

RESEARCH ARTICLE

Assessment of core and support functions of the communicable disease surveillance system in the Kurdistan Region of Iraq

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Abstract

Early detection and prompt response are crucial measures to prevent and control outbreaks. Public health agencies, therefore, designed the Communicable Disease Surveillance System (CDSS) to obtain essential data instantaneously to be used for appropriate action. However, a periodic evaluation of CDSS is indispensable to ensure the functionality of the system. For this reason, this study aims to assess the performance of the core and support functions of the CDSS in the Kurdistan Region of Iraq. A descriptive cross-sectional study was used. From a total of 291 health facilities HFs (Primary health care centers and Hospitals) in the Kurdistan region of Iraq that have surveillance activities, 74 HFs were selected using a random stratified sampling approach. The World Health Organization (WHO) generic questionnaire has been used to interview the surveillance staff, together with direct collection of the data. Our analysis shows a lack of surveillance guiding manual in the HFs. Even at the district level, where a surveillance manual existed, case definitions, thresholds, and control measures were still missing. To note, more than 93% of HFs had organized and comprehensive patients registers for the collection of their clinical and secondary data. Also, all HFs had functioning laboratories. The majority of them (almost 93%) were equipped to collect, process, and store blood, stool, and urine specimens. About 72% of these laboratories were also able to transport timely the specimens to more specialized laboratories. At all levels, data reporting to the higher level exceeded the recommended minimum rate of 80%. The reporting system at the district level was based on emails, while in the periphery on hand-delivered in paper-based formats (50%), telephone (22%), and social media (22%). Furthermore, our analysis highlights the lack of data analysis: only 3.8% of Primary Health Care Centers conduct simple data analysis regularly, while hospitals do not do any sort of analysis. Also, only a few HFs investigated an outbreak, though using system routine sources to capture these public health events. Our findings show a lack in epidemic

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preparedness (3%), in feedback (53%), in standard guidelines, training, supervision, and resource allocations in HFs (0%). Taken together, our data show the importance of strengthening the CDSS in the Kurdistan region of Iraq, by reinforcing the surveillance system with continuous feedback, supervision, well-trained and motivated staff, technical support, and coordination between researchers and physicians.

KEYWORDS

assessment, communicable diseases, Iraq, Kurdistan, surveillance, system evaluation

1 | INTRODUCTION

The burden of communicable diseases has always stricken the entire humanity. Despite the significant progress in prevention and treatment, infectious diseases remain leading causes of mortality, morbidity, and worsening of the living condition of millions of people, particularly in developing countries.¹ The new coronavirus pandemic (COVID-19) is a good example to understand the ability of a communicable disease to transform from an endemic disease to a pandemic, and how an infectious disease can ruin lives and destroy the global economy. Thus, it is important to emphasize the need for strengthening national disease surveillance systems to rapidly recognize and block onward local transmissions to avoid global spreading.²

Surveillance has been defined as “the ongoing, systematic collection, analysis, and interpretation of health-related data essential to planning, implementation, and evaluation of public health practice”.^{3,4} In particular, communicable disease surveillance contributes information to determine and characterize the burden and distribution of infectious diseases, helps in prioritizing public health activities, assists in assessing the effectiveness of control measures, and identifies emerging disease outbreaks that may have a major impact on people health. Communicable disease surveillance is considered the backbone of prevention and control of infectious diseases by monitoring the population health.^{5,6}

From a public health perspective, the Communicable Disease Surveillance System (CDSS) is a valuable tool for policymakers to implement timely decisions and possibly avoid certain public health disasters.⁷ Given the drastic reductions in travel times that can facilitate the spread of emerging pathogens and the introduction of existing ones in new regions, disease surveillance is more crucial than in the past.⁸ Despite significant efforts to improve CDSS capabilities for early detection and efficient outbreak management, it is still difficult to implement.^{9,10} In fact, to ensure an effective CDSS, it is indispensable to continuously monitor and evaluate the surveillance system,¹¹ together with strengthening the response performance.^{12–14}

The COVID-19 pandemic highlighted the urgent need to strengthen the CDSS everywhere, particularly in the low and middle-income countries (LMICs).¹⁵ In fact, despite the infrastructure investment and capacity enhancement of CDSS, these are poorly allocated globally,¹³ in LMICs they are generally even less present, with the consequent lower ability of early detection and prompt response to infectious diseases than in high-income countries (HICs).¹⁴

The Iraqi health system has been severely affected by ongoing and complex conflicts, in particular, the 2003 and 2017 invasions.^{16,17} However, the Iraqi health system necessitates expanding the disease surveillance and response system to achieve public health security.¹⁷

The Kurdistan region, which is an autonomous region in northern Iraq, has been affected by this situation as well. The Kurdistan Regional Government (KRG) governs four Kurdish majority governorates, namely Erbil, Sulaimani, Duhok, and Halabja, with a population of about six millions¹⁸ (Figure 1).

