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Abstract

Background: Disease surveillance is very crucial especially in high vulnerability settings like Pakistan. However, surveillance and outbreak response management are still evolving in the country and research studies are needed to assess the existing system.

Aim: To assess the impact of integrated disease surveillance and response system (IDSRS) implemented by the provincial government to strengthen infectious disease surveillance and reporting in 6 districts of Pakistan in 2016.

Methods: A baseline cross-sectional assessment of health facilities and the healthcare workforce was conducted in 2016 to identify needs and gaps in public sector health facilities and the health system of 6 selected districts of Khyber Pakhtunkhwa Province, Pakistan. This was followed by a 2018 endline survey of the same facilities using the same variables.

Results: Overall, there was improvement in district management and facility level performance

($\chi 2(1, 314) = 21.19$, P

$\chi 2(1, 154) = 30.41$, P

Conclusion: IDSRS is effective in improving surveillance and response systems, however, its effectiveness appears to depend on locale-specific economies and can be enhanced by modifying the implementation approach. Better empowerment of the local workforce can contribute to such improvement.

Keywords: Disease surveillance, outbreak response, healthcare facility, IDSRS, Pakistan

Citation: Haq ZU, Fazid S, Hussain B, Khan MF, Betanni A, Behrawar B, Afridi S. Assessment of the impact of integrated disease surveillance and response system on surveillance management at healthcare facilities in Pakistan. East Mediterr Health J. 2024;30(2):109–115. https://doi.org/10.26719/emhj.24.026.

Received: 05/07/23; Accepted: 04/10/23

Introduction

The global burden of noncommunicable diseases increased from 61% of deaths in 2000 to 79% in 2019 and communicable diseases continue to have a negative effect, affecting mostly low- and middle-income countries (1). As a low- and middle-income country, Pakistan has to deal with the dual burden of communicable and noncommunicable diseases, therefore, surveillance, detection and response for both groups of diseases need to be agile. Without a sensitive surveillance and reporting system, timely action cannot be initiated to address disease

occurrence and without a timely coordinated response, disease control and prevention measures cannot be effective (2). Khyber Pakhtunkhwa has experienced repeated outbreaks of communicable diseases like dengue and Crimean-Congo hemorrhagic fevers, and it is a known endemic area for malaria (3-6). Due to the sociopolitical and environmental conditions of Khyber Pakhtunkhwa, the risk of such outbreaks will continue to exist for the foreseeable future. Under such circumstances, effective surveillance and response systems become critically important. The development of surveillance capacities is necessary to meet national and international control and eradication targets, which place the surveillance of communicable diseases high among national priorities.

Periodic assessments of a surveillance system enable it to reveal evolving national disease control priorities, remain efficient, and take advantage of emerging opportunities for the integration of activities. New surveillance methods and techniques should be considered and incorporated into the existing system.

The Government of Khyber Pakhtunkhwa started the health management information system (HMIS) in 1990 as part of the United States-supported Women's Health Project which was implemented until 1996. Four years later, in 2002, the Japan International Cooperation Agency (JICA) piloted the District Health Information System (DHIS) in 4 districts of Pakistan, including Swabi from Khyber Pakhtunkhwa. The provincial government was invited to submit proposals for initiating the system in other districts, after which the Khyber Pakhtunkhwa government received a grant of 90 million rupees to introduce the DHIS in 12 districts over 3 years. The United States Agency for International Development (USAID) funded the implementation of DHIS in another 7 districts (7). After the 2005 earthquake in northwest Pakistan, the Disease Early Warning System (DEWS)—for detecting disease outbreaks through analysing data collated from government and private healthcare facilities— was deployed and managed by WHO from 2005 to 2009. DEWS was further strengthened in 2008 with the heavy influx of internally displaced persons (IDPs) in different cities of Khyber Pakhtunkhwa and federally administered tribal areas (FATAs) (8). Unfortunately, WHO withdrew its support from DEWS in 2009 and it could not be adopted by the Khyber Pakhtunkhwa health department.

The integrated disease surveillance and response system (IDSRS) is a WHO strategy for improving epidemiologic surveillance and response. It coordinates and integrates surveillance activities by improving the integration of surveillance, laboratory, and response functions of the provincial disease surveillance system (9).

In 2016, as a pre-inception survey before the implementation of IDSRS, the provincial government decided to assess the existing surveillance and outbreak response system in 6

high-risk districts of Khyber Pakhtunkhwa The system was to be reassessed after implementation. The findings of the reassessment could then be used to inform existing or new health policies. Surveillance and outbreak response management in Pakistan are still evolving and there are currently no research studies exploring the existing system, especially in Khyber Pakhtunkhwa.

Objective

To assess the impact of IDSRS implementation on the surveillance and response components of the existing health system in Khyber Pakhtunkhwa, highlighting the characteristics and covariates of change.

Ethical approval

Ethical approval for this study was granted by the Khyber Medical University. For district offices and facilities, the approving authority—the Khyber Pakhtunkhwa health department—initiated the study.

Methods

A baseline cross-sectional assessment of health facilities and the healthcare workforce was conducted in 2016 to identify needs and gaps in public sector health facilities and the health system of 6 selected districts of Khyber Pakhtunkhwa Province. Data was collected using a comprehensive and standard model questionnaire developed by WHO for the assessment of a surveillance and outbreak response management system (10). There were 3 sets of questions; for provincial, district, and facility-level assessments. This was followed by a 2018 endline survey of the same facilities using the same variables.

