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Exploring stakeholders' experiences and perceptions of barriers to effective surveillance of communicable diseases in a rural district of Pakistan – a qualitative study

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A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
<i>Personal characteristics</i>			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	
Occupation	3	What was their occupation at the time of the study?	
Gender	4	Was the researcher male or female?	
Experience and training	5	What experience or training did the researcher have?	
<i>Relationship with participants</i>			
Relationship established	6	Was a relationship established prior to study commencement?	
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	
Interviewer characteristics	8	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	
Domain 2: Study design			
<i>Theoretical framework</i>			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	
<i>Participant selection</i>			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	
Sample size	12	How many participants were in the study?	
Non-participation	13	How many people refused to participate or dropped out? Reasons?	
<i>Setting</i>			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	
<i>Data collection</i>			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	
Repeat interviews	18	Were repeat interviews carried out? If yes, how many?	
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	
Field notes	20	Were field notes made during and/or after the interview or focus group?	
Duration	21	What was the duration of the interviews or focus group?	
Data saturation	22	Was data saturation discussed?	
Transcripts returned	23	Were transcripts returned to participants for comment and/or	

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction?	
Domain 3: analysis and findings			
<i>Data analysis</i>			
Number of data coders	24	How many data coders coded the data?	
Description of the coding tree	25	Did authors provide a description of the coding tree?	
Derivation of themes	26	Were themes identified in advance or derived from the data?	
Software	27	What software, if applicable, was used to manage the data?	
Participant checking	28	Did participants provide feedback on the findings?	
<i>Reporting</i>			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	
Data and findings consistent	30	Was there consistency between the data presented and the findings?	
Clarity of major themes	31	Were major themes clearly presented in the findings?	
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

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1 **TITLE:**

2 **Exploring stakeholders' experiences and perceptions of barriers to effective**
3 **surveillance of communicable diseases in a rural district of Pakistan – a**
4 **qualitative study**

5
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19 ABSTRACT

20 **Objective:** To explore the experiences and perceptions of health system stakeholders of a
21 rural district of Sindh, Pakistan regarding the barriers to effective surveillance of
22 communicable diseases.

23 **Design:** This exploratory qualitative study comprised of in-depth interviews. An inductive
24 thematic analysis was applied to identify key themes from the data.

25 **Settings:** The study was conducted in public sector healthcare facilities and the district
26 health office of the rural district of Thatta, in Sindh province, Pakistan.

27 **Participants:** Fifteen healthcare managers and healthcare providers working in the eight
28 public sector primary and secondary healthcare facilities were interviewed using an open-
29 ended in-depth interview guide.

30 **Results:** Key themes that emerged from the data were: poor governance and absence of
31 surveillance policy framework; fragmentation in the health system leading to lack of uniform
32 reporting; inadequate (human) resources that weakened the infrastructure for disease
33 surveillance; hospital-based reporting of cases that led to a predominantly passive
34 surveillance system; paper-based surveillance system as the key determinant of delayed
35 reporting; non-utilization of surveillance data for decision making; absence of local
36 laboratory capacity to complement the detection of disease outbreaks and lack of private
37 sector integration in disease surveillance.

38 **Conclusions:** Poor governance and lack of policy framework were perceived to be
39 responsible for weak surveillance infrastructure. inadequate resource investment including
40 human resource, paper-based reporting and the absence of local laboratory capacity was
41 considered to result in delayed, poor, and inadequate reporting. The lack of private sector
42 engagement was identified as a major gap.

43
44 **Keywords:** surveillance, communicable diseases, health services research, qualitative

45 **Strengths and limitations of this study**

- 46 • The study comprehensively explored the barriers and perceptions to effective disease
47 surveillance by interviewing a diverse group of key stakeholders that were directly
48 engaged in service delivery at the district level
- 49 • Adopting a qualitative approach provided a deeper insight into the challenges faced by
50 district health system stakeholders in disease surveillance
- 51 • The study was conducted in a predominantly rural district of Pakistan that is already
52 challenged in terms of resource availability. Despite that state of disease surveillance is
53 more or less similar in most districts of Pakistan when generalizing the study findings,
54 these may be interpreted in a similar context.

55

56 BACKGROUND

57 Infectious diseases continue to pose threat to the health of the public globally. In developing
58 countries, infectious diseases form a significant portion of the disease burden including
59 HIV/AIDS, tuberculosis (TB), malaria, respiratory infections, hepatitis B & C in adults and
60 pneumonia and diarrhoea in children under five years of age ^{1 2}. In Pakistan, communicable
61 diseases remain a major cause of public health concern with a significant contribution to
62 morbidity and mortality. Conditions like overcrowding, low socio-economic status, poor
63 hygiene and unsafe drinking water and poor awareness of health lead to an environment
64 conducive to disease outbreaks. The Health System of the country is toppled by issues of
65 poor governance and lack of resources resulting in a disease surveillance system that is
66 inept at detecting disease outbreaks ³. Before the devolution of the health system, Pakistan
67 had two main sources to collect data for health indicators namely: 1) health management
68 information system: this was designed to collect data on selected health indicators from
69 health facilities with established reporting lines from provincial to federal health ministry; 2)
70 data from vertical programs such as national TB control program, malaria control program,
71 HIV/AIDS control program amongst others ⁴. Following health system devolution in 2010,
72 administrative powers were devolved to provinces with the district becoming the
73 autonomous unit for defining its health priorities and health planning ⁵. In the new, albeit ill-
74 prepared administrative setup district health information system (DHIS) was established to
75 collect disease-related data from the health facility level. In all provinces of the country
76 including the Sindh province, DHIS is the major or only source of information on health
77 indicators of the population presenting to public sector health facilities. However, the DHIS
78 has remained underutilized for communicable disease surveillance. In the last five years,
79 rural districts of Sindh have seen outbreaks of diseases including measles ⁶ and HIV/AIDS ⁷ in
80 children pointing out a surveillance system weak at detecting outbreaks. As per the
81 international health regulations, member states of the World Health Organization have the
82 obligation to develop and strengthen disease surveillance with the help of existing health
83 system resources ⁸. However, the emergence of recent outbreaks has indicated weaker
84 surveillance of communicable diseases more so in rural areas. Moreover, only those
85 diseases with global priority (such as COVID-19 and Polio) manage to get attention, whereas
86 surveillance for diseases of national priority is often unable to compete with other health

1
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3 87 priorities for policy space and resources. There often is reliance on disease numbers to
4
5 88 highlight weak surveillance. But perceptions and experiences of those at the forefront of
6
7 89 service delivery are less well studied in Pakistan. Hence, we conducted this study to explore
8
9 90 the experiences and perceptions of health system stakeholders of a rural district of Sindh,
10
11 91 Pakistan regarding the barriers to effective surveillance of communicable diseases.

12 13 92 **METHODS**

14 15 16 93 **Study design and setting**

17
18 94 This study used a descriptive exploratory design to explore the perceptions and experiences
19
20 95 of district health system stakeholders regarding the barriers to an effective surveillance
21
22 96 system for communicable diseases in the rural district of Thatta located in the province of
23
24 97 Sindh, Pakistan. Thatta is situated approximately 100 kilometres from the provincial capital
25
26 98 of Karachi. It is a predominantly rural district with an approximate population of 1 million⁹
27
28 99 ¹⁰. Health indicators including maternal mortality ratio and neonatal mortality rate are
29
30 100 amongst the worst in the country^{11 12}. The situation of the healthcare system of Thatta is
31
32 101 comparable to any other rural district of Pakistan with inadequate infrastructure and
33
34 102 resources. There exist primary and secondary healthcare facilities in the district and there is
35
36 103 also a private healthcare system in the district comprising general practitioner clinics and
37
38 104 small hospitals. The study was conducted from February 15 to April 30, 2022, in eight public
39
40 105 sector primary and secondary healthcare facilities in the district.

41 106 **Study participant**

42
43 107 We used purposive sampling to select study participants. Eligible participants were
44
45 108 healthcare managers and healthcare providers working in the eight public sector primary
46
47 109 and secondary healthcare facilities. Healthcare managers were those working at the district
48
49 110 level and were responsible for the management of health services. Healthcare providers
50
51 111 were the doctors responsible for the provision of clinical care at selected healthcare
52
53 112 facilities. Participants included both males (n = 12) and females (n = 3). The age range of
54
55 113 study participants was 29 – 57 years.

56
57 114 We used the 'saturation principal' to determine the sample size for the study. Upon
58
59 115 researchers' observation, with further interviews yielding no added information and
60

1
2
3 116 producing no new or significant findings, data collection was stopped. This resulted in 15 in-
4
5 117 depth interviews with healthcare managers and healthcare providers.
6

7 118 **Data collection**

8
9
10 119 The data were collected using an open-ended interview guide. The interview guide was used
11
12 120 to conduct in-depth interviews for exploring participants' perceptions and experiences with
13
14 121 the surveillance system for communicable diseases in the Thatta district. The interview
15
16 122 guide was developed by researchers after a thorough literature search on the subject and a
17
18 123 review of literature in line with the objective of the research. The interview guide contained
19
20 124 open-ended questions regarding perceptions and experiences about the current state of the
21
22 125 surveillance system of communicable diseases, challenges faced in terms of resources,
23
24 126 infrastructure and financing, and barriers faced in terms of reporting, timeliness, and data
25
26 127 quality. The interview guide was piloted before data collection. The interviews were
27
28 128 conducted by the first author (IN) who has research experience in health systems and
29
30 129 communicable diseases and qualitative research. The first author moderated the interviews
31
32 130 along with note-takers. The interviews were conducted in the local language (Sindhi) and
33
34 131 were audiotaped. The first author and the note takers held a debriefing session after each
35
36 132 interview to reflect on the participants' responses. The interviews took place in health
37
38 133 facilities at a time suitable for study participants with each interview lasting about 20 – 35
39
40 134 minutes. Researchers had formal links established with the study respondents due to their
41
42 135 four years long work experience with stakeholders of the Thatta district. The study
43
44 136 participants were explained the study objective, and any queries raised before data
45
46 137 collection were satisfied.