In the Kurdistan Region of Iraq, 291 surveillance sites (Hospitals and Primary Health Care Centers—PHCC) report communicable diseases throughout 23 administrative districts. The information is first passively perceived by the system and then investigated by the rapid response teams depending on the type of threat identified.¹⁶ The Ministry of Health (MoH) in Baghdad in collaboration with the WHO is directly in charge of coordinating and supporting the CDSS in Kurdistan. The KRG has its own MoH that directs all HFs and health services including CDSS. The regional MoH has no significant role regarding the CDSS, its role is confined to supplying the necessary resources. The scarcity of benchmark information about the CDSS functionality and the fact that to our knowledge this system was never evaluated raise several questions, such as “is there a well-functioning CDSS in place? What are the current challenges and requirements? And which areas need further development? Which opportunities can the improved system bring?” This study aims to answer these questions by assessing the core activities and support functions of the CDSS in the Kurdistan region of Iraq.

2 | METHODOLOGY

2.1 | Design and settings

A descriptive cross-sectional design was approached. We were involved as communicable disease surveillance contributors physicians, laboratorians, health officers, and other surveillance staff from the Kurdistan Region of Iraq. To define core and support activities, we used the proposed conceptual framework of communicable disease surveillance monitoring and evaluation of the World Health Organization (WHO).¹⁹

The core functions included case detection, case registration, case confirmation, reporting, data analysis, and public health response, such as feedback from the systems to the data providers and epidemic



FIGURE 1 The Kurdistan region of Iraq on the Iraq map

preparedness. The functions that instead facilitate implementation of the core activities were identified as support functions, namely standards and guidelines, training, supervision, communication facilities, resources (human, financial, logistical), and coordination between stakeholders. To test the validity and reliability of the survey, a pilot study was conducted in the Sulaimani governorate. The duration of the study was from June 2019 to March 2021.

2.2 | Sampling and sample size estimation

According to the WHO guidelines for the service availability and readiness assessment (SARA),²⁰ we determined the sample size (*n*) equal to 74 HF (out of 291 HF in the Kurdistan Region of Iraq) using random stratified sampling. The HF were located in the three Kurdistan districts (governorates) of Duhok, Erbil, and Sulaimani,

which involve the Halabja governorate as well (Figure 2). The following formula was used to chose a proper random sample size:

$$n = [(z^2 \times p \times q) + ME^2] / [ME^2 + z^2 \times p \times q / N],$$

where $z = 1.96$ for a confidence level (α) of 95%, $p = .5$ proportion (expressed as a decimal), $q = 0.5 (1-p)$, $N = 291$ population size, $ME = 0.10$ margin of error.

2.3 | Data collection and data analysis

The CDSS was assessed at three levels (central, district, and HFs) using an adapted WHO generic questionnaire.²¹ The questionnaire has been modified to be consistent with the WHO CDSS Guide to monitoring and evaluating dated from 2006 (19), and translated into Kurdish and Arabic language. The first author has visited all the study sites and collected the data by direct interviews with the surveillance staff and observation of the surveillance activities. The collected data was extracted into/and analyzed by SPSS software, version 26. The findings have been summarized using descriptive statistical

measurements (frequencies and percentages). The indicators were compared with an 80% performance benchmark as a standard target performance based on WHO and CDC guides for Africa.^{22,23}

2.4 | Ethical considerations

The Ethics Committee of the Sulaimani Polytechnic University granted permission to conduct this study under project number CH00035/21/October/2019. At the start of each interview, the interviewer explained the study's intent to the participants. Participation in the study was entirely voluntary and the anonymity of the participants and confidentiality of the information was assured and maintained throughout this study.

3 | RESULTS

The office of communicable disease surveillance as a division of the Centre for Diseases Control and Prevention (CDC) in Baghdad is in charge of managing infectious diseases spread (24). This office

