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Evaluation of diarrheal disease surveillance in the Minawao refugee camp, Cameroon, 2016

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ABSTRACT

Background: Between 2013 and 2015, the Minawao refugee camp in Cameroon received about 51 000 refugees fleeing Boko Haram. A rapid increase in population and inadequate sanitary installations increase the risk of diarrheal disease. This study was performed to assess the structure and attributes of the surveillance system in Minawao.

Methods: Updated US Centers for Disease Control and Prevention guidelines were used to evaluate the public health surveillance system. Information sources included health registers, surveillance reports, and key informant interviews. Scorecards were used to assess the simplicity, flexibility, data quality, acceptability, sensitivity, timeliness, stability, and usefulness of the system.

Results: Surveillance in Minawao is both passive and active, integrating four diseases reported weekly/immediately. All key informants agreed that surveillance was part of their routine work. Of 138 surveillance reports reviewed, all were complete; 91 (66%) were timely. Overall, 143 (100%) cases of diarrheal disease identified in health registers were reported to the next level. Only two (20%) surveillance personnel could correctly state standardized case definitions (SCD); three (30%) were unable to identify cases of diarrheal disease based on SCD.

Conclusions: In Minawao, diarrheal disease surveillance is acceptable, flexible, sensitive, and useful. To improve timeliness and the use of SCD, we recommend the use of mobile phones to report and display SCD in health facilities.

Introduction

Infectious diarrheal diseases are a major cause of morbidity and mortality worldwide. In Cameroon, 15% of deaths among children under 5 years of age are attributable to diarrheal diseases (WHO Department of Evidence, Information and Research, Maternal and Child Epidemiology Estimation (MCEE) Group, 2016). Cameroon adopted the integrated disease surveillance and response (IDSR) strategy in 2005 (Ministry of Public Health of Cameroon and World Health Organization (WHO), 2011). The IDSR strategy is used for the surveillance of diarrheal diseases in Cameroon.

Humanitarian emergencies are complex situations that usually result in dramatically increased risks of morbidity and mortality in the affected population (Coulombier et al., 2002). Effective disease surveillance and outbreak investigation can help direct public health interventions (Elias et al., 1990). However, disease surveillance during humanitarian emergencies can be challenging. The Minawao refugee camp was created in Cameroon in July 2013 following the Boko Haram insurgency, which led to a massive influx of refugees from neighboring Nigeria and internally displaced persons within the Cameroonian territory (United Nations High Commission for Refugees (UNHCR), 2016). The Minawao refugee camp is located about 70 km from the Nigerian border. The occurrence of a cholera outbreak within the Minawao camp in 2014, with 53 recorded cases and five deaths (case fatality rate = 9.6%), underscored the need for a highly sensitive surveillance system that could rapidly detect and respond to epidemics. Specifically, the rapid agglomeration of this vulnerable population and the inadequacy of the sanitary installations highlighted the

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need for a proficient diarrheal disease surveillance system within the camp.

This study was performed to describe the structure and assess the attributes of the surveillance system for diarrheal diseases in the Minawao refugee camp, in order to ensure adequate functioning in this challenging setting.

Methods

System structure and attribute evaluation

An evaluation was conducted in the Minawao refugee camp, Far North region of Cameroon (Figure 1), for the January 2014 to December 2015 data collection time period. The US Centers for Disease Control and Prevention (CDC) updated guidelines for evaluating public health surveillance systems were followed (German et al., 2001). Information sources included health registers, surveillance reports, and key informant interviews. Key informants were all health staff from the Mokolo Health District Office (MHDO) and health facilities within the Minawao camp who conducted epidemiological surveillance activities. All consenting health personnel (working for either the private or public sector) were interviewed. A semi-structured questionnaire was used as a guide during key informant interviews to obtain information on the structure, purpose, and usefulness of the surveillance system, as well as resources used to operate the system. Scorecards were used to assess the simplicity, flexibility, data quality, acceptability, sensitivity, timeliness, and stability of the system. Table 1 shows the elements used to assess each surveillance system attribute. Direct observation and a review of the archives were used to confirm the existence of required working tools (case definitions, health facility registers, notification sheets, sample collection material).

Data management

Questionnaires were checked visually for completeness, obvious errors, and inconsistencies. Data were entered and analyzed using Epi Info 7.0 and maps were produced using QGIS version 2.18.3 software. Descriptive statistics included frequencies and proportions for categorical data and means with standard deviations (SD) for continuous data.