47 138 **Ethical considerations**

48 139 Informed written and verbal consent was obtained from all study participants. Ethical
49
50 140 approval for this study was obtained from the Ethics Review Committee of the Aga Khan
51
52 141 University Karachi, Pakistan (ERC # 2020-5777-15184). Privacy, confidentiality, and
53
54 142 anonymity of the respondents were ensured during data collection and reporting of the
55
56 143 study findings.
57

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145 **Researchers' characteristics**

146 In qualitative research, research findings have the potential to be influenced by the study
147 settings and researchers' interest and understanding of the topic. In this study, researchers
148 were not the staff of the health facilities where the study was conducted. However, due to
149 the researchers' four years' work experience in the district, they were considered by the
150 study respondents to be someone familiar with the district health system and its challenges
151 and with an interest in exploring their perceptions and experiences regarding the challenges
152 that the district might be facing in terms of disease surveillance.

153 **Patient and public involvement statement**

154 Patients or the public were not involved in the design, or conduct, or reporting, or
155 dissemination plans of our research

156 **DATA ANALYSIS**

157 We used the inductive method to perform data analysis. The analysis approach used a
158 combination of interviews with study participants facilitated by field observations. The first
159 author transcribed all audio tapes from Sindhi to English and wrote interview notes. Manual
160 content analysis was performed where interview notes were read and re-read to identify
161 similarities and differences of perspectives among study participants. Similar perspectives
162 were grouped and classified into main themes. All the authors and field team members read
163 the themes, and discrepancies were discussed during the interpretation and analysis of
164 data. The themes emerging from the analysis were shared and discussed with study
165 participants for their comments.

166 **RESULTS**

167 Data analysis identified a number of core themes from the experiences and perceptions of
168 healthcare managers and healthcare providers regarding the surveillance system of
169 communicable diseases. Where appropriate, verbatim quotations from the interview
170 transcripts have been used to ensure rigour in the reporting of data. To avoid identifying
171 specific individuals, the participants have been allocated aliases.

172 **The absence of a surveillance policy framework and poor governance leads to an ill-** 173 **defined disease surveillance system**

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3 174 All study participants unanimously pointed out the lack of a comprehensive policy
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5 175 framework for disease surveillance. As a result, there is a lack of clarity in reporting disease-
6
7 176 related data, coordination between different stakeholders, and meaningful analysis of data
8
9 177 and its use for taking action.

10
11 178 *“National health policy emphasizes the importance of disease surveillance and having such a*
12
13 179 *system in place; however, it is up to provinces to develop detailed guidelines for disease*
14
15 180 *surveillance and ensure its implementation which is not happening! [Participant 14].”*

16
17 181 Provincial disease surveillance and response unit

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19
20 182 A digital system named Provincial Disease Surveillance and Response Unit (PDSRU) was
21
22 183 developed a few years ago with the support of donor money. The PDSRU had all the
23
24 184 communicable diseases of importance listed and the system was expected to be linked up
25
26 185 with secondary hospitals in the province for regular data collection. However, interview
27
28 186 respondents commented that the PDSRU unit has remained dysfunctional and has not been
29
30 187 utilized for the purpose it was built for.

31
32 188 *“It is very unfortunate that we got the donor money to establish a surveillance system in the*
33
34 189 *province, but we didn’t plan for resources to make the system functional [participant 5].”*

35
36 190 District health information system

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38 191 The DHIS has existed longer than the PDSRU, has the service delivery data collated from
39
40 192 primary and secondary health facilities and the frequency of reporting is monthly. The data
41
42 193 is collected on paper at the health facility level and a hard copy of the monthly DHIS
43
44 194 reporting form is handed over physically by each facility to the district health office. There, a
45
46 195 computer operator enters the data into the digital portal of DHIS which then can be viewed
47
48 196 on a dashboard.

49
50 197 In the current state, DHIS is the only functional health information system that has up-to-
51
52 198 date disease information. However, this information remains underutilized for disease
53
54 199 surveillance as there is hardly any review and feedback on the reported data from the
55
56 200 district health office or provincial health department. Moreover, since the data is collated
57
58 201 and shared at the end of each month, its utility for detecting disease outbreaks is limited.

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2
3 202 *“DHIS data can be a very good source of passive surveillance, but we need to increase the*
4 *reporting frequency from monthly to weekly and have regular reviews of the reported data*
5 *[Participant 5].”*
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9 205 Communicable Disease Control unit

10
11 206 The Communicable Disease Control (CDC) unit was built at the provincial level with the
12 intent to integrate all the vertical (disease-specific) programs under one roof for planning,
13
14 207 resource allocation and intervention. Under the CDC unit, blood-borne diseases like
15
16 208 HIV/AIDS, hepatitis C and hepatitis B could be looked after single-handedly when addressing
17
18 209 the mode of spread, designing interventions and surveillance. Unfortunately, the unit lacks
19
20 210 any infrastructure, dedicated human resources and disease integration plan at the district
21
22 211 level.
23

24
25 213 *“Having CDC presents an immediate opportunity for syndromic surveillance; we should not*
26 *waste this opportunity [Participant 10].”*
27
28

29 215 **Fragmentation in the healthcare system is a hindrance to a uniform reporting system**

30
31 216 Under the public-private partnership (PPP), the public sector healthcare system in Thatta
32 has been contracted out to various private providers. Under PPP, these providers are
33
34 217 responsible for providing health services on a day-to-day basis while the health department
35
36 218 provides a budget. However, due to extensive contracting out each level of health facility
37
38 219 (i.e., primary, and secondary) is managed by a different private partner. Distinct reporting
39
40 220 lines and a lack of data sharing mechanisms between private partners have given rise to
41
42 221 fragmentation within the district health system.
43

44
45 223 *“Primary level facilities are supposed to be linked with secondary level facilities for referrals*
46 *and reporting of disease-related data, however, there are so many partners with each*
47
48 224 *having its reporting line. This has negatively affected the reporting of disease surveillance*
49
50 225 *[participant 10].”*
51

52
53 227 At the district level, surveillance for vaccine-preventable diseases (VPDs) is conducted by the
54 district health office with the district surveillance coordinator as the focal point. Whereas
55
56 228 notifiable diseases are reported by the focal persons of the disease-specific programs with a
57
58 229 flow of information that is separate from that of VPDs. This vertical nature of surveillance of
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3 231 different diseases is inefficient in terms of resource utilization as it creates parallel systems
4
5 232 where surveillance activities are carried out in siloes. These inefficiencies in turn create a
6
7 233 weaker surveillance system and put the population at higher risk for communicable disease
8
9 234 outbreaks.

10
11 235 *“Every disease-specific program such as that of tuberculosis, malaria etc reports its data in*
12
13 236 *isolation, how can we have an integrated disease surveillance system in this situation?*
14
15 237 *[Participant 7].”*

17 238 **Inadequate resources translate to poor disease surveillance**

18
19
20 239 In the district health office, there is a district surveillance coordinator who is mandated to
21
22 240 look after the surveillance of VPDs in the district. He is solely responsible for coordinating
23
24 241 with all eight public sector health facilities of the district, ensuring the timely collection of
25
26 242 surveillance data and its reporting. He is also responsible for entering the disease-related
27
28 243 information into the district health information system. This not only leads to increased
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30 244 workload but often time leads to delayed data entry and communication of this information
31
32 245 to district health stakeholders.

33
34 246 Not only that he lacks a team of dedicated individuals for surveillance, but he also has no
35
36 247 provision of transportation for reaching out to health facilities and communities for active
37
38 248 surveillance. Most of the time, he has to rely on making telephonic contact with each in
39
40 249 charge of health facilities to get disease-related information.

41
42 250 Currently, reporting for VPDs is mandatory and health facilities are required to send weekly
43
44 251 reports (even for no cases called ‘zero reports’) of VPDs to the district surveillance
45
46 252 coordinator. However, due to a lack of resources such as transportation and dedicated
47
48 253 surveillance staff, the reports from various health facilities in the district often get delayed.

49
50 254 *“Expecting one person to lead disease surveillance in the district, in the absence of*
51
52 255 *transportation and adequate human resource is too much to ask [Participant 2].”*

53
54 256 For notifiable diseases, the district focal persons of disease-specific programs have the
55
56 257 responsibility to report the number of cases of the disease. The primary role of the focal
57
58 258 person is program implementation which involves numerous tasks from planning and
59
60 259 implementing to monitoring and reporting program activities. In absence of adequate

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3 260 human resource, focal persons primarily rely on data reported as part of program
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5 261 implementation. This has limitations namely 1) this is a form of passive surveillance rather
6
7 262 than active; 2) reporting of program data takes place at specific intervals whereas
8
9 263 surveillance requires continuous monitoring of disease cases and prompt action. These
10
11 264 limitations lead to a disease surveillance system that struggles with timely detection, and
12
13 265 reporting of disease outbreaks.

14 15 266 **The current surveillance system is hospital-based**

16
17 267 Study respondents pointed out that since the data collection is passive as it is collected
18
19 268 largely from those patients that present to health facilities, hence it is a form of passive
20
21 269 surveillance rather than active surveillance.

22
23
24 270 *“We could be missing out on outbreaking at the community level since there is no one going*
25
26 271 *and actively screening the community members [Participant 1]”*

27
28 272 Respondent attributed the lack of community-based active surveillance to a lack of
29
30 273 resources and mentioned that there is a need to increase resource allocation for
31
32 274 strengthening active surveillance.

33 34 275 **Paper-based reporting is a key determinant of delayed disease reporting**

35
36 276 The system for reporting health-related data from health facility to district health office in
37
38 277 Pakistan is paper-based for both vaccine-preventable diseases and notifiable diseases. In
39
40 278 this system, the health facility in-charge fills out a zero-reporting form or a case report for a
41
42 279 notifiable disease. A physical copy of this report is then sent to the district surveillance
43
44 280 officer. This often gets delayed as someone must visit either the health facility or the office
45
46 281 of the district surveillance coordinator to deliver the physical copy of the report. To prevent
47
48 282 delay, telephonic contact often plays a key role, however, it is not a feasible way to
49
50 283 disseminate the information to all the relevant stakeholders.