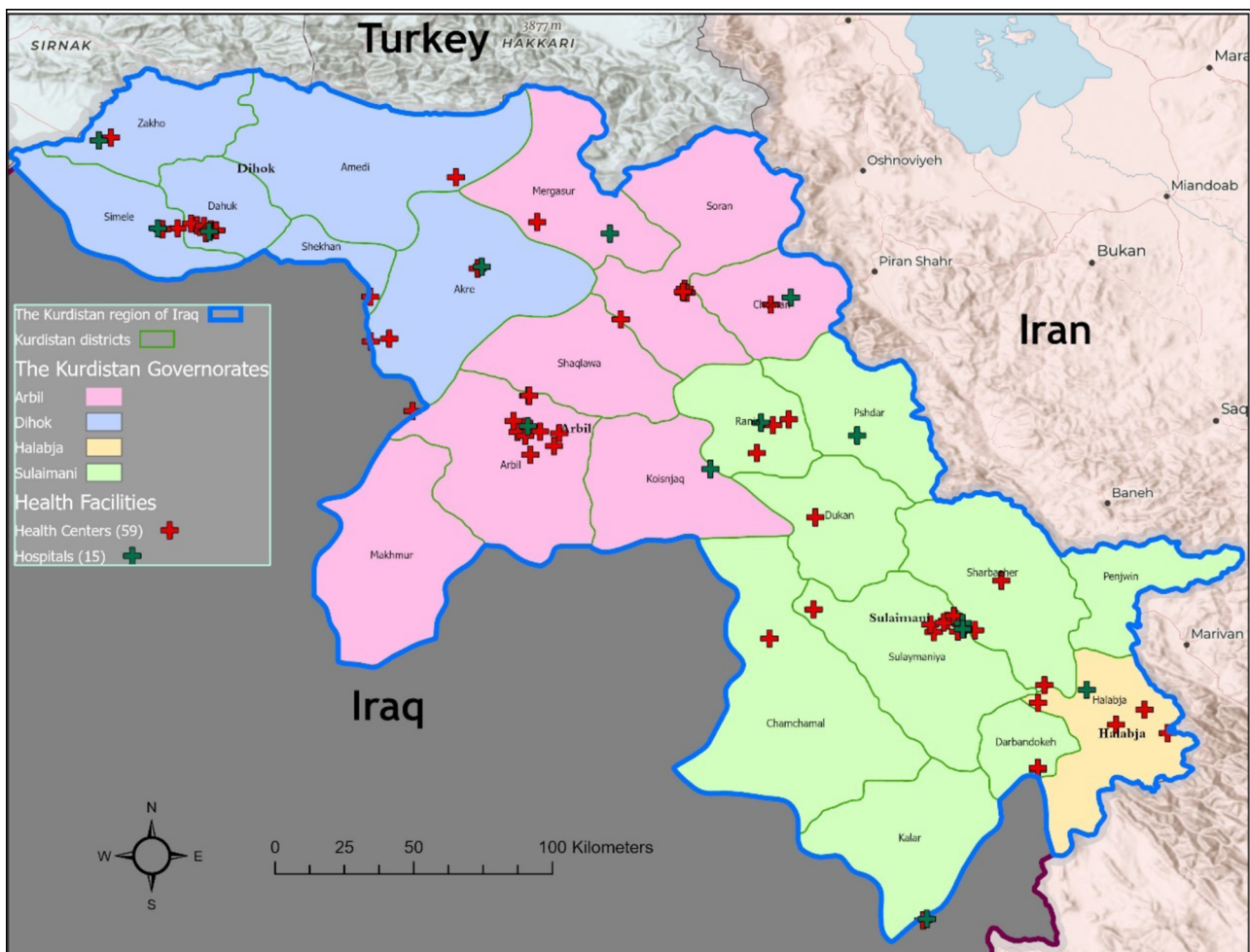


FIGURE 2 The health facilities which have been visited for data collection

mission is in fact to plan, facilitate and lead all surveillance activities in Iraq, including the Kurdistan region. The national CDSS in the Kurdistan region of Iraq receives data and information on communicable diseases from across the region, and collects reports on 53 communicable diseases, arranged then in three timeline reporting form frames (immediate notifications, case-based reporting, and weekly reporting).²⁴

All communicable disease surveillance sites are located in HFs at the district level, in both Primary health care centers and Hospitals. The 74 HFs randomly selected to represent all communicable disease surveillance units were investigated as shown in Figure 2. They include 15 hospitals and 59 PHCC. The core and support functions' performance variations of CDSS in district and HFs are shown in Tables 1 and 2.

3.1 | Core functions

3.1.1 | Case detection and registration

The disease-specific case definition manual is critical for case detection. One of the key findings of our analysis has been the lack of a case definition manual in HFs. All HFs had a patient register and 95.9% of them had a complete and correct recording of the cases. However, some staff claimed difficulty in extracting data due to the lack of medical history or illegible physician handwriting. All the cases and outbreaks in the Kurdistan Region of Iraq used for our analysis were from the formal health system. All other sources, such as rumors and event-based surveys, have not been used for outbreak detection.

3.1.2 | Case confirmation

A functioning laboratory was available in all HFs. Almost 90% of these laboratories were able to collect blood, stool, and urine specimens, while less than a quarter of them were equipped to collect sputum and cerebrospinal fluid (CSF) specimens (Table 1). Also, almost 93.2% of HFs had capacities to store specimens until shipment to laboratories able to better handle these samples. The ability to timely transport the specimens to these specialized laboratories was nearly 68.8%. Fifty-five (74.3%) HFs collected specimens' result reports.

3.1.3 | Reporting

All recommended reporting forms (immediate notification form, case-based reporting form, and weekly form) were present at all levels. Ten HFs (13.5%) had a deficiency in reporting forms due to the problems in their photocopier devices or late arrival of the forms from the district level. The delay was even more significant during the COVID19 pandemic lockdown. Several professional figures were in

charge of preparing the reports. Despite their different backgrounds (such as medical assistants, accountants, bookkeepers, statisticians), they all agreed that filling in reporting forms was easy and not time-consuming.

More than 82.4% of urgent notifications were timely forwarded to the next levels in all HFs. Also, the submission of a report happened even if there were no reportable cases (zero reporting) in 85.1% of the cases (Table 1). The reporting method for almost all district levels was online using the Epi Info software (available at: <https://www.cdc.gov/epiinfo/index.html>). On the contrary, at the HFs level, the reporting was in paper-based formats hand-delivered in 35 facilities (47.3%), or via social media (Viber), telephone or email in 16 (21.6%), 15 (20.3%), and 6 (8.1%) facilities, respectively.

3.1.4 | Data management and data analysis

All districts and the majority of HFs provided weekly reports to the next surveillance level. Immediate notifiable diseases' reports from the surveillance site were sent to the highest level within 24 h, and within 72 h they had to reach the Epidemiological Monitoring Division at the CDC Center. The case-based notifications were submitted within a maximum of 15 days of the following month, and it was preferable after getting the laboratory results for diseases that needed a laboratory diagnosis. No analysis and line graph presentations of communicable disease surveillance data were conducted in HFs, except for diarrhea in less than 9% of those sites. On the contrary, at the district level, there was evidence of regular weekly analyses and data presentations for several diseases.