Ethical considerations

The study comprised a retrospective analysis of routinely collected programmatic data and thus was exempted from formal review. Authorizations were obtained from the Ministry of Public Health in order to have full access to the data for intended analysis. Before the administration of questionnaires, informed consent forms

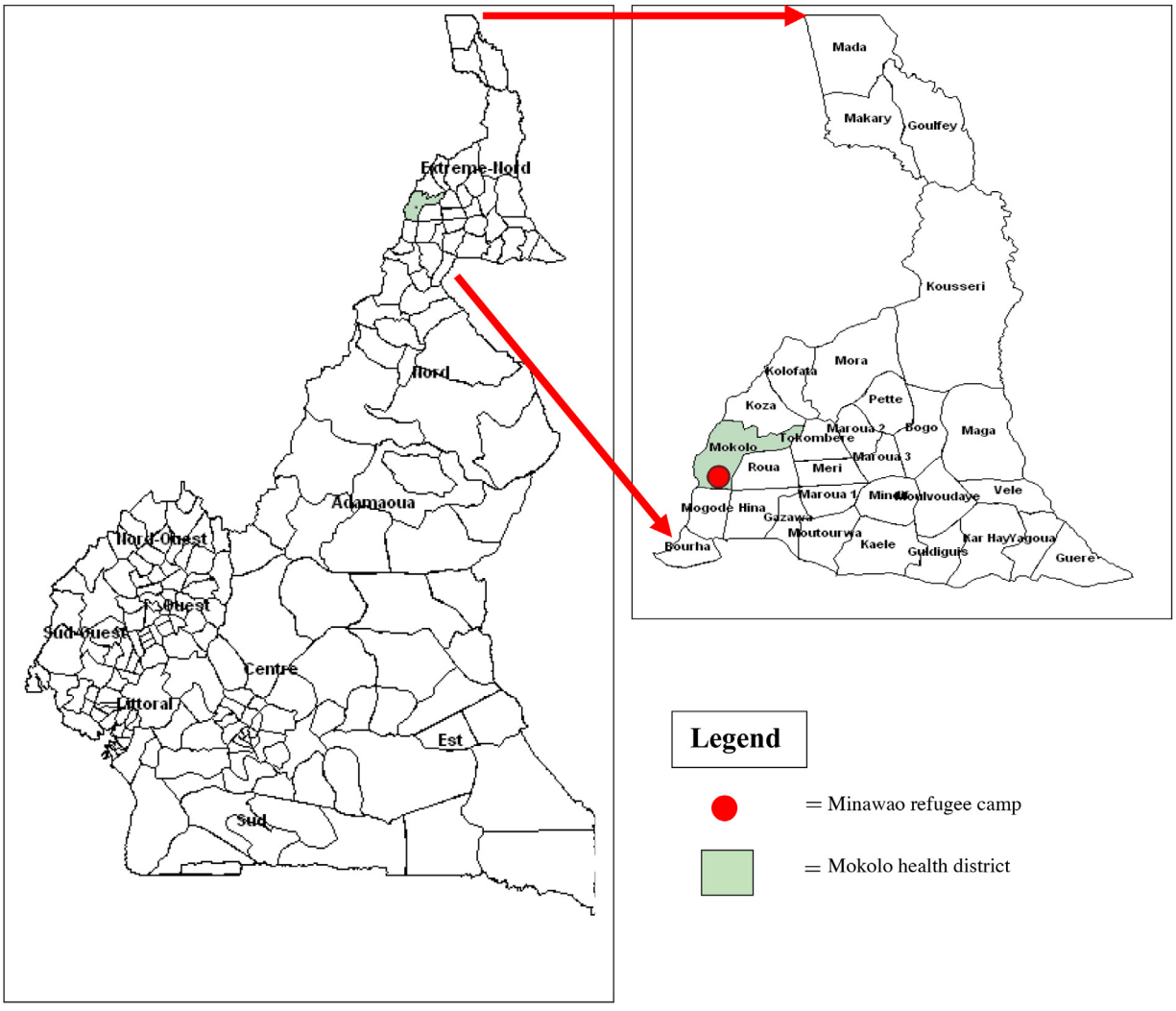

Figure 1. Situation of the Minawao refugee camp, Far North region, Cameroon, 2016. Map developed by the corresponding author using QGIS 2.18.3 software.