51
52 284 *“We should have a digital system with a dashboard which can show data in real-time. We*
53
54 285 *will avoid delayed reporting forever [participant 2].”*

55 56 286 **Surveillance data is underutilized for evidence-based decision making**

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2
3 287 The majority of study respondents mentioned that data verification is essential to ensure its
4
5 288 fidelity. To ensure data quality, monitoring and supervision of field staff and the facility
6
7 289 healthcare staff sending data need strengthening.
8

9 290 In the existing system of disease surveillance, there is an emphasis on data collection only.
10
11 291 No monitoring and supervision are happening from the district or provincial levels. Other
12
13 292 than the circumstances where a suspected or confirmed case of disease under surveillance
14
15 293 is reported, there is no action taken to verify the authenticity and quality of routinely
16
17 294 reported data.

18
19 295 *“Despite that, the data is regularly collected through DHIS and other channels, it is rarely*
20
21 296 *reviewed or utilized for analysis or action [Participant 12].”*
22

23 297 **Lack of laboratory testing capacity takes a toll on disease surveillance**

24
25
26 298 Among the eight public sector health facilities in the Thatta district, only two have clinical
27
28 299 laboratories. However, none of these laboratories is equipped to conduct testing for any of
29
30 300 the VPDs or notifiable diseases in the district. Biological samples collected from suspected
31
32 301 patients are sent to a regional laboratory that is based in the capital city of the country
33
34 302 (laboratory at National Institute of Health, Islamabad) situated at least 1000 kilometres from
35
36 303 Thatta district.

37
38 304 The absence of a fully equipped laboratory nearby calls for measures to ensure proper
39
40 305 storage and transportation of biological samples. This not only is resource-intensive but
41
42 306 adds to the delays in the system staggered by issues of delayed reporting.

43
44 307 *“Provincial health department should, at the least, take measures to build a laboratory in the*
45
46 308 *province so that disease surveillance can be made a little more efficient [Participant 6].”*
47

48 309 **The lack of integration of the private sector in disease surveillance is a major gap**

49
50
51 310 The private health sector is a major stakeholder in service delivery and caters to
52
53 311 approximately 70% healthcare needs of the population. Unfortunately, however, the service
54
55 312 delivery data of the private health sector is not integrated into the DHIS of the public health
56
57 313 sector. In fact, the government is still lagging in taking measures to regulate the private
58
59 314 health sector in Sindh province.
60

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3 315 Integration of data from the private sector in the health information system is essential to
4
5 316 ensure effective disease surveillance as currently, a significant chunk of the population's
6
7 317 disease burden remains to be captured.
8

9 318 *“Our disease surveillance will be at a loss from capturing the true disease burden unless it*
10
11 319 *integrates data from the private health sector [Participant 6].”*
12

13 320 **DISCUSSION**

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15
16 321 Our study explored multifaceted barriers to effective surveillance of communicable diseases
17
18 322 in a rural district of Pakistan. Findings showed that while infrastructure for surveillance at
19
20 323 the provincial level is underutilized, structural challenges such as resource deficiencies
21
22 324 (including human resource), poor coordination among stakeholders for sharing data,
23
24 325 absence of private sector involvement, paper-based reporting, and lack of utilization of data
25
26 326 for decision making are some of the key challenges at the district level.

27
28 327 Though it has been over a decade since the devolution of the health system in Pakistan, the
29
30 328 pace of provinces leading health planning has remained rather sluggish. Given the increasing
31
32 329 disease outbreaks in Sindh and other provinces in recent years i.e., measles, HIV/AIDS and
33
34 330 the global COVID pandemic, the need for comprehensive guidelines and laws for disease
35
36 331 surveillance has grown stronger. Study participants were concerned about the delay in
37
38 332 taking initiatives for the development of surveillance guidelines at the provincial level. This
39
40 333 experience is similar to other lower and lower-middle-income countries. Studies from
41
42 334 Nigeria and Zambia show that the laws related to public health surveillance existed but were
43
44 335 considered to be outdated and/or poorly implemented¹³. Studies from Iran and Palestine
45
46 336 concluded that having laws and policies for disease surveillance enable governments to
47
48 337 allocate funds for establishing surveillance programs and that health authorities should play
49
50 338 a lead role in ensuring their implementation^{14 15}.

51
52 339 Having a dysfunctional PDSRU for reporting surveillance data is a classic example of relying
53
54 340 on donor money instead of concentrating on building local capacity toward a functional
55
56 341 information system. Many respondents termed this unfortunate and emphasized investing
57
58 342 resources in reviving the PDSRU which was already there. In a study from China inadequacy
59
60 343 of resources at the local level was termed as the key factor affecting the effectiveness of
344 disease surveillance. The study reported that the top tier of government invests more in

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2
3 345 building digital information systems, but lower levels don't receive enough planned
4
5 346 resources to ensure its implementation ¹⁶. A functional digital information system has been
6
7 347 found to speed up the reporting, improve data flow and ensure the availability of up-to-date
8
9 348 data for the decision-makers. This eventually leads to early detection of outbreaks and
10
11 349 timely action ¹⁴. Having the district surveillance coordinator as the sole person responsible
12
13 350 for surveillance activities in the district without any additional resources was considered the
14
15 351 major weakness in the surveillance system by study respondents. Literature shows that
16
17 352 during an epidemic, there is an increase in the workload requiring more human resource
18
19 353 and support for efficient data reporting ¹⁷. The resource deficiencies including field-based
20
21 354 staff have been shown to undermine effective disease surveillance ^{15 18}. Moreover, putting
22
23 355 an extra burden of surveillance activities on healthcare providers alongside the service
24
25 356 delivery affects their motivation, performance, and quality of reporting ^{14 16 19}.
26
27 357 Despite several advantages of contracting out of health services that the literature notes,
28
29 358 the structural challenges largely remain unaddressed ²⁰. One such structural challenge is
30
31 359 poor coordination between stakeholders. Many respondents pointed out that having
32
33 360 multiple stakeholders in the same district had been detrimental to disease surveillance due
34
35 361 to a lack of coordination and ambiguous reporting lines. The flow of data is independent of
36
37 362 the level of health facility defeating the notion of integrated disease surveillance. Similarly,
38
39 363 disease-specific programs (malaria, dengue), that have a strong component of
40
41 364 environmental control measures, lack integration with the public health engineering
42
43 365 department. A study from India attributed the inefficiency in reporting dengue surveillance
44
45 366 data to poor integration of health services ¹⁸. Poor coordination between health and other
46
47 367 sectors ¹⁷ and between various levels of health facilities ¹⁴ has been reported to affect not
48
49 368 just the data reporting but also may lead to a lack of trust among stakeholders.
50
51 369 The current system for reporting diseases is a form of passive surveillance as it is hospital-
52
53 370 based, and data is gathered from patients presenting to health facilities. Literature shows
54
55 371 that the majority of people may not opt to show up unless they have serious symptoms ¹⁶.
56
57 372 This, in the event of a communicable disease, not only has the potential for the spread of
58
59 373 infection but also may cause a delay in detecting an outbreak. Relying on passive
60
374 surveillance only is often dependent on factors including patients' awareness and health-
375 seeking behaviours and socioeconomic status and hence needs to be supplemented by
376 some form of active surveillance ¹⁹.

1
2
3 377 Paper-based reporting in our study came out as an important barrier to timely reporting.
4
5 378 The need for transitioning from slow, staff reliant and paper-based reporting to the digital
6
7 379 mode of reporting is increasingly recognized in literature ^{14 17} and a study from India has
8
9 380 demonstrated improved disease notification and enhanced data reporting due to
10
11 381 transitioning to digital media ²¹.
12
13 382 Except when suspected or a confirmed case of a disease is detected, data sent from health
14
15 383 facilities is rarely reviewed at higher levels. Respondents in our study pointed out that there
16
17 384 is more emphasis on data collection than its analysis and use. It is evident from the
18
19 385 Literature that providing regular feedback to facility staff on the data has been shown to act
20
21 386 as a motivating factor and a performance boost ^{14 18}.

22
23 387 Respondents in our study cited the lack of local laboratory capacity in the district as an
24
25 388 important gap in detecting disease outbreaks. Studies in literature have demonstrated that
26
27 389 in absence of a local laboratory, rapid diagnostics kits (RDTs) may facilitate confirming
28
29 390 outbreak until laboratory test results become available ¹⁹ thus preventing delays that may
30
31 391 incur in the transfer of biological samples. However, despite being cheap, resource
32
33 392 investment is still required to ensure their uninterrupted availability ¹⁸.

34
35 393 The extent to which a health system can detect disease outbreaks is dependent on its
36
37 394 capacity to capture patients' data. In Pakistan, the private health sector caters to the
38
39 395 majority of the population's healthcare needs. However, it is largely unregulated,
40
41 396 particularly in Sindh province leading to a lack of integration of its patient data with the
42
43 397 public sector. Studies show that the poor private sector engagement in disease surveillance
44
45 398 is an important issue hampering the surveillance efforts in many countries including India ¹⁸
46
47 399 ²¹, Iran ²² and China ¹⁹.

47 400 **LIMITATION**

48
49 401 Our study was conducted in a predominantly rural district of Pakistan that is already
50
51 402 challenged in terms of resource availability. Hence, when generalizing the study findings,
52
53 403 these may be interpreted in a similar context. However, the state of disease surveillance is
54
55 404 more or less similar in the country and hence experiences and perceptions given are
56
57 405 relatable to several districts of the country.