3.1.5 | Outbreak detection

The outbreak detection mainly depends on district-level detection of unusual clustering and rising in the number of cases, since there is no data analysis at the HFs level. The majority of HFs (46, 62.2%) claimed that no mechanisms other than the system routine sources were available to capture public health events. Only a few HFs investigated outbreaks in the past few years: 14% in 2018, 11.6% in 2019, and 9.3% in 2020.

3.1.6 | Epidemic preparedness

Our data showed no evidence of an epidemic preparedness plan, except for cholera at the district level in 2018. None of the lower levels had a threshold level for action (i.e., the critical number of cases or indicator, proportion, rate, etc.) that can be used as an early warning to launch an investigation and be eventually prepared to respond to the epidemic. None of the HFs were aware of case fatality rates and the number of cases during the outbreaks. Twenty-nine (39%) of the HFs reported that they experienced a shortage of drugs, vaccines or supplies during the most recent epidemic. Five (6.8%)

TABLE 1 Communicable diseases surveillance system (CDSS) core activities at district and HF levels of CDSS in the Kurdistan region of Iraq

Core activities Surveillance levels	District level 3 districts	Health Facilities level			Target
		Hospitals 15 hospitals	PHCC 59 PHCC	Total 74 HFs	
Case definition					
Availability of standard case definitions	1 (33.3%)	0 (0%)	0 (0%)	0 (0%)	80%
A mechanism for outbreak detection within routine sources	3 (100%)	4 (26.7%)	16 (27.1%)	20 (27%)	80%
Existence of event-based surveillance ^a	0 (0%)	0 (0%)	6 (10.2%)	6 (8%)	80%
Case detection and registration					
Availability of registers	NA	15 (100%)	59 (100%)	74 (100%)	80%
Correct filling of registers	NA	14 (93.3%)	55 (93.2%)	69 (93%)	80%
Are patient's register easy to use	NA	15 (100%)	55 (93.2%)	70 (95%)	80%
Existence of rumour log ^b	0 (0%)	0 (0%)	0 (0%)	0 (0%)	80%
Case confirmation					
Confirmation of priority diseases ^c	3 (100%)	13 (86.7%)	44 (76.4%)	57 (77%)	80%
The ability to collect the specimens	3 (100%)	8 (53.3%)	3 (5.1%)	11 (15%)	80%
Sputum	3 (100%)	15 (100%)	54 (91.5%)	69 (93%)	80%
Stool	3 (100%)	15 (100%)	56 (94.9%)	71 (96%)	80%
Blood	3 (100%)	15 (100%)	56 (94.9%)	71 (96%)	80%
Urine	3 (100%)	9 (60%)	0 (0%)	9 (12%)	80%
Cerebrospinal fluid (CSF)	3 (100%)	14 (93.3%)	56 (94.9%)	70 (95%)	80%
Supplies for specimen collection and storage The capacity to transportation specimens to a higher level	3 (100%)	15 (100%)	38 (64.4%)	53 (72%)	80%
Reporting					
Types of reporting	0 (0%)	8 (53.3%)	29 (49.2%)	37 (50%)	
Mail (by hand)	0 (0%)	2 (13.3%)	13 (22%)	15 (20%)	
Telephone	3 (100%)	2 (13.3%)	4 (6.8%)	6 (8%)	
Email social media (Viber, WhatsApp ... etc.)	0 (0%)	3 (20%)	13 (22%)	16 (22%)	
Data analysis					
Routine analysis of data by surveillance units	3 (100%)	0 (0%)	6 (10.2%)	6 (8%)	80%
Surveillance units having epidemic threshold values	0 (0%)	0 (0%)	0 (0%)	0 (0%)	80%
Perform trend analysis (regular data)	3 (100%)	0 (0%)	2 (3.8%)	2 (3%)	80%
Epidemic preparedness and response					
Epidemic preparedness plan	2 (67%)	0 (0%)	2 (3.8%)	2 (3%)	80%
Emergency funds	0 (0%)	0 (0%)	0 (0%)	0 (0%)	80%
Adequacy/availability of supplies and drugs for outbreak—management and control	3 (100%)	9 (69.2%)	24 (44.4%)	33 (49%)	80%
Availability of rapid response team for epidemics	3 (100%)	0 (0%)	5 (9.1%)	5 (7.4%)	80%

TABLE 1 (Continued)

Core activities	District level	Health Facilities level			Target
		Hospitals	PHCC	Total	
Surveillance levels	3 districts	15 hospitals	59 PHCC	74 HF's	
Feedback					
Existence of feedback	3 (100%)	7 (46.7%)	32 (54.2%)	39 (53%)	80%
Feedback received regularly	3 (100%)	4 (30.8%)	23 (42.6%)	27 (40%)	80%

Abbreviation: PHCC, Primary Health Care Centers (PHCC).

^aExistence of a mechanism to capture unusual or public health events from nonroutine sources in the health system (e.g., from the community, media or other informal sources).

^bExistence of rumour log or database for registration of suspected public health events from informal sources.