Table 1
Scores for the diarrheal diseases surveillance system attributes, Minawao Camp, 2016.

Attribute	Indicator	Expected value	Result	Score
Simplicity	The standardized case definition is correctly stated (the main part) by key informants	≥80%	20%	0
	Disease notification sheet is easy to fill in and available	≥80%	100%	1
	Next level of data transmission is clearly defined	≥80%	100%	1
	Cases are easy to recognize based on the case definition	≥80%	70%	0
	Average time spent filling in disease notification report	≤10 min	35 min	0
Score obtained (simple if ≥4)				2
Flexibility	IDSR report sheet allows for notification a disease/event other than diarrheal disease	Yes	Yes	1
Score obtained (flexible if ≥1)				1
Data quality	Percentage of 'unknown' or 'blank' responses to items on weekly notification sheets	≤10%	3%	1
	Case definitions used	Yes	No	0
	Clear hardcopy of surveillance forms available	Yes	Yes	1
	Percentage of weekly surveillance forms signed twice (double checked)	≥80%	0%	0
Score obtained (data quality good if ≥3)				2
Acceptability	Completeness of surveillance forms ≥90%	Yes	Yes	1
	Timeliness of surveillance forms ≥80%	Yes	No	0
	Proportion of personnel participating in surveillance ≥80%	Yes	Yes	1
	Proportion of key informants that consider surveillance activities as part of their routine work ≥90%	Yes	Yes	1
Score obtained (acceptable if ≥1)				3
Sensitivity	Proportion of suspected cases identified when reviewing logbooks and reported to next level	80%	100%	1
Score obtained (sensitive if = 1)				1
Representativeness	Proportion of weekly reports sent by the camp's surveillance sites from 2014 to 2015	90%	100%	1
Score obtained (representative if = 1)				1
Timeliness	Proportion of weekly reports transmitted to the district on time from 2014 to 2015	80%	66%	0
Score obtained (reactive if = 1)				0
Stability	Availability of a focal person for surveillance	Yes	Yes	1
	Proportion of personnel trained for disease surveillance	≥80%	70%	0
	Proportion of surveillance reports archived	≥80%	70%	0
	Availability of revised Integrated Disease Surveillance Guide and other data collection tool	Yes	No	0
Score obtained (stable if ≥3)				1

IDSR, Integrated Disease Surveillance and Response.

were signed by each participant. Confidentiality was maintained in the handling of service statistics and archived weekly reports.

Results

System structure and operation

The population under surveillance within the Minawao refugee camp was estimated at 58 000 inhabitants as of May 2016. The camp covers a surface area of 319 hectares and is divided into two main surveillance sites operated by the private sector (non-governmental organizations): one overseen by the International Medical Corps (IMC) and the other by Médecins Sans Frontières (MSF). Overall, 10 persons operate this surveillance system within the camp sites and the MHDO. Each site has a formally designated epidemiological surveillance focal person and a deputy, who are supervised by the Camp Surveillance Officer (CSO). MHDO staff oversee activities of the CSO under the coordination of the district medical officer (DMO). The purpose of this surveillance system is the timely transmission of health information to create a rational basis for decision-making in the fight against diarrheal diseases.

Diarrheal diseases under surveillance include diarrhea with dehydration in children under five, Shigella dysentery (diarrhea with visible blood in stool), cholera (severe dehydration or death from acute watery diarrhea in a person aged 5 years and above), and typhoid fever (any person with gradual onset of steadily increasing and then persistently high fever, chills, malaise and sometimes constipation or diarrhea). Suspected and confirmed case definitions used are found in the revised National IDSR guidelines (Ministry of Public Health of Cameroon and World Health Organization (WHO), 2011).