58 406 **CONCLUSION**

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2
3 407 We concluded that poor governance was perceived to lead to underutilization of existing
4
5 408 resources for surveillance whereas lack of a policy framework on surveillance was
6
7 409 considered to lead to a poor investment of resources in surveillance infrastructure. The
8
9 410 absence of resources and inadequate human resource was identified by respondents as the
10
11 411 key determinant of delayed and inadequate reporting leading to delayed detection of
12
13 412 disease outbreaks. This was further aggravated by the absence of local laboratory capacity.
14
15 413 The existing surveillance system was perceived as largely paper-based, slow, and comprised
16
17 414 of hospital-based passive surveillance. The lack of private sector engagement in
18
19 415 communicable disease surveillance was perceived as a significant gap.
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6
7
8 420 **Competing Interests**

9 421 All authors declare that they have no competing interests

10
11
12 422 **Authors contributions**

13 423 IN conceived the idea for the manuscript and developed the first draft of the manuscript. All
14 424 authors subsequently read the manuscript. All authors agreed to the final version of the
15 425 manuscript.

16
17
18 426 **Acknowledgement**

19 427 We acknowledge all our participants for their cooperation during the conduct of this study

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21
22 428 **Checklist for the appropriate reporting statement**

23 429 We used COnsolidated criteria for REporting Qualitative research (COREQ) checklist while
24 430 writing the manuscript to ensure rigour in reporting the data for qualitative research

25
26
27 431 **Patient consent for publication**

28 432 Not applicable

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30
31 433 **Data availability statement**

32 434 All the data collected as part of this research study are reported in the manuscript

33 435 **Word count:** 4277

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39 437 **List of abbreviations**

40 438 TB – Tuberculosis

41 439 DHIS – District health information system

42 440 PDSRU – Provincial Disease Surveillance and Response Unit

43 441 CDC – Communicable Disease Control

44 442 PPP – Public-private partnership

45 443 VPDs – Vaccine preventable diseases

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4 445 **References**

- 5 446 1. Ward JL, Azzopardi PS, Francis KL, et al. Global, regional, and national mortality among young
6 447 people aged 10–24 years, 1950–2019: a systematic analysis for the Global Burden of Disease
7 448 Study 2019. *Lancet* 2021;398(10311):1593-618.
- 8 449 2. Ledesma JR, Ma J, Vongpradith A, et al. Global, regional, and national sex differences in the global
9 450 burden of tuberculosis by HIV status, 1990–2019: results from the Global Burden of Disease
10 451 Study 2019. *Lancet Infect Dis* 2022;22(2):222-41.
- 11 452 3. World Health Organization. Communicable disease surveillance and response - Pakistan 2022
12 453 [cited 2022 July]. Available from:
13 454 [http://www.emro.who.int/pak/programmes/communicable-disease-a-surveillance-](http://www.emro.who.int/pak/programmes/communicable-disease-a-surveillance-response.html)
14 455 [response.html](http://www.emro.who.int/pak/programmes/communicable-disease-a-surveillance-response.html) accessed July 2022.
- 15 456 4. Ali M, Horikoshi YJPJMR. Situation analysis of health management information system in Pakistan.
16 457 *Pakistan Journal Medical Research* 2002;41(2):64-9.
- 17 458 5. Zaidi SA, Bigdeli M, Langlois EV, et al. Health systems changes after decentralisation: progress,
18 459 challenges and dynamics in Pakistan. *BMJ Glob Health* 2019;4(1):e001013.
- 19 460 6. Ahmad Z, Zahid HJJotPMA. Threat of a Measles outbreak amidst COVID 19 surge in Sindh,
20 461 Pakistan-Letter to the editor. *J Pak Med Assoc* 2021;71(10):2488-88.
- 21 462 7. Siddiqui AR, Nathwani AA, Abidi SH, et al. Investigation of an extensive outbreak of HIV infection
22 463 among children in Sindh, Pakistan: protocol for a matched case–control study. *BMJ Open*
23 464 2020;10(3):e036723.
- 24 465 8. World Health Organization. International Health Regulations 2005 2022 [cited 2022 July]. Available
25 466 from: [http://apps.who.int/iris/bitstream/handle/10665/246107/9789241580496-](http://apps.who.int/iris/bitstream/handle/10665/246107/9789241580496-eng.pdf;jsessionid=95E436B7F04EA4A8635945E4C684A14C?sequence=1)
26 467 [eng.pdf;jsessionid=95E436B7F04EA4A8635945E4C684A14C?sequence=1](http://apps.who.int/iris/bitstream/handle/10665/246107/9789241580496-eng.pdf;jsessionid=95E436B7F04EA4A8635945E4C684A14C?sequence=1) accessed July 2022.
- 27 468 9. Abbasi IN, Siddiqi S. Overcoming the challenges of community-engaged emergency referrals in a
28 469 rural district of Pakistan. *J Pak Med Assoc* 2021
- 29 470 10. Pakistan Bureau of Statistics. Thatta district 2017 [cited 2022 July]. Available from:
30 471 <https://www.pbs.gov.pk/census-2017-district-wise/results/091> accessed July 2022.
- 31 472 11. Pasha O, Saleem S, Ali S, et al. Maternal and 347 newborn outcomes in Pakistan compared to
32 473 other low and middle income 348 countries in the Global Network's Maternal Newborn
33 474 Health Registry: an 349 active, community-based, pregnancy surveillance mechanism.
34 475 *Reprod Health* 2015;350:12.
- 35 476 12. National Institute of Population Studies Islamabad Pakistan. Pakistan Demographic and Health
36 477 Survey 2017-18 [cited 2022 July]. Available from:
37 478 <https://dhsprogram.com/pubs/pdf/FR354/FR354.pdf> accessed July 2022.
- 38 479 13. Makinde OA, Odimegwu COJPAMJ. A qualitative inquiry on the status and adequacy of legal
39 480 instruments establishing infectious disease surveillance in Nigeria. *Pan Afr Med J* 2018;31(1)
- 40 481 14. Dehcheshmeh NF, Arab M, Foroushani AR, et al. Survey of communicable diseases surveillance
41 482 system in hospitals of Iran: A Qualitative approach. *Glob J Health Sci* 2016;8(9):44.
- 42 483 15. Abuzerr S, Zinszer K, Assan AJSom. Implementation challenges of an integrated One Health
43 484 surveillance system in humanitarian settings: A qualitative study in Palestine. *SAGE Open*
44 485 *Med* 2021;9:20503121211043038.
- 45 486 16. Yan W, Zhou Y, Wei S, et al. The difficulties of early detection for infectious disease outbreak in
46 487 China: a qualitative investigation. *Journal of Nanjing Medical University* 2008;22(1):66-70.
- 47 488 17. Angelo M, Ramalho WM, Gurgel H, et al. Dengue surveillance system in Brazil: A qualitative study
48 489 in the federal district. *Int J Environ Res Public Health* 2020;17(6):2062.
- 49 490 18. Pilot E, Murthy G, Nittas VJGPH. Understanding India's urban dengue surveillance: A qualitative
50 491 policy analysis of Hyderabad district. *Glob Public Health* 2020;15(11):1702-17.
- 51 492 19. Lu G, Liu Y, Beiersmann C, et al. Challenges in and lessons learned during the implementation of
52 493 the 1-3-7 malaria surveillance and response strategy in China: a qualitative study. *Infect Dis*
53 494 *Poverty* 2016;5(1):1-11.

- 1
2
3 495 20. Lagarde M, Palmer NJCDoSR. The impact of contracting out on health outcomes and use of
4 496 health services in low and middle-income countries. *Cochrane Database Syst Rev* 2009(4)
5 497 21. Prajitha KC, Rahul A, Chintha S, et al. Strategies and challenges in Kerala's response to the initial
6 498 phase of COVID-19 pandemic: a qualitative descriptive study. *BMJ Open*
7 499 2021;11(7):e051410.
8 500 22. Asadi H, Gouya M-M, Nabavi M, et al. The communicable diseases surveillance system in Iran:
9 501 challenges and opportunities. *Arch Iran Med* 2019
10 502
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1 **TITLE:**

2 **Exploring stakeholders' experiences and perceptions regarding barriers to**
3 **effective surveillance of communicable diseases in a rural district of Pakistan**
4 **– a qualitative study**

5
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19 ABSTRACT

20 **Objective:** To explore the experiences and perceptions of health system stakeholders of a
21 rural district of Sindh, Pakistan regarding the barriers to effective surveillance of
22 communicable diseases.

23 **Design:** This qualitative descriptive exploratory design comprised in-depth interviews. Both
24 inductive and deductive thematic analysis was applied to identify key themes from the data.

25 **Settings:** The study was conducted in public sector healthcare facilities and the district
26 health office of the rural district of Thatta, in Sindh province, Pakistan.

27 **Participants:** Fifteen healthcare managers and healthcare providers working in the eight
28 public sector primary and secondary healthcare facilities were interviewed using an open-
29 ended in-depth interview guide.

30 **Results:** Key themes that emerged from the data were: poor governance and absence of
31 surveillance policy framework; fragmentation in the health system leading to lack of uniform
32 reporting; inadequate (human) resources that weakened the infrastructure for disease
33 surveillance; hospital-based reporting of cases that led to a predominantly passive
34 surveillance system; paper-based surveillance system as the key determinant of delayed
35 reporting; non-utilization of surveillance data for decision making; absence of local
36 laboratory capacity to complement the detection of disease outbreaks and lack of private
37 sector integration in disease surveillance.

38 **Conclusions:** Poor governance and lack of policy framework were perceived to be
39 responsible for weak surveillance infrastructure. Resource deficiencies including inadequate
40 human resource, paper-based reporting and the absence of local laboratory capacity were
41 considered to result in delayed, poor quality, and incomplete reporting. The lack of private
42 sector engagement was identified as a major gap.