^cCapacity to confirm selected priority diseases either within the laboratory or at a reference laboratory.

health units had rapid response teams for epidemics, but only one (1.4%) of them had trained physicians and responders. Finally, 38 (51%) health units had public educational materials ready for epidemic-prone disease.

3.1.7 | Feedback

Almost all district surveillance units showed evidence of receiving feedbacks on regular basis, while only 39 (52.7%) lower-level surveillance units have received feedbacks from higher levels. Despite the absence of a standardized feedback form, 23 (31.1%) HF's received feedbacks on a regular basis, and 40 participants (54.1%) believed that the feedbacks were beneficial.

3.1.8 | Support functions

Standard and guidelines

In 1999 the Ministry of Health in Iraq published the first edition of the communicable diseases control guidelines. This manual is expected to be edited and updated continuously every 3 years.²⁵ After 8 years without any update, in 2020 53 diseases with surveillance priority have been included in the communicable disease surveillance plan manual. However, it still did not include case definition, control measures, and it did not specify roles and responsibilities.²⁴ Furthermore, the manual was only available at the central and district level, and PHCCs and hospitals at periphery sites did not receive it.

Training

Almost all surveillance staff at the district level received at least one training course about CDSS, while 63.5% of the surveillance staff at the HF's level have been trained, and 13.5% of them had a refresher training course in the previous year. Typically, the training was conducted in the CDC district for a duration of 3 days. At a lower level, only 32.4% of the staff have received basic training on acute watery diarrhea management protocols.

Supervision

The communicable diseases surveillance plan established that the central CDS division and district CDC department have to provide supervision visits to the lower-level surveillance sites, and the directorate of health in governorates had to facilitate this task by providing the logistical and financial support needed. All district-level units and 54 (73%) HF's have had supervisory visits, 82% of which have been done by the district-level surveillance unit with a mean of 1.62 visits per year, whereas some sites were visited monthly and others were not visited at all. As there were no supervision guidelines or checklists, 53 (71.6%) HF's stated that during the visits supervisors reviewed the surveillance activities and 42 (56.8%) checked the implementation of the previous recommendations.

Resources

There was no earmarked budget for communicable disease surveillance both at the district and HF's levels. In case of occurrence of outbreaks, the CDC was responsible for providing the required resources for prompt action.

At the district level, well-trained proficient staff was managing the surveillance activities. These health officers held a Master in Public Health (MPH), or they were medical doctors. On the other hand at the HF's level, it was difficult to assess the availability and quality of human resources, since the staff had various educational backgrounds and had additional duties other than communicable disease surveillance. Insufficient personnel due to transfers or turnover, lack of training, transportation, technical issues related to computers, statistical software package (SPSS, Epi Info or others), printers, and internet access were the main hindrances of the system.

4 | DISCUSSION

Communicable disease surveillance aims to provide timely information for action. Thus, a successful surveillance system has three pillars: (i) a reasonable selection of diseases with surveillance priority; (ii) preparedness to provide reliable and valid information; (iii) the information should lead to prompt response. Therefore, a thorough

TABLE 2 Communicable diseases surveillance system (CDSS) support activities at district and HFs levels of CDSS in the Kurdistan region of Iraq

Support activities	District level	Health facilities level			Target
		Hospitals	PHCCs	Total	
Standards, guidelines					
Availability of surveillance guideline manual	3 (100%)	0 (0%)	0 (0%)	0 (0%)	80%
Availability of reporting forms	3 (100%)	15 (100%)	50 (84.7%)	65 (88%)	80%
Training					
Staff trained on surveillance	3 (100%)	10 (66.7%)	37 (62.7%)	47 (64%)	80%
Staff received refresher courses on surveillance in the previous-year	3 (100%)	4 (30.8%)	6 (11.1%)	10 (15%)	80%
Staff received basic training in acute watery diarrhea management protocol	3 (100%)	6 (40%)	18 (30.5%)	24 (32%)	80%
Supervision					
Supervisions conducted	3 (100%)	11 (73.3%)	43 (72.9%)	54 (73%)	80%
Equipment support					
Availability of functioning computers	3 (100%)	11 (73.3%)	48 (81.4%)	59 (80%)	80%
Availability of analytic program	3 (100%)	3 (20%)	15 (24.4%)	18 (24%)	80%
Availability of telephone	3 (100%)	7 (46.7%)	20 (33.9%)	27 (37%)	80%
Educational and communicational materials	3 (100%)	10 (66.7%)	44 (74.6%)	54 (73%)	80%
Financial support					
Availability of budget for surveillance activities	0 (0%)	0 (0%)	0 (0%)	0 (0%)	80%
Technical support					
Availability of internet and computer software.	3 (100%)	12 (80%)	32 (54.2%)	44 (60%)	80%

CDSS requires a rational plan which embraces standards and guidelines to approach those goals.

A robust surveillance guideline should describe the prioritized diseases for surveillance, standardize and update case definitions, define action thresholds, and involve reporting and data management tools, define roles and responsibilities and anticipate actions by surveillance level (19).