Surveillance for diarrheal diseases is both passive and active. Weekly reporting is done as shown in the flow diagram in Figure 2. Site surveillance focal persons review registers of health facilities on Fridays and prepare reports of weekly aggregates. Aggregates from both surveillance sites are then compiled by the CSO on the IDSR report sheet. Reports are done in two copies, one of which is archived by the CSO and the other transmitted to the MHDO on Mondays by midday latest. In the event of the suspicion of an epidemic-prone diarrheal disease requiring immediate notification (e.g. cholera), the CSO will immediately alert the district's health authorities via telephone call or SMS, complete an individual disease notification form, collect the recommended laboratory sample(s), and ensure the sample is transported to the reference laboratory. The MHDO collates the IDSR reports received, analyses and forwards a synthesis on Tuesdays in paper format to the Regional Delegation for Public Health (RDPH). A copy of the synthesis is archived at the MHDO and an electronic copy is also stored on a computer, which is protected by a password. In order to ensure confidentiality, the keys to the archives and the password protecting the computer containing electronic reports are kept only by the DMO and his deputy. The RDPH, via the health information office, in turn compiles the data, performs an analysis, and transmits an electronic copy to the central level via e-mail. At the central level, the Department for the Control of Disease, Epidemics and Pandemics (DLMEP) is in charge of coordinating disease surveillance activities within the Ministry of Health (MoH). Every Thursday at midday, the DLMEP collates electronic reports and produces a consolidated national database, which is then shared with all stakeholders.

Evaluation of system attributes and usefulness

A total of 10 key informants were interviewed: seven nurses, two medical doctors (clinicians), and a logistician. Key informants all played roles in the detection and notification of cases. Medical

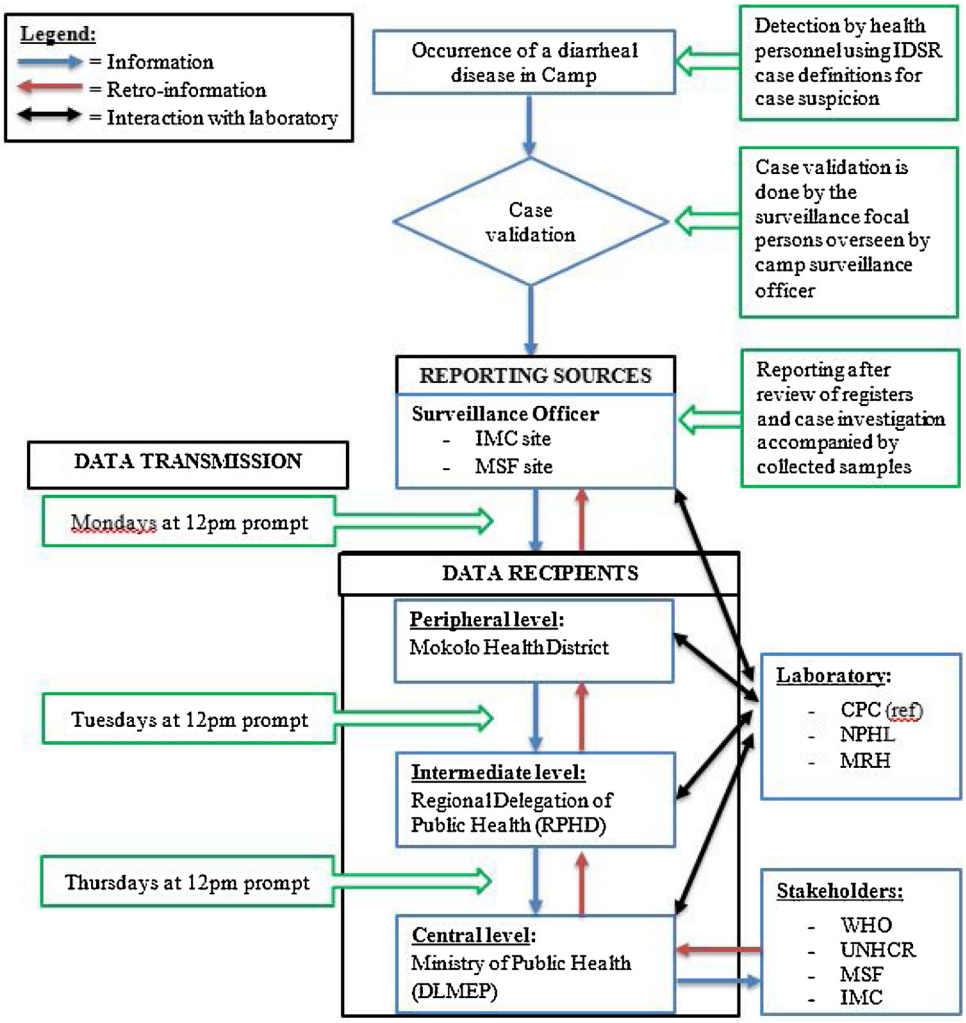

Figure 2. Information flow chart for the diarrheal disease surveillance system in Minawao refugee camp, 2016. (Abbreviations: DLMEP, Department for the Control of Disease, Epidemics and Pandemics; CPC, Centre Pasteur Cameroon; IDSR, Integrated Disease Surveillance and Response; IMC, International Medical Corps; NPHL, National Public Health Laboratory; MRH, Maroua Regional Hospital ; MSF, Médecins sans Frontières; UNHCR, United Nations High Commissioner for Refugees; WHO, World Health Organization.).