43
44 **Keywords:** surveillance, communicable diseases, health services research, qualitative, rural,
45 Pakistan

46 **Strengths and limitations of this study**

- 47 • The study has explored experiences and perceptions regarding barriers to effective
48 surveillance of communicable diseases in-depth by involving representatives from
49 various levels of the healthcare system including from the public health sector and those
50 working under public-private partnership
- 51 • The inclusion of both healthcare managers and healthcare providers in the study
52 provided deeper insights into barriers at both the stewardship level and the operational
53 level
- 54 • The study is amongst few in Pakistan to adopt a qualitative research approach for
55 exploring barriers to infectious disease surveillance as perceived and experienced by
56 health system stakeholders

57

58 BACKGROUND

59 Infectious diseases continue to pose threat to the health of the public globally. In developing
60 countries, infectious diseases form a significant portion of the disease burden including
61 HIV/AIDS, tuberculosis (TB), malaria, respiratory infections, hepatitis B & C in adults and
62 pneumonia and diarrhoea in children under five years of age ^{1,2}. In Pakistan, communicable
63 diseases remain a major cause of public health concern with a significant contribution to
64 morbidity and mortality. Conditions like overcrowding, low socio-economic status, poor
65 hygiene and unsafe drinking water and poor awareness of health lead to an environment
66 conducive to disease outbreaks. The Health System of the country is overwhelmed by issues
67 of poor governance and lack of resources resulting in a surveillance system that is ill-
68 equipped at detecting outbreaks of infectious disease ³. Before the devolution of the health
69 system, Pakistan had two main sources to collect data for health indicators namely: 1)
70 health management information system: this was designed to collect data on selected
71 health indicators from health facilities with established reporting lines from provincial to
72 federal health ministry; 2) data from vertical programs such as national TB control program,
73 malaria control program, HIV/AIDS control program amongst others that also reported to
74 federal health ministry ⁴. Following health system devolution in 2010, administrative powers
75 were devolved to provinces with the district becoming the autonomous unit for defining its
76 health priorities and health planning ⁵. In the new, albeit ill-prepared administrative setup
77 district health information system (DHIS) was established to collect disease-related data
78 from the health facility level ⁶. In all provinces of the country including the Sindh province,
79 DHIS is the only source of information on health indicators of the population based on
80 service delivery data from public sector health facilities. However, the DHIS has remained
81 underutilized for communicable disease surveillance. In the last five years, rural districts of
82 Sindh have witnessed outbreaks of diseases such as measles ⁷ and HIV/AIDS ⁸ while the
83 surveillance system was unable to predict these outbreaks. As per the international health
84 regulations, member states of the World Health Organization have the obligation to develop
85 and strengthen disease surveillance with the help of existing health system resources ⁹.
86 However, the emergence of recent outbreaks has indicated weaker surveillance of
87 communicable diseases more so in rural areas of Pakistan. Moreover, only diseases with
88 global priority (such as COVID-19 and Polio) have managed to get attention, whereas

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2
3 89 surveillance for diseases of national priority has often struggled to compete for policy space
4
5 90 and resources. The scientific literature on infectious disease surveillance in Pakistan is either
6
7 91 quantitative in nature or mostly has discussed the implementation of models like the
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9 92 disease early warning system (DEWS) for surveillance¹⁰⁻¹². However, there is a dearth of
10
11 93 literature regarding the challenges that healthcare managers and providers face when
12
13 94 implementing disease surveillance programs and perceptions and experiences of these
14
15 95 healthcare professionals regarding barriers to effective surveillance of infectious diseases
16
17 96 are less well studied in Pakistan. Such information will not only give an in-depth insight into
18
19 97 the challenges faced in infectious disease surveillance but also inform the policy makers
20
21 98 with recommendations for addressing those challenges. Hence, we conducted this study to
22
23 99 explore the experiences and perceptions of health system stakeholders of a rural district of
24
25 100 Sindh, Pakistan regarding the barriers to effective surveillance of communicable diseases.

101 **METHODS**

102 **Study design and setting**

103 This study used a qualitative descriptive exploratory design to explore the perceptions and
104
105 experiences of district health system stakeholders regarding the barriers to an effective
106
107 surveillance system for communicable diseases in the rural district of Thatta located in the
108
109 province of Sindh, Pakistan. Thatta is situated approximately 100 kilometres from the
110
111 provincial capital of Karachi. It is a predominantly rural district with an approximate
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113 population of 1 million^{13 14}. Health indicators including maternal mortality ratio and
114
115 neonatal mortality rate are amongst the worst in the country^{15 16}. The situation of the
116
117 healthcare system of Thatta is comparable to any other rural district of Pakistan with
118
119 inadequate infrastructure and resources. There exist primary and secondary healthcare
120
121 facilities in the district and there is also a private healthcare system in the district comprising
122
123 general practitioner clinics and small hospitals. The study was conducted from February 15
124
125 to April 30, 2022, in eight public sector primary and secondary healthcare facilities in the
126
127 district.

116 **Study participants**

117 We used purposive sampling to select study participants. Eligible participants were
118
119 healthcare managers and healthcare providers working in the eight public sector primary

1
2
3 119 and secondary healthcare facilities. Healthcare managers were those working at the district
4
5 120 level and were responsible for the management of health services. Healthcare providers
6
7 121 were the doctors responsible for the provision of clinical care at selected healthcare
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9 122 facilities. Participants included both males (n = 12) and females (n = 3). The age range of
10
11 123 study participants was 29 – 57 years. The experience of study participants with the district
12
13 124 health system ranged from 5 – 30 years.

14
15 125 We used the ‘saturation principle’ to determine the sample size for the study. Upon
16
17 126 researchers’ observation, with further interviews yielding no new or significant findings,
18
19 127 data collection was stopped. This resulted in 15 in-depth interviews with healthcare
20
21 128 managers and healthcare providers.

22 23 129 **Data collection**

24
25 130 The data were collected using an open-ended interview guide. The guide comprised
26
27 131 questions and probes regarding perceptions and experiences about the current state of
28
29 132 communicable disease surveillance and challenges in infrastructure and financing for
30
31 133 surveillance, barriers in data reporting, timeliness of reporting, and quality of reported data.
32
33 134 The guide was developed following a thorough literature review and researchers’ own
34
35 135 experience and expertise on the subject. The guide was piloted before data collection.
36
37 136 Based on the pretest results, researchers gained new insights and revised the interview
38
39 137 guide by adding further questions and probes. The interviews were conducted by the first
40
41 138 author (IN) having research experience in health systems, communicable diseases, and
42
43 139 qualitative research. The first author moderated the interviews along with note-takers. The
44
45 140 interviews were conducted in the local language (Sindhi) and were audiotaped. A debriefing
46
47 141 session was held after each interview to reflect on the participants’ responses. The
48
49 142 interviews took place in health facilities at a time suitable for study participants with each
50
51 143 interview lasting about 40 – 50 minutes.

52 144 **Ethical considerations**

53
54 145 Informed written and verbal consent was obtained from all study participants and queries
55
56 146 raised were satisfied. Ethical approval for this study was obtained from the Ethics Review
57
58 147 Committee of the Aga Khan University Karachi, Pakistan (ERC # 2020-5777-15184). Privacy,
59
60

1
2
3 148 confidentiality, and anonymity of the respondents were ensured during data collection and
4
5 149 reporting of the study findings.
6

7 150 **Researchers' reflexivity**

8
9 151 In qualitative research, research findings are liable to be influenced by researchers' interest
10
11 152 and understanding of the topic. In this study, researchers were not the staff of the health
12
13 153 facilities where the study was conducted. However, due to the research team's four years'
14
15 154 work experience in the district, they were not considered outsiders by the study
16
17 155 respondents but rather someone familiar with the district health system and interested in
18
19 156 exploring their views. Moreover, researchers used reflexive notes during data collection that
20
21 157 fed into the interpretation of study findings to minimize researcher bias.

22 158 Researchers had knowledge of the health system and infectious diseases research which
23
24 159 influenced the development of the interview guide, however, while pre-testing the guide
25
26 160 researchers gained new knowledge which informed the revision of the interview guide.

27 161 **Patient and public involvement statement**

28
29 162 Patients or the public were not involved in the design, or conduct, or reporting, or
30
31 163 dissemination plans of our research
32

33 164 **DATA ANALYSIS**

34
35 165 We used both inductive and deductive methods to perform data analysis. The analysis
36
37 166 approach used a combination of interviews with study participants facilitated by field
38
39 167 observations. Researchers' background knowledge of health systems and infectious disease
40
41 168 research guided the process of data collection and analysis using the deductive method.
42
43 169 However, during the analysis new themes emerged that were analysed using the inductive
44
45 170 method. All audio tapes were transcribed from Sindhi to English and interview notes were
46
47 171 written. Manual content analysis was performed where interview notes and notes from
48
49 172 audio transcripts were read and re-read to identify patterns in data. Manual codes were
50
51 173 assigned to identified patterns in data which were subsequently grouped and classified into
52
53 174 main themes. All the authors and field team members read the themes, and discrepancies
54
55 175 were discussed during the interpretation and analysis of data. The themes emerging from
56
57 176 the analysis were shared and discussed with study participants for their comments.

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3 **179 RESULTS**
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5 180 Data analysis identified a number of core themes from in-depth interviews. Where
6
7 181 appropriate, direct quotes from the interviews have been used to ensure rigour in the data
8
9 182 reporting. To avoid identifying specific individuals, the participants have been allocated
10
11 183 aliases. Table 1 summarizes the themes and codes that emerged from the data.