In the Kurdistan Region of Iraq, the prioritized diseases for communicable diseases surveillance are adapted from the WHO list and not from studies on locally important diseases. This may lead to consuming resources in collecting unnecessary data, when information on locally important infectious diseases may go unnoticed. Additionally, the absence of a case definition may affect the validity and reliability of the data. Also, since there is no standard case definition in the HFs sites for surveillance priority diseases except for one or two diseases, the case detection depends on physicians' knowledge and experience. Thus, for instance, allergic skin rashes may be reported as a measles disease. Similarly, the lack of administrative power and funds from the surveillance department may delay the response activities in detecting outbreaks due to red tape paperwork.

The lack of case definition in HFs in this region is similar to other parts of Iraq and other countries, like Ghana.²⁶ Results from Wasit governorate of Iraq by Tawfeeq et al. reported that 5.9% of HFs have case definitions,²⁷ in other studies in Baghdad and Mosul governorate the presence of case definition was 16% and 23.3%, respectively.^{28,29} These results are lower compared to other countries, such as Arabia Saudi, India, and Nigeria, where the presence of case definition was 54.5%, 67%, and 62%, respectively.^{8,30,31}

In the current study, more than 93% of visited HFs have had clinical registers completely and correctly filled. Several studies conducted in Baghdad, in Wasit, and in Mosul reported similar results: registers were present in 98%, 94.1%, and 100% of the HFs, respectively.²⁷⁻²⁹ However, one study reported that the registers were correctly filled in only 22.9% of the HFs.²⁷

Almost all HFs had their laboratories, 93% of which were able to collect blood, stool, and urine and confirm simple cases. However, sputum and CSF tests were conducted mostly in hospital laboratories. Most communicable disease confirmations were conducted in central laboratories at the district level. However, confirmations of some diseases that needed advanced capacity laboratories were performed in-country

referral laboratories. In these situations, storage and transportation are thus of great importance. Our results showed that 72% of HFs could transport specimens to the referral laboratories within a threshold time. Thus, as suggested by Kadhum in 2012, enhancing HFs transportation capacity would improve CDSS in Iraq.²⁸

Regarding reporting, a systematic review by Janati et al. showed that similar difficulties in the disease-reporting system were found globally, such as problems at the reporter level, during the reporting process, at the recipient level, insufficient surveillance staff, high workload, staff unconsciousness about the disease reporting system, lack of standardized processes, absence of an obligation to report, lack of appropriate training, lack of established electronic reporting systems, lack of giving feedback to the lower levels, and a limited budget for the disease reporting system.³² Thus, issues in reporting, incompleteness, and delays were even more expected due to the COVID19 pandemic lockdown. The implementation of an electronic-based program could improve the completeness, timeliness and reliability of reporting as showed by global evidence.^{33–35}

Limited data analysis at HFs level was observed in the current study, resembling those from Yemen, India, Nigeria, and other parts of Iraq.^{8,27,29,31,36} The weak data analysis performed in the Kurdistan region may be explained by the fact that the data analysis is confined to the surveillance unit at the district level.

Lack of routine trend analysis and line graph presentation of the diseases, together with the lack of community-based surveillance or utilization of rumor or media and other information sources reduce the opportunity of early detection of outbreaks.

Weak epidemic preparedness was noticed due to poor planning, administrative issues, and limited resources. Annual report data from 182 countries about present health security capacities against public health risks and events showed that 18% of countries had lower readiness. The study concludes on the necessity of capacity building and collaboration to improve the readiness for outbreak control.¹⁴

Feedback is an indispensable function for sustaining the involvement and inspiration of surveillance staff.⁸ Missing, unstructured and irregular feedbacks at the HFs level may result from a deficiency in supervisory visits and the sense that it is a nonbeneficial workload. The current findings are comparable with other evaluations from Tanzania, Mozambique, and Four African countries.^{37–39} Other studies in Iraq showed similar results.^{27–29}

Supervision aims to maintain high-quality services by improving work performances.⁴⁰ This study reveals that supervisory visits were conducted in 73% of the lower-level surveillance sites. This is comparable to what Kadhum²⁸ reported in Baghdad (65%) and Al-Jawadi and Alneami²⁹ in Mosul (68.5%). Our findings were contrary to Tawfeeq et al.²⁷ that observed them in only 15.7% of the cases. This inconsistency may result from counting all supervision visits to the HFs, not only the ones with specific surveillance purposes.

Surveillance capacity building requires the training of surveillance staff. In our study, 64% of the surveillance staff received at least one training course, similar to the results reported in Mosul (69%)²⁹ and in Saudi Arabia (66.7%).³⁰ Some lower scores can be explained by staff changes and the absence of staff commitment to the training.

Finally, deficiency in early detection, prompt response or shortage of resources (human, financial, technical) can negatively affect the overall outcome of the program. Therefore, our findings suggest that the Kurdistan region's CDSS needs revision to modify resources allocation and more support.

4.1 | Study limitations

This study focused on assessing core and support functions rather than the quality of the system (timeliness, sensitivity, specificity, simplicity, flexibility, and representativeness). The surveillance functions at the HFs level and district level were assessed, together with the CDSS in Kurdistan directed by the MoH of the regional government. However, due to the absence of data from the central level in the MoH in the regional government, the surveillance activities in this level could not be assessed.