doctors conducted routine analysis of data collected and a logistician ensured availability of surveillance materials (weekly report sheets, individual disease notification forms, sample collection kits). Overall, four health registers were reviewed and data from 138 IDSR weekly report sheets were examined.

Simplicity

Almost all key informants (90%; $n = 9$) reported that the IDSR weekly report sheet was easy to fill in and could clearly define the next level of data transmission (Table 1). Standardized case definitions (SCD) were correctly stated by 20% ($n = 2$) of health personnel; 70% ($n = 7$) declared that there is not enough information in health registers to correctly identify cases based on SCD. None of the reporting sites in the camp had standardized IDSR health registers. The average time spent to completely fill in the IDSR weekly report sheet at camp level (not limited to the diarrheal disease section) was 35 min.

Acceptability and flexibility

Nine (90%) key informants considered surveillance activities as part of their routine work and all key informants agreed that IDSR weekly report sheets could easily integrate a new disease or other health-related event.

Data quality and sensitivity

Form completeness is the proportion of reports with all the variables filled in. Almost all (97%; $n = 134$) of the IDSR weekly reports at the camp level were completely filled in, although none was signed twice or endorsed by the CSO. IDSR guidelines were not available and case definitions were not displayed in consultation rooms. Completeness of reporting was calculated as the percentage of reports from the camp level received at the district level with respect to the number expected for the study period. Timeliness was the percentage of reports received on time. Completeness of reporting for the period spanning from 2014 to 2015 was 100% (138/138) and timeliness was 65.9% (91/138). Following the review of available health registers, 100% ($n = 143$) of the suspected cases of diarrheal disease compatible with the IDSR case definition were detected and notified by the surveillance focal person to the next level.

Stability

Seven (70%) of the 10 key informants had received formal training on IDSR (Table 1). Hard copies of weekly reports were available at all surveillance sites during the study visits, but only 70% (97/138) of filled in weekly reports were made available upon request at camp level. Materials for collection of laboratory

Table 2
Decisions implemented within the Minawao refugee camp.

Year	Number of actions taken on the basis of data collected via the surveillance system	Type of decision/action taken
2014	4	(1) Systematic organization of coordination meetings by the local cholera crisis committee (2) Mass anti-cholera immunization campaign (3) Hygiene and sanitation activities piloted by the community to reduce open air defecation (4) Institution of weekly epidemiological surveillance meetings by all stakeholders within the camp
2015	3	(1) Prepositioning of cholera management drugs (2) Round two of mass anti-cholera immunization (3) Construction of toilets and water-trucking to improve availability of potable water

samples (vials, individual disease notification forms, tracking sheets, rapid diagnostic tests, and transport media) were available at surveillance sites during the study visits.

Usefulness

Seven public health interventions/decisions were identified based on the analysis of data from the diarrheal disease surveillance system, which have been undertaken by the MoH and its partners (Table 2). Interventions range from setting up a district-level disease surveillance coordination committee to implementing reactive vaccination campaigns.

Discussion

Strengths of the Minawao refugee camp diarrheal disease surveillance system

The surveillance system for diarrheal disease at Minawao refugee camp has multiple strengths. First, the flow of information within the diarrheal disease surveillance system in the camp reflects the hierarchical structure of a health pyramid. This is important because various levels in the hierarchy will have the information they need for evidence-based decision-making (Ngwa et al., 2016). This also allows for verification and validation of information prior to onward transmission. Second, the surveillance tools used in the camp are standardized and the surveillance focal persons are the same persons in charge of reporting any epidemic-prone disease that may occur. This allows for easy integration of other diseases and reduces waste of resources. Third, the inclusion of the private sector (non-governmental associations) in the reporting system was a major structural strength that improved reporting completeness and hence representativeness. In addition, it was found that the system was both flexible and acceptable; most health personnel within the Minawao refugee camp participate in diarrheal disease detection and notification as part of their routine activities. Disease notification sheets were routinely filled in by surveillance focal persons and transmitted to the next level.

