintegrated surveys, there are a number of financial benefits, especially when considering variations in coverage, sample size, and resource allocation. To be specific the unintegrated survey requires a large amount of qualitative data (168) and a sample size ranging from 3384 to OF and POP to 9,155 IMSIAs with extensive coverage of woredas ranging from 12 to the COVID-19 vaccine to 30 for OF and POP. On the other hand, despite its narrower scope, the integrated survey covering 19 woredas with an optimum qualitative data (45) and a quantitative sample size ranges from 3211 to RI and 16,704 to COVID-19 vaccination—benefits from operational and resource management efficiency. In general, the estimated 13,8,9 sample size reduces the expenses associated with logistics and data processing, and it is reasonable. Also, with employing 129 data collectors and 27 supervisors, the integrated survey may also significantly reduce costs (number of days for training, hall rent, IT personnel, refreshment cost, transportation cost etc) than handling independently for different research survey.

Research techniques like cross-sectional surveys can be used to gather data on people's conditions throughout the post-conflict period. It was acknowledged that a great deal of uncertainty and danger still faced by those impacted by the violence stems from the fact that many have returned to areas from which they may have previously fled, places that may lack basic amenities like infrastructure. These communities may continue to be impacted by sporadic shocks such minor conflicts, hyper-inflation and economic instability, and disease outbreaks [15]. Inline with this, seveal topics included in the integrated survey have a significant likelihood of being made worse by t he conflicts. These are malaria, disability, displacement, rape, mortality, maternal and child health services (ANC, delivery service, PNC, FP, OF, POP, IMSIAs and RI) and COVID 19-vaccination. These health services are severely impacted by a precarious situation that puts the elderly, children, and women at risk of impoverishment under constraint and exacerbates their preexisting problems. But, great care should be taken while doing research in a post-conflict environment to ensure the security and safety of study participants, data collectors, supervisors, and investigators. This is a critical matter that should come first [15].

Since high-quality data is the foundation of any empirical research, when gathering data for a study objective, whether separately or in an integrated manner, care should be taken to preserve the data's quality throughout the entire process [16]. A Salehynan suggests six steps for gathering conflict-related data. These include being methodologically correct and open about the sources used to compile the data, considering what might be missing from the sources that are already available, addressing potential biases in the sources that are used, developing clear coding guidelines and ensuring the accuracy of numerical values, thinking about using automated methods when analyzing large amounts of source materials, and making the data easily accessible to others [16]. In line with this, the integrated survey aims to ensure and oversee the entire research process with high quality to achieve the intended objectives. Quantitative and qualitative data were gathered from community and health facility sources among the randomly selected 19 districts within the region.

In order to create representative data, it also gathered data from the IDP. Strong supervision was also in place, along with a five-day intensive training for the supervisor and data collectors. The developed tool was pretested, and it was collected using an Open Data Kit (ODK). Also, Atlas.ti 7 and R software version 4.3.2 were used to analyze the qualitative and quantitative data, respectively. Ultimately, an endeavor will be undertaken to publish the study results in a peer-reviewed journal in addition to disseminate the finding to the stakeholders.

To solve a community issue, research must ultimately persuade policymakers, program administrators, and service providers to concentrate their efforts on the most critical evidence-based gaps. This will help to expedite the healing process of the health system by generating timely evidence. Consequently, an intervention mechanism was applied in this integrated survey to address obstetric fistula (OF) and pelvic organ prolapse (POP). After gathering data at the community level, data collectors use interviews to identify women who may be OF or POP suspects. Women who were suspected of having OF and POP were therefore referred to a nearby health facility for confirmation and improved care. In addition, a local data collector was chosen, trained, and assigned with gathering data at their catchment in order to improve the referral linkage. All things considered, using local data collectors would greatly benefit next efforts including the correlation of the subjectively gathered data to objectively confirm these cases.

Conclusions and recommendations

Our findings suggest that integrated survey was likely to reduce cost as opposed to the unintegrated approach. To provide stronger evidence for policy decisions about cost-effectiveness in post-war crisis settings, more economic evaluation should focus on methodological concerns. Under resource restrictions, doing research with integrated survey would be a cost-effective strategy in evidence generation in post war crisis. However, maintaining the quality of the survey should also be a part of conducting an integrated survey.

Declarations

Ethical considerations

Before conducting the actual research an ethical clearance was obtained from the Institutional Review Board (IRB) of the Tigray Health Research Institute (THRI). A letter of support was obtained from Tigray Health Bureau (THB). Oral consent was obtained from each participant of the integrated survey (quantitative and qualitative).

Abbreviations and acronyms

Amref Health Africa:- African Medical and Research Foundation; ANC:-Antenatal Care;- BeSD:- Behavioral and Social Drivers; CE: Cost-Effectiveness; CSA:- Central Statistical Agency; DHS:- Demographic Health Survey; ETB:- Ethiopian Birr; FGD:- Focused Group Discussions; FGM/C:- Female Genital Mutilation/Cutting; FP:- Family Planning; IDI:-In-depth Interview:- Internally Displaced People; IMSIAs:-Integrated Measles Supplementary Immunization Activities; IRB:- Institutional Review Board; IT:- Information Technology; KII:- Key Informant Interviews; MUCHS:- Mekelle University College of Health Sciences; MfM:- Mums for Mums; ODK:- Open Data Kit; OF:- Obstetric Fistula; POP:- Pelvic Organ Prolapse; RI:-Routine Immunization; THB:- Tigray Health Bureau; THRI:- Tigray Health Research Institute; UNFPA:- United Nation Population Fund; UNICEF:- United Nation Children Fund; WHO: World Health Organization.

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Data Availability

All data available in the document

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Conflict of interest

None.

Authors Contribution

MA conceived and designed the experiments: FH, TW, AA, AAM, ZHK, LM, AA, MKC, RS, DM, GGM, MY, AY, MA, HK, HG, TH, FG, AA, KD, MT, MW, AG, BA, AAD, HG, GG, AH, RE, TB, HH, AG, TT, AA and AMG performed the experiments: MA and DM Analysed the data: AAM and AMB approved the final manuscript.

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