12
13 **Table 1. Themes and codes emerging from data**

Themes	Codes
The absence of a surveillance policy framework and poor governance leads to an ill-defined disease surveillance system	<ul style="list-style-type: none"> • Lack of provincial policy on infectious disease surveillance • Lack of laws • Lack of surveillance standards • Lack of resource planning leading to dysfunctional digital information systems • Lack of planning to ensure integrated surveillance of infectious diseases
Fragmentation in the healthcare system is a hindrance to a uniform reporting system	<ul style="list-style-type: none"> • Poor coordination between health system stakeholders • Lack of integration between different levels of health facilities • Lack of defined reporting lines for surveillance data • Different organization managing various levels of health facilities in the district
Inadequate resources translate to poor disease surveillance	<ul style="list-style-type: none"> • Inadequate provision of facilities and equipment • Lack of dedicated human resource for surveillance • Lack of financial support • Lack of dedicated line item for surveillance in provincial/district budget
In the current system surveillance is predominantly passive	<ul style="list-style-type: none"> • Hospital based surveillance • Surveillance data collected from patients presenting to hospitals • Lack of human resource to conduct surveillance in communities • Low level of surveillance activities outside hospitals

Paper-based reporting is a key determinant of delayed disease reporting	<ul style="list-style-type: none"> • Surveillance data compiled on hard copies • Hard copies are delivered from health facilities to district health office • No dedicated human resource to transfer health facility reports to district health office
Surveillance data is underutilized for evidence-based decision making	<ul style="list-style-type: none"> • Monthly report submission by health facilities to district health office is mandatory • No feedback provided from district health office to facilities on submitted reports • Submitted reports are not reviewed for data errors • No one from district or provincial makes monitoring visits to check fidelity of reported data
Lack of laboratory testing capacity takes a toll on disease surveillance	<ul style="list-style-type: none"> • There is no laboratory capable of conducting tests for diseases under surveillance • Samples are sent to regional laboratory for testing
The lack of integration of the private sector in disease surveillance is a major gap	<ul style="list-style-type: none"> • At provincial or district level, no measures are taken to bring surveillance data from private health sector into mainstream • Private health sector does not report surveillance data to district health office or provincial health department except in case of COVID

184

185 **The absence of a surveillance policy framework and poor governance leads to an ill-**
 186 **defined disease surveillance system**

187 All study participants unanimously pointed out the lack of a comprehensive policy
 188 framework for disease surveillance. A respondent mentioned that despite that following
 189 devolution in the health system where the province has the autonomy of decision making,
 190 no initiative regarding disease surveillance policy has been taken. As a result, there is a lack

1
2
3 191 of clarity in reporting disease-related data, coordination between different stakeholders,
4
5 192 and meaningful analysis of data and its use for taking action.
6

7 193 *“National health policy emphasizes the importance of disease surveillance and having such a*
8
9 194 *system in place; however, it is up to provinces to develop detailed guidelines for disease*
10
11 195 *surveillance and ensure its implementation which is not happening! [Participant 14].”*
12

13
14 196 Provincial disease surveillance and response unit
15

16 197 One of the study respondents mentioned that a digital information system named Provincial
17
18 198 Disease Surveillance and Response Unit (PDSRU) was developed in 2016 with the support of
19
20 199 donor money. The PDSRU had all the communicable diseases of importance listed and the
21
22 200 system was expected to be linked up with secondary hospitals in the province for regular
23
24 201 data collection. However, the PDSRU unit has remained dysfunctional and has not been
25
26 202 utilized for the purpose it was built for.
27

28 203 *“It is very unfortunate that we got the donor money to establish a surveillance system in the*
29
30 204 *province, but we didn’t plan for resources to make the system functional [participant 5].”*
31

32 205 District health information system
33

34 206 One of the respondents said that the DHIS was developed and implemented in 2010⁶. It was
35
36 207 meant to collate service delivery data from primary and secondary health facilities with a
37
38 208 monthly reporting frequency. The data is collected on paper at the health facility level and a
39
40 209 hard copy of the monthly DHIS reporting form is handed over physically by each facility to
41
42 210 the district health office. There, a computer operator enters the data into the digital portal
43
44 211 of DHIS which then can be viewed on a dashboard.
45

46 212 In the current state, DHIS is the only functional health information system that has up-to-
47
48 213 date disease information. But a study respondent pointed out that this information remains
49
50 214 underutilized for disease surveillance as there is hardly any review and feedback on the
51
52 215 reported data from higher levels (i.e., district health office or provincial health department).
53
54 216 Moreover, since the data is collated and shared at the end of each month, its utility for
55
56 217 detecting disease outbreaks is limited.
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2
3 218 *“DHIS data can be a very good source of passive surveillance, but we need to increase the*
4
5 219 *reporting frequency from monthly to weekly and have regular reviews of the reported data*
6
7 220 *[Participant 5].”*
8

9 221 Communicable Disease Control unit

10
11 222 A study respondent mentioned that for infectious diseases, a Communicable Disease
12
13 223 Control (CDC) unit was established at the provincial level in 2015. The intent was to
14
15 224 integrate all the vertical (disease-specific) programs under one roof for planning, resource
16
17 225 allocation and public health interventions. Under the CDC unit, blood-borne diseases like
18
19 226 HIV/AIDS, hepatitis C and hepatitis B could be looked after single-handedly when addressing
20
21 227 the mode of spread, designing interventions and surveillance. Unfortunately, at the district
22
23 228 level, the CDC unit lacks infrastructure (e.g., dedicated building and office space, computers,
24
25 229 and internet), dedicated human resources (district focal CDC person) and a plan ensuring
26
27 230 how the integration of various diseases can take place.

28
29 231 *“Having CDC presents an immediate opportunity for syndromic surveillance; we should not*
30
31 232 *waste this opportunity [Participant 10].”*
32

33 233 **Fragmentation in the healthcare system is a hindrance to a uniform reporting system**

34
35
36 234 Under the public-private partnership (PPP), the public sector healthcare system in Thatta
37
38 235 has been contracted out to various private providers. Under PPP, these providers are
39
40 236 responsible for providing health services on a day-to-day basis while the health department
41
42 237 provides a budget¹⁷.

43
44 238 One of the study respondents mentioned that in the Thatta district extensive contracting
45
46 239 out of health services has been done and that each level of health facility (i.e., primary, and
47
48 240 secondary) is managed by a different private partner. Distinct reporting lines and a lack of
49
50 241 data-sharing mechanisms between private partners have given rise to fragmentation within
51
52 242 the district health system.

53
54 243 *“Primary level facilities are supposed to be linked with secondary level facilities for referrals*
55
56 244 *and reporting of disease-related data, however, there are so many partners with each*
57
58 245 *having its reporting line. This has negatively affected the reporting of disease surveillance*
59
60 246 *[participant 10].”*

1
2
3 247 A healthcare manager pointed out that in the Thatta district, surveillance for vaccine-
4
5 248 preventable diseases (VPDs) is conducted by the district health office with the district
6
7 249 surveillance coordinator as the focal point. Whereas notifiable diseases are reported by the
8
9 250 focal persons of the disease-specific programs with a flow of information that is separate
10
11 251 from that of VPDs. This vertical nature of surveillance of different diseases is inefficient in
12
13 252 terms of resource utilization as it creates parallel systems where surveillance activities are
14
15 253 carried out in siloes. These inefficiencies in turn create a weaker surveillance system and put
16
17 254 the population at higher risk for communicable disease outbreaks.

18
19 255 *“Every disease-specific program such as that of tuberculosis, malaria etc reports its data in*
20
21 256 *isolation, how can we have an integrated disease surveillance system in this situation?*
22
23 257 *[Participant 7].”*

24 25 258 **Inadequate resources translate to poor disease surveillance**

26
27 259 A healthcare manager highlighted the dearth of human resource for surveillance in the
28
29 260 district. He mentioned that in the district health office, there is only one person (district
30
31 261 surveillance coordinator) who is tasked to coordinate for surveillance of vaccine-
32
33 262 preventable diseases (VPDs), data reporting and data entry into DHIS for all eight public
34
35 263 sector health facilities of the district. The increased workload results in delayed data entry
36
37 264 and delay in data transfer to district health stakeholders. Not only that he lacks a team of
38
39 265 dedicated individuals for surveillance, but he also has no provision of transportation for
40
41 266 reaching out to health facilities and communities for active surveillance. Most of the time,
42
43 267 he has to rely on making telephonic contact with each in charge of health facilities to get
44
45 268 disease-related information.

46
47 269 All the study respondents mentioned that reporting for VPDs is mandatory and health
48
49 270 facilities are required to send weekly reports (even for no cases called ‘zero reports’) of
50
51 271 VPDs to the district surveillance coordinator. But due to a lack of resources e.g.,
52
53 272 transportation and dedicated surveillance staff, the reports from various health facilities in
54
55 273 the district often get delayed.

56
57 274 *“Expecting one person to lead disease surveillance in the district, in the absence of*
58
59 275 *transportation and adequate human resource is too much to ask [Participant 2].”*
60

1
2
3 276 A district healthcare manager pointed out that for notifiable diseases, the district focal
4
5 277 persons of disease-specific programs have the responsibility of reporting data. The primary
6
7 278 role of the focal person is program implementation which involves numerous tasks from
8
9 279 planning and implementing to monitoring and reporting program activities. In absence of
10
11 280 adequate human resource, focal persons primarily rely on data reported as part of program
12
13 281 implementation. This has limitations namely 1) this is a form of passive surveillance rather
14
15 282 than active; 2) reporting of program data takes place at specific intervals whereas
16
17 283 surveillance requires continuous monitoring of disease cases and prompt action. Many
18
19 284 study respondents believed that these limitations lead to a disease surveillance system that
20
21 285 struggles with timely detection, and reporting of disease outbreaks.

22 286 **In the current system, surveillance is predominantly passive**

23
24
25 287 Study respondents pointed out that since the data collection is passive as it is collected
26
27 288 largely from those patients that present to health facilities, hence it is a form of passive
28
29 289 surveillance rather than active surveillance.

30
31 290 *“We could be missing out on outbreaking at the community level since there is no one going*
32
33 291 *and actively screening the community members [Participant 1]”*

34
35 292 Respondents attributed the lack of community-based active surveillance to the lack of
36
37 293 resources and mentioned that there is a need to increase resource allocation for
38
39 294 strengthening active surveillance.

40
41 295

42 43 44 296 **Paper-based reporting is a key determinant of delayed disease reporting**

45
46 297 Several study respondents attributed the delayed reporting of surveillance data to paper-
47
48 298 based reporting. The system for reporting health-related data from health facilities to the
49
50 299 district health offices in Pakistan is paper-based for both VPDs and notifiable diseases. The
51
52 300 health facility in charge fills out a zero-reporting form (for VPDs) or a case report (for a
53
54 301 notifiable disease). A physical copy of this report is then sent to the district surveillance
55
56 302 officer. This often gets delayed as someone must visit the health facility or district
57
58 303 surveillance coordinator to deliver the physical copy of the report. To prevent delay,

1
2
3 304 telephonic contact often plays a key role, however, it is not a feasible way to disseminate
4
5 305 the information to all the relevant stakeholders.