Challenges of the Minawao refugee camp diarrheal disease surveillance system

The system also faced some challenges. The operation of the system is not simple; most health personnel did not know SCD and some had difficulties identifying cases in hospital registers. Although SCD for diarrheal diseases exist at the national level, low penetration at the district level and unavailability in both national languages (English and French) have slowed their impact (Pond et al., 2011; Rumisha et al., 2007). Training of health personnel coupled with sustainable supervision and feedback, reliable communication, and the availability of simplified reporting tools could contribute to improved performance of the disease surveillance system (Sow et al., 2010). Also, displaying SCD in health facilities of the camp and using standardized IDSR health registers would make the system simpler. One of the best strategies to limit the effect of high attrition of personnel along with frequent turnover on training is to institutionalize IDSR training in regular public health curricula (CDC, 2003).

Beyond this, systematic review (double-checking) of the data collected by the system was not satisfactory. Implementing supervisory visits and regular review of IDSR weekly report sheets by the CSO was a challenge. Supervisory visits are conducted more frequently at the district and regional levels than at the facility level in most countries (Phalkey et al., 2015). Supportive supervision with checklists along with well-defined schedules at each level are recommended to improve IDSR performance and staff motivation (Gueye et al., 2006; Sathyanarayana, 2010). These visits associated with on-the-job training will improve the quality of data collected by camp surveillance focal persons.

Timeliness of reporting was also a challenge, as almost one-third of weekly reports were not forwarded on time to the next level. The use of hand-delivered, paper-based systems delayed reporting. The World Health Organization Regional Office for Africa (WHO AFRO) implemented the use of phones for reporting in Cameroon through a green line mobile fleet (free communication between users). The timeliness of the system could be improved with the use of mobile phones for diarrheal disease surveillance. Weekly reports could thus be communicated by phone call or SMS prior to transmitting hardcopies of the reports. The use of mobile phones has been shown to significantly improve the timeliness of reporting of key infectious diseases from primary health care to the district level (Quan et al., 2014).

The timeliness of outbreak detection (an identified IDSR indicator) could not be tracked due to inaccurate recording of dates of onset and response to the 2014 cholera outbreak. Decisions and public health actions implemented following analysis of the surveillance data attest to the usefulness of the diarrheal disease surveillance system in the camp. As archiving was a major challenge within the Minawao refugee camp, it was not possible to review health registers for the 2014–2015 period in order to better assess certain system attributes. Also, hardcopies of laboratory results for cholera cases were not available; as a result, laboratory results presented in this article were based on verbal reports by key informants.

Conclusions

In Minawao, diarrheal disease surveillance centered on the health pyramid is acceptable, flexible, representative, and useful. Several documented decisions/actions have been implemented

based on surveillance data. In order to improve timeliness and the use of SCD, we recommend that the CSO be included in the phone fleet for data reporting, the dissemination of national IDSR technical guidelines to the camp surveillance focal persons, and continuous formative supervision of surveillance personnel by the district level. In addition, displaying SCD in health facilities of the camp and using standardized IDSR health registers will make the system simpler.

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Declarations

Ethical approval and consent to participate: The study comprised a retrospective analysis of routinely collected programmatic data and thus was exempted from formal review. Administrative authorizations were obtained from the Ministry of Public Health, the Regional Delegation for Public Health of the Far North, and the Mokolo District Health Office. Before the administration of questionnaires, informed consent forms were signed by each participant. Confidentiality was maintained in the handling of service statistics and archived weekly reports.

Consent for publication: This article was cleared by the US CDC prior to publication and all co-authors listed signed a publication consent form.

Availability of data and materials: Data will be made available upon request addressed to the corresponding author.

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Conflict of interest: None to declare.

Author contributions

FCA, ECS, and EM participated in study conception and design. FCA collected the data, conducted the data analysis, and drafted the manuscript. EM, GAE, and ECS reviewed and revised the manuscript. All authors read and approved the final manuscript. FCA is the guarantor of this study.

Submission declaration and verification

The work described has not been published previously and is not under consideration for publication elsewhere. Its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out; if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder.

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