A census was used for data collection from the offices of the Director General Health Services, District Health Officers and District Headquarters Hospitals, while stratified random sampling was used to select 12 healthcare facilities from the 6 identified districts.

The data collection team comprised public health students; 3–4 data collectors were allocated for each district. Data supervisors and monitors were recruited to ensure data validity and accuracy during fieldwork. Data collectors were trained on the WHO tool for 2 consecutive days. The training was classroom-based using audiovisual aids and interactive information sharing on the first day, and fieldwork using the tool on the second day. Data from the questionnaires were entered into Microsoft Excel® and checked for validity, consistency, and accuracy by 2 independent data entry specialists.

STATA, version 14.2, was used for data analysis (11). The data being paired, nominal dichotomous in nature, asymptotic symmetry and marginal homogeneity (Stuart-Maxwell) tests were used to compare pre-post discordance of indicator variables. STATA symmetry command was used for the purpose. Cramér's V is reported as an effect size for chi square (χ2) tests, with 0.1 to 0.3 denoting small, 0.4 to 0.5 medium, and values above 0.5 representing large effect size. All tests of significance are 2-tailed at an alpha of 0.05.

Results

Five percent of the facility and 3% of the district data were missing. Three of the 6 districts—Nowshera, Dera Ismail Khan, and Haripur—had a higher Gross Domestic Product (GDP) than the other 3—Buner, Karak, and Lakki Marwat (12,13,14). The information collected was classifiable under 2 domains, function and facilitation, which had 10 and 6 subdomains, respectively.

District level data

Overall district level improvement

Overall, at district level, there were significant improvements (Figure 1) in the surveillance and outbreak response system (SORS) during the period; 84 (71%) of the discordant indicators changed from nonconforming to conforming status, while only 34 (29%) changed from conforming to nonconforming; asymptotic symmetry and marginal homogeneity

χ2(1, 314) = 21.19, P **Domain level impact in districts**

District level indicators were classifiable under 2 major domains: surveillance related activities were aspects of ‘function’, while logistic and other support for such activities was classifiable under ‘facilitation’.

In the function domain, improvement was significant with a medium effect size; 59 (88%) of the discordant indicators converted from nonconforming to conforming, while only 8 (12%) changed from conforming to nonconforming (χ2(1, 166) = 38.82, P

In contrast, in the facilitation domain at district level, there was an overall trend—albeit statistically nonsignificant—towards deterioration in the post- compared with the pre-initiation period; 26 (51%) of the discordant indicators changed from compliant to noncompliant, while 25 (49%) changed from noncompliant in the pre-inception period to compliant χ2(1, 148) = 0.02, P

= 0.889). Stratified by GDP ranking, districts with relatively lower GDP showed significant improvement; 16 (76%) of the discordant indicators changed from noncompliant to compliant, while only 5 (24%) changed from compliant to noncompliant ($\chi 2(1, 74) = 5.76$, P = 0.016, V = 0.28). In comparison, districts with relative affluence showed a significant deterioration, with 21 (70%) changing from compliant to noncompliant, while 9 (30%) converted from noncompliant to compliant status ($\chi 2(1, 74) = 4.80$,

P = 0.028, V = 0.25). This modification of the intervention's effects by GDP ranking could explain the nonsignificant overall change in the facilitation domain (Figure 2).

Subdomain level impact in districts

In the function domain, there were 10 subdomains: surveillance manual availability, case confirmation ability, data reporting ability, data analysis ability, outbreak investigations performance, preparedness for outbreak investigations, outbreak control measures implementation, feedback activity, supervisory process functionality, and training in outbreak investigation. Out of the 10, 4 showed improvements: manual availability ($\chi 2(1, 6) = 4.0$, P = 0.045, V = 0.82), outbreak investigations performance ($\chi 2(1, 23) = 10.0$, P = 0.002, V = 0.66), preparedness for outbreak investigation ($\chi 2(1, 42) = 7.12$, P = 0.008, V = 0.41), and outbreak control measures implementation ($\chi 2(1, 30) = 10.0$, P = 0.002, V = 0.58). All of these 4 indicators were related to the employee's work routine choices, while the indicators that did not improve (case confirmation at higher level, case reporting process to higher levels, feedback from higher levels, supervision, training, and data analysis) involved higher levels of hierarchy, except data analysis which basically reflects on the training process, again a higher hierarchical level activity.

There were 6 subdomains in the facilitation domain: logistic support, data management materials, communication technology aids, educational aids availability, hygiene and sanitation materials availability, and surveillance coordination. The only subdomain that showed significant improvement was the surveillance coordination process, where all 8 of the discordant indicators changed from noncompliance to compliance ($\chi 2(1, 12) = 8.0$, P = 0.005, V = 0.82). This subdomain was also related to the employees' workplace management.

Structure process impact in districts

At district level, 178 (56%) of the variables were classifiable as indicators of structure elements, 134 (42%) as process elements, and 6 (2%) as equivocal in stance. Regarding structure components, there was no significant improvement between the pre- and post-implementation periods ($\chi 2(1, 174) = 0.15$, P = 0.696). In the process class indicator, there was a highly significant improvement; 48 (91%) of the discordant indicators changed from nonconforming to

conforming, while only 5 (9%) changed from conforming to nonconforming ($\chi 2(1, 128) = 34.89$, p