6
7 306 *“We should have a digital system with a dashboard which can show data in real time. We*
8
9 307 *will avoid delayed reporting forever [participant 2].”*

308 **Surveillance data is underutilized for evidence-based decision making**

309 Most study respondents mentioned that data verification is essential to ensure its fidelity.
310 To ensure data quality, monitoring and supervision of field staff and the facility healthcare
311 staff sending data need strengthening. But all respondents agreed that in the existing
312 system of disease surveillance, there is an emphasis on data collection only. No monitoring
313 and supervision are happening from the district or provincial levels. Other than the
314 circumstances where a suspected or confirmed case of disease under surveillance is
315 reported, there is no action taken to verify the authenticity and quality of routinely reported
316 data.

317 *“Despite that, the data is regularly collected through DHIS and other channels, it is rarely*
318 *reviewed or utilized for analysis or action [Participant 12].”*

319 **Lack of laboratory testing capacity takes a toll on disease surveillance**

320 All the study respondents showed their concern regarding poor laboratory capacity for
321 surveillance in the district. Among the eight public sector health facilities in the Thatta
322 district, only two have clinical laboratories. However, none of these laboratories is equipped
323 to conduct testing for any of the VPDs or notifiable diseases in the district. Biological
324 samples collected from suspected patients are sent to a regional laboratory that is based in
325 the capital city of the country (laboratory at National Institute of Health, Islamabad) situated
326 at least 1000 kilometres from Thatta district.

327 A healthcare manager pointed out that the absence of a fully equipped laboratory nearby
328 calls for measures to ensure proper storage and transportation of biological samples. This
329 not only is resource-intensive but adds to the delays in the system staggered by issues of
330 delayed reporting.

331 *“Provincial health department should, at the least, take measures to build a laboratory in the*
332 *province so that disease surveillance can be made a little more efficient [Participant 6].”*

1
2
3 333 **The lack of integration of the private sector in disease surveillance is a major gap**
4

5
6 334 All the study respondents considered the absence of private sector integration as an
7
8 335 important gap. The private health sector is a major stakeholder in service delivery and
9
10 336 caters to approximately 70% healthcare needs of the population. Unfortunately, however,
11
12 337 the service delivery data of the private health sector is not integrated into the DHIS of the
13
14 338 public health sector. In fact, the government is still lagging in taking measures to regulate
15
16 339 the private health sector in Sindh province.

17
18 340 One of the respondents said that integration of data from the private sector in the health
19
20 341 information system is essential to ensure effective disease surveillance as currently, a
21
22 342 significant chunk of the population's disease burden remains to be captured.

23
24 343 *“Our disease surveillance will be at a loss from capturing the true disease burden unless it*
25
26 344 *integrates data from the private health sector [Participant 6].”*

27
28 345 **DISCUSSION**
29

30 346 Our study explored multifaceted barriers to effective surveillance of communicable diseases
31
32 347 in a rural district of Pakistan. Our study showed that the lack of policy guidelines at the
33
34 348 provincial level was fundamental to ineffective disease surveillance and poor data reporting.
35
36 349 Poor stakeholders' coordination led to a lack of sharing of surveillance data hampering the
37
38 350 surveillance efforts. Due to poor resource planning, the digital information systems i.e.,
39
40 351 PDSRU and DHIS built using donor resources were underutilized. Having the district
41
42 352 surveillance coordinator as the sole person responsible for surveillance activities in the
43
44 353 district, in absence of additional resources, was considered a major resource gap by study
45
46 354 respondents. Most study respondents were concerned about the predominantly passive
47
48 355 nature of existing district surveillance. Paper-based reporting together with inadequate
49
50 356 human resource was considered an important cause of delayed reporting in surveillance.
51
52 357 The lack of laboratory testing capacity in the district was another determinant for delayed
53
54 358 reporting. There was an increasing emphasis on collecting data than using it for predicting
55
56 359 outbreaks or taking measures to control these. The absence of inclusion of infectious
57
58 360 disease surveillance data of private sector data in the district surveillance was identified as
59
60 361 another major gap by study respondents.

1
2
3 362 Despite that a decade has elapsed since the health system in Pakistan was devolved, the
4
5 363 pace of provinces taking charge of health planning and resource generation has remained
6
7 364 rather sluggish. A study respondent mentioned that despite the increasing infectious
8
9 365 disease outbreaks in Sindh and other provinces in recent years i.e., measles, HIV/AIDS and
10
11 366 the global COVID pandemic, initiatives regarding comprehensive guidelines and laws for
12
13 367 disease surveillance are still lacking. Studies from Nigeria and Zambia show that the laws
14
15 368 related to public health surveillance existed but were considered to be outdated and/or
16
17 369 poorly implemented¹⁸. Studies from Iran and Palestine concluded that having laws and
18
19 370 policies for disease surveillance enable governments to allocate funds for establishing
20
21 371 surveillance programs and that health authorities should play a lead role in ensuring their
22
23 372 implementation^{10 19}.
24
25 373 Having a dysfunctional PDSRU for reporting surveillance data is a classic example of relying
26
27 374 on donor money instead of concentrating on building local capacity for a functional health
28
29 375 information system. Many respondents termed this unfortunate and emphasized investing
30
31 376 resources in reviving the PDSRU. In a study from China inadequacy of resources at the local
32
33 377 level was identified as an important determinant of a functional digital information system
34
35 378 for disease surveillance. The study reported that the top tier of government invests more in
36
37 379 building digital information systems, but lower levels don't receive enough planned
38
39 380 resources to ensure its implementation²⁰. A functional digital information system has been
40
41 381 found to speed up the reporting, improve data flow and ensure the availability of up-to-date
42
43 382 data for the decision-makers. This eventually leads to early detection of and timely action
44
45 383 against outbreaks¹⁰.
46
47 384 Respondents in our study found the lack of adequate human resource for surveillance at the
48
49 385 district level as concerning. Literature shows that for surveillance to be effective, adequate
50
51 386 human resource is essential to undertake field-based surveillance and for efficient data
52
53 387 reporting²¹. The resource deficiencies including field-based staff have been shown to
54
55 388 undermine effective disease surveillance^{19 22}. Moreover, putting the burden of surveillance
56
57 389 activities on healthcare staff engaged in service delivery negatively affects their motivation,
58
59 390 performance, and consequently the quality of reporting^{10 20 23}.
60
61 391 Despite several advantages of contracting out of health services that the literature notes,
62
63 392 the structural challenges largely remain unaddressed²⁴. One such challenge is poor
64
65 393 coordination between stakeholders. Many respondents pointed out that having multiple

1
2
3 394 stakeholders in the same district had been detrimental to disease surveillance due to a lack
4
5 395 of coordination and ambiguous reporting lines. The flow of data is independent of the level
6
7 396 of health facility defeating the notion of integrated disease surveillance. Poor coordination
8
9 397 between stakeholders ^{21 22} and between different levels of health facilities ¹⁰ have been
10
11 398 reported to adversely affect the data reporting for disease surveillance.

12 399 Many study respondents pointed out the need to strengthen active surveillance in the
13
14 400 district as in the present system, the surveillance was largely hospital-based where the data
15
16 401 was being gathered from patients presenting to health facilities. Literature shows that the
17
18 402 majority of people may opt not to show up for health seeking unless they develop serious
19
20 403 symptoms ²⁰. This, in the event of a communicable disease, not only has the potential for
21
22 404 the infection to spread but also leads to a delay in detecting an outbreak. Relying on passive
23
24 405 surveillance only is often dependent on factors including patients' awareness, health-
25
26 406 seeking behaviour and socioeconomic status and hence needs to be supplemented by some
27
28 407 form of active surveillance ²³.

29 408 Paper-based reporting in our study came out as an important barrier to timely reporting.
30
31 409 The need for transitioning from slow, staff-reliant and paper-based reporting to the digital
32
33 410 mode of reporting is increasingly recognized in literature ^{10 21}. A study from India has
34
35 411 demonstrated improved disease notification and enhanced data reporting due to
36
37 412 transitioning to digital media ²⁵.
38
39 413 Except when suspected or a confirmed case of a disease is detected, data sent from health
40
41 414 facilities is rarely reviewed at higher levels. Respondents in our study pointed out that there
42
43 415 is more emphasis on data collection than its analysis and use. It is evident from the
44
45 416 literature that providing regular feedback to facility staff on the data has been shown to act
46
47 417 as a motivating factor and a performance boost ^{10 22}.

48 418 Study respondents emphasized the need for having local laboratory capacity to ensure
49
50 419 timely detection of disease outbreaks. Studies in literature have demonstrated that in
51
52 420 absence of a local laboratory, rapid diagnostics kits (RDTs) may facilitate confirming
53
54 421 outbreak until laboratory test results become available ²³ thus preventing delays that may
55
56 422 incur in the transfer of biological samples ²².

57
58 423 The extent to which a health system can detect disease outbreaks is dependent on its
59
60 424 capacity to capture patients' data. In Pakistan, the private health sector caters to most of

1
2
3 425 the population's healthcare needs. However, it is largely unregulated in Sindh province and
4
5 426 in Pakistan in general, leading to a lack of integration of its patient data with the public
6
7 427 sector. Studies show that the poor private sector engagement in disease surveillance is an
8
9 428 important issue hampering the surveillance efforts in many countries including India ^{22 25},
10
11 429 Iran ²⁶ and China ²³.