5 | CONCLUSION

Strengthening the CDSS in the Kurdistan region of Iraq is needed. Periodic evaluation and monitoring to assess the functionality of the system is an appropriate method to identify the system drawbacks and recognize the areas that need further improvement. A functioning surveillance system implies (i) strengthening the core activities by providing a surveillance manual that includes case definition, control measures, feedbacks, and enhancing epidemic preparedness activities; (ii) strengthening the CDSS support function by close monitoring of the process and allocation of well-trained and motivated staff, and also technical support (i.e., computers, a statistical program for data analysis and access to the internet); (iii) strengthening coordination of laboratorians and physicians and other contributors with surveillance unit; (iv) assigning earmarked budgets for CDSS.

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CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

AUTHOR CONTRIBUTIONS

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REFERENCES

- Lawrence CM, Dennis LK. Basic considerations in infectious diseases In: *Harrison's Principles of Internal Medicine*. 18th ed.; 2012:1007.
- Dureab F, Ahmed K, Beiersmann C, Standley CJ, Alwaleedi A, Jahn A. Assessment of electronic disease early warning system for improved disease surveillance and outbreak response in Yemen. *BMC Public Health*. 2020;20(1):1422. <https://bmcpublihealth.biomedcentral.com/articles/10.1186/s12889-020-09460-4>
- Centers for Disease Control and Prevention (CDC). Introduction to Public Health. In: *Public Health 101 Series*. Atlanta, GA: US Department of Health and Human Services, CDC; 2014. CDC Public Health; 2014:1. Accessed September 18, 2020. <https://www.cdc.gov/publichealth101/surveillance.html>
- Thacker SB, Berkelman RI. Public health surveillance in the United States. *Epidemiol Rev*. 1988;10(1):164-190. <https://academic.oup.com/epirev/article-lookup/doi/10.1093/oxfordjournals.epirev.a036021>
- Murray J & Cohen AL Infectious disease surveillance. In: *International Encyclopedia of Public Health*. Elsevier Inc.: Springer, 2016:222-229.
- May L, Chretien JP, Pavlin JA. Beyond traditional surveillance: applying syndromic surveillance to developing settings-opportunities and challenges. *BMC Public Health*. 2009;9:9.
- Lee LM, Teutsch SM, Stephen B, Thacker MESL. *Principles and Practice of Public Health Surveillance*. 3rd ed. Oxford: Oxford University Press; 2010: 766. https://books.google.iq/books?id=FF78GciUbwUC%26pg=PA155%26lpg=PA155%26dq=surveillance%26policymakers%26source=bl%26ots=a-cZxRr7wH%26sig=ACFu3U1TDnb4JDEI82N5IdUi3hygALreVw%26hl=en%26sa=X%26ved=2ahUKewj_27mQ9eLpAhVlqxoKHel-DtQQ_6AEwAXoECAkQAQ#v=onepage%26q=surveillance
- Phalkey RK, Shukla S, Shardul S, et al. Assessment of the core and support functions of the integrated disease surveillance system in Maharashtra, India. *BMC Public Health*. 2013;13(1):575.
- Steele L, Orefuwa E, Dickmann P. Drivers of earlier infectious disease outbreak detection: a systematic literature review. *Int J Infect Dis*. 2016;53:15-20.
- Ibrahim NK. Epidemiologic surveillance for controlling Covid-19 pandemic: types, challenges and implications. *J Infect Public Health*. 2020;13:1630-1638.
- Groseclose SL, Buckeridge DL. Public health surveillance systems: recent advances in their use and evaluation. *Annu Rev Public Health*. 2017;38:57-79.
- World Health Organization (WHO). Technical review on monitoring and evaluation protocol for communicable disease surveillance and response systems Report of a WHO meeting. Geneva, Switzerland; 2004. https://www.who.int/csr/resources/publications/surveillance/WHO_CDS_CSR_LYO_2004_15/en/
- Jones KE, Patel NG, Levy MA, Storeygard A, Balk D, Gittleman JL, Daszak P. Global trends in emerging infectious diseases. *Nature*. 2008;451(7181):990-993.
- Kandel N, Chungong S, Omaar A, Xing J. Health security capacities in the context of COVID-19 outbreak: an analysis of International Health Regulations annual report data from 182 countries. *Lancet*. 2020;395(10229):1047-1053.
- Raoofi A, Takian A, Sari AA, Olyaeemanesh A, Haghghi H, Aarabi M. COVID-19 pandemic and comparative health policy learning in Iran. *Arch Iran Med*. 2020;23(4):220-234.
- World Health Organization. Joint external evaluation of IHR core capacities of the Republic of Iraq: mission report: 12-17 March 2019. Government and Politics of the Middle East and North Africa. Geneva PP, Geneva: World Health Organization; 2017. <https://apps.who.int/iris/handle/10665/325488>
- Zhao Y, Lafta R, Hagopian A, Flaxman AD. The epidemiology of 32 selected communicable diseases in Iraq, 2004-2016. *Int J Infect Dis*. 2019;89:102-109.
- Kurdistan Region Statistics Office. Population and labor force. 2020. Accessed May 22, 2021. <http://www.krso.net/Default.aspx?page=article%26id=899%26l=1%26krso2>
- WHO. Communicable disease surveillance and response systems Guide to monitoring and evaluating. 2006. Accessed July 14, 2019. https://www.who.int/csr/resources/publications/surveillance/WHO_CDS_EPR_LYO_2006_2.pdf?ua=1
- World Health Organization. Health facility assessment of service availability and readiness, Service Availability and Readiness Assessment (SARA) An annual monitoring system for service delivery Implementation Guide; 2015. Accessed February 15, 2021. www.who.int
- Protocol for the Assessment of National Communicable Disease Surveillance and Response Systems. WHO/CDS/CSR/ISR/2001.2. World Health Organization; 2001. Accessed July 20, 2019. p. Anexes 12-14. <http://www.who.int/emc>
- World Health Organization. WHO Regional Office for Africa. Guide for the Use of Core Integrated Disease Surveillance and Response Indicators in the African Region World; 2005. Accessed July 20, 2019.
- World Health Organization and Centers for Disease Control and Prevention. Technical Guidelines for Integrated Disease Surveillance and Response in the African Region. 2nd ed. In: Kasolo F, Rongou JB, Perry H, editors. Brazzaville, Republic of Congo and Atlanta, USA; 2010:398.
- CDC Surveillance section/Iraq. Communicable diseases surveillance plan for 2020. Baghdad; 2020:18.
- CDC Center. The communicable diseases control guidelines. 2nd ed. In: Baker HH, Muslem Abdul Hussein H, Noah Ghazala A, Khider M, Salman Yousef H, Nawar A, et al., eds; 2012:118.
- Adokiya MN, Awoonor-Williams JK, Beiersmann C, Müller O. The integrated disease surveillance and response system in northern Ghana: challenges to the core and support functions. *BMC Health Serv Res*. 2015;15(1):288. <https://bmchealthservres.biomedcentral.com/articles/10.1186/s12913-015-0960-7>
- Tawfeeq WF, Saeed ARK, Abbas TM. Assessment of Health Facilities' performance of surveillance activities for childhood vaccine-preventable diseases at health facilities in Wasit Governorate/Iraq/2010. *Med J Babylon*. 2012;9(4):12-25. <https://www.iasj.net/iasj/article/68513>
- Kadhun SA. Assessment of communicable diseases surveillance system activities in phc centers in Baghdad. *Res Artic Kadhun World J Pharm Res*. 2019;8(7):1-37.
- Al-Jawadi AA, Al-Neami MA. Assessment of infectious diseases surveillance system in Mosul, Iraq. *Duhok Med J*. 2008;2(1):127-140. <https://www.iasj.net/iasj/article/159121>
- Ibrahim NKR, Al-Bar HM. Surveillance of childhood vaccine-preventable diseases at health facilities in Jeddah, Saudi Arabia. *East Mediterr Heal J*. 2009;15(3):532-543.
- Abubakar A, Idris S, Nguku P, Sabitu K, Sambo M. Assessment of integrated disease surveillance and response strategy implementation in selected Local Government Areas of Kaduna state. *Ann Niger*

- Med.* 2013;7(1):14. <http://www.anmjournals.com/text.asp?2013/7/1/14/119981>
32. Janati A, Hosseiny M, Gouya MM, Moradi G, Ghaderi E. Communicable disease reporting systems in the world: a systematic review article. *Iran J Public Health.* 2015;44(11):1453-1465.
 33. Kiberu VM, Matovu JK, Makumbi F, Kyoziira C, Mukooyo E, Wanyenze RK. Strengthening district-based health reporting through the district health management information software system: the Ugandan experience. *BMC Med Inform Decis Mak.* 2014; 14(1):40.
 34. Sips ME, Bonten MJM, Van Mourik MSM. Automated surveillance of healthcare-associated infections: state of the art. *Curr Opin Infect Dis.* 2017;30:425-431.
 35. Nsoesie EO, Kluberg SA, Mekaru SR, et al. New digital technologies for the surveillance of infectious diseases at mass gathering events. *Clin Microbiol Infect.* 2015;21:134-140.
 36. Sahal N, Reintjes R, Eltayeb EM, Aro AR. Assessment of core activities and supportive functions for the communicable diseases surveillance system in Khartoum state, Sudan, 2005-2007. *East Mediterr Heal J.* 2010;16(12):1204-1210.
 37. Mghamba JM, Mboera LEG, Krekamoo W, et al. Challenges of implementing an Integrated Disease Surveillance and Response strategy using the current Health Management Information System in Tanzania. *Tanzan Health Res Bull.* 2004;6. <https://www.ajol.info/index.php/thrb/article/view/14243>
 38. Ministry of Health (MoH). *Assessment of Epidemiological Disease Surveillance System in Mozambique.* Mozambique: Ministry of Health and the World Health. https://www.scholar.google.com/scholar_lookup?title=Assessment_of_Epidemiological_Disease_Surveillance_System_in_Mozambique%26publication_year=2006%26book=Assessment_of_Epidemiological_Disease_Surveillance_System_in_Mozambique
 39. Nsubuga P, Brown WG, Groseclose SL, et al. Implementing integrated disease surveillance and response: four African countries' experience, 1998-2005. *Glob Public Health.* 2010;5(4):364-380.
 40. World Health Organization. Regional Office for Africa and, Centers for Disease Control and Prevention Center for Global Health. *Integrated Disease Surveillance Technical Guidelines for and Response in the African Region.* 2nd ed. Brazzaville, Republic of Congo and Atlanta, USA; 2010:398.

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