12 430 **LIMITATIONS OF THE STUDY**

13
14 431 Our study was conducted in a predominantly rural district of Pakistan that is already
15
16 432 challenged in terms of resource availability. Hence, when generalizing the study findings,
17
18 433 these may be interpreted in a similar context. Due to the researchers' experience and
19
20 434 familiarity with the health system of the study district, the possibility of contamination of
21
22 435 study results with researchers' own perceptions can not be completely eliminated, however,
23
24 436 objectivity was ensured by note-taking during interviews and the use of interviews' audio
25
26 437 recordings to ensure accuracy in data reporting.

27 438 **CONCLUSION**

28
29 439 We concluded that poor governance was perceived to lead to underutilization of existing
30
31 440 resources for surveillance whereas lack of a policy framework on surveillance was
32
33 441 considered to lead to a poor investment of resources in surveillance infrastructure. The
34
35 442 absence of resources and inadequate human resource was identified by respondents as the
36
37 443 key determinant of delayed and inadequate reporting leading to delayed detection of
38
39 444 disease outbreaks. This was further aggravated by the absence of local laboratory capacity.
40
41 445 The existing surveillance system was perceived as largely paper-based, slow, and comprised
42
43 446 of hospital-based passive surveillance. The lack of private sector engagement in infectious
44
45 447 disease surveillance was perceived as a significant gap.

46 448 47 48 449 49 50 450 **RECOMMENDATIONS**

51
52 451 The lack of directions from the provincial level regarding infectious disease surveillance
53
54 452 necessitates the need for formulation of policy guidelines outlining not just the technical
55
56 453 aspects of surveillance but also ensuring adequate resource planning and allocation to
57
58 454 establish and sustain effective infectious disease surveillance at the district level. To ensure
59
60 455 disease surveillance in the district, there is a need to i) address resource requirements

1
2
3 456 including adequate budget and human resource; ii) engage with the private health sector to
4
5 457 capture maximum data of patients presenting to health facilities; iii) build active surveillance
6
7 458 into the existing system by having designated human resource, iv) take advantage of the
8
9 459 paperless system for data reporting to eliminate reporting delays and make real-time
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11 460 reporting system where data is instantly available after collection.
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2
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4
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6
7 464 1070479-0

8
9 **465 Competing Interests**

10 466 All authors declare that they have no competing interests

11
12 **467 Authors contributions**

13
14 468 IN, SS, RAS contributed to the plan and design of the study. IN developed the interview
15
16 469 guide which RAS & RH reviewed and provided feedback. IN led data collection and
17
18 470 performed data analysis. IN, SS, RAS & RH participated in the interpretation of the results. IN
19
20 471 drafted the manuscript. SS, RAS, and RH contributed to revisions of the manuscript for
21
22 472 intellectual content. All authors approved the final version of the manuscript.

23
24 **473 Acknowledgement**

25 474 We acknowledge all our participants for their cooperation during the conduct of this study

26
27 **475 Checklist for the appropriate reporting statement**

28
29 476 We used COnsolidated criteria for REporting Qualitative research (COREQ) checklist while
30
31 477 writing the manuscript to ensure rigour in reporting the data for qualitative research

32
33 **478 Patient consent for publication**

34 479 Not applicable

35
36 **480 Data availability statement**

37
38 481 All the data collected as part of this research study are reported in the manuscript

39
40 **482 Word count: 4744**

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42 483

43
44 **484 List of abbreviations**

45 485 TB – Tuberculosis

46
47 486 DHIS – District health information system

48
49 487 PDSRU – Provincial Disease Surveillance and Response Unit

50
51 488 CDC – Communicable Disease Control

52
53 489 PPP – Public-private partnership

54
55 490 VPDs – Vaccine preventable diseases

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57 491

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492 References

- 493 1. Ward JL, Azzopardi PS, Francis KL, et al. Global, regional, and national mortality among young
494 people aged 10–24 years, 1950–2019: a systematic analysis for the Global Burden of Disease
495 Study 2019. *Lancet* 2021;398(10311):1593–618.
- 496 2. Ledesma JR, Ma J, Vongpradith A, et al. Global, regional, and national sex differences in the global
497 burden of tuberculosis by HIV status, 1990–2019: results from the Global Burden of Disease
498 Study 2019. *Lancet Infect Dis* 2022;22(2):222–41.
- 499 3. World Health Organization. Communicable disease surveillance and response - Pakistan 2022
500 [cited 2022 July]. Available from:
501 [http://www.emro.who.int/pak/programmes/communicable-disease-a-surveillance-](http://www.emro.who.int/pak/programmes/communicable-disease-a-surveillance-response.html)
502 [response.html](http://www.emro.who.int/pak/programmes/communicable-disease-a-surveillance-response.html) accessed July 2022.
- 503 4. Ali M, Horikoshi YJPJMR. Situation analysis of health management information system in Pakistan.
504 *Pakistan Journal Medical Research* 2002;41(2):64–9.
- 505 5. Zaidi SA, Bigdeli M, Langlois EV, et al. Health systems changes after decentralisation: progress,
506 challenges and dynamics in Pakistan. *BMJ Glob Health* 2019;4(1):e001013.
- 507 6. Agency JIC. The District Health Information System (DHIS) Project for Evidence-Based Decision
508 Making and Management 2009 [cited 2022 September]. Available from:
509 https://www.jica.go.jp/pakistan/english/activities/activity02_03.html accessed September
510 2022.
- 511 7. Ahmad Z, Zahid HJJotPMA. Threat of a Measles outbreak amidst COVID 19 surge in Sindh,
512 Pakistan-Letter to the editor. *J Pak Med Assoc* 2021;71(10):2488–88.
- 513 8. Siddiqui AR, Nathwani AA, Abidi SH, et al. Investigation of an extensive outbreak of HIV infection
514 among children in Sindh, Pakistan: protocol for a matched case–control study. *BMJ Open*
515 2020;10(3):e036723.
- 516 9. World Health Organization. International Health Regulations 2005 2022 [cited 2022 July]. Available
517 from: [http://apps.who.int/iris/bitstream/handle/10665/246107/9789241580496-](http://apps.who.int/iris/bitstream/handle/10665/246107/9789241580496-eng.pdf;jsessionid=95E436B7F04EA4A8635945E4C684A14C?sequence=1)
518 [eng.pdf;jsessionid=95E436B7F04EA4A8635945E4C684A14C?sequence=1](http://apps.who.int/iris/bitstream/handle/10665/246107/9789241580496-eng.pdf;jsessionid=95E436B7F04EA4A8635945E4C684A14C?sequence=1) accessed July 2022.
- 519 10. Dehcheshmeh NF, Arab M, Ferooshani AR, et al. Survey of communicable diseases surveillance
520 system in hospitals of Iran: A Qualitative approach. *Glob J Health Sci* 2016;8(9):44.
- 521 11. Bilal W, Qamar K, Abbas S, et al. Infectious diseases surveillance in Pakistan: Challenges, efforts,
522 and recommendations. 2022;78:103838.
- 523 12. Baig MA, Shaikh BTJAPJoPH. Disease surveillance system: a mandatory conduit for effective
524 control of infectious diseases in Pakistan. 2012;24(4):586–94.
- 525 13. Abbasi IN, Siddiqi S. Overcoming the challenges of community-engaged emergency referrals in a
526 rural district of Pakistan. *J Pak Med Assoc* 2021
- 527 14. Pakistan Bureau of Statistics. Thatta district 2017 [cited 2022 July]. Available from:
528 <https://www.pbs.gov.pk/census-2017-district-wise/results/091> accessed July 2022.
- 529 15. Pasha O, Saleem S, Ali S, et al. Maternal and 347 newborn outcomes in Pakistan compared to
530 other low and middle income 348 countries in the Global Network’s Maternal Newborn
531 Health Registry: an 349 active, community-based, pregnancy surveillance mechanism.
532 *Reprod Health* 2015;350:12.
- 533 16. National Institute of Population Studies Islamabad Pakistan. Pakistan Demographic and Health
534 Survey 2017–18 [cited 2022 July]. Available from:
535 <https://dhsprogram.com/pubs/pdf/FR354/FR354.pdf> accessed July 2022.
- 536 17. Shaikh B, Rabbani F, Safi N, et al. Contracting of primary health care services in Pakistan: is up-
537 scaling a pragmatic thinking. 2010;60(5):387.
- 538 18. Makinde OA, Odimegwu COJPAMJ. A qualitative inquiry on the status and adequacy of legal
539 instruments establishing infectious disease surveillance in Nigeria. *Pan Afr Med J* 2018;31(1)
- 540 19. Abuzerr S, Zinszer K, Assan AJSom. Implementation challenges of an integrated One Health
541 surveillance system in humanitarian settings: A qualitative study in Palestine. *SAGE Open*
542 *Med* 2021;9:20503121211043038.

- 1
2
3 543 20. Yan W, Zhou Y, Wei S, et al. The difficulties of early detection for infectious disease outbreak in
4 544 China: a qualitative investigation. *Journal of Nanjing Medical University* 2008;22(1):66-70.
5 545 21. Angelo M, Ramalho WM, Gurgel H, et al. Dengue surveillance system in Brazil: A qualitative study
6 546 in the federal district. *Int J Environ Res Public Health* 2020;17(6):2062.
7 547 22. Pilot E, Murthy G, Nittas VJGPH. Understanding India's urban dengue surveillance: A qualitative
8 548 policy analysis of Hyderabad district. *Glob Public Health* 2020;15(11):1702-17.
9 549 23. Lu G, Liu Y, Beiersmann C, et al. Challenges in and lessons learned during the implementation of
10 550 the 1-3-7 malaria surveillance and response strategy in China: a qualitative study. *Infect Dis*
11 551 *Poverty* 2016;5(1):1-11.
12 552 24. Lagarde M, Palmer NJCDoSR. The impact of contracting out on health outcomes and use of
13 553 health services in low and middle-income countries. *Cochrane Database Syst Rev* 2009(4)
14 554 25. Prajitha KC, Rahul A, Chintha S, et al. Strategies and challenges in Kerala's response to the initial
15 555 phase of COVID-19 pandemic: a qualitative descriptive study. *BMJ Open*
16 556 2021;11(7):e051410.
17 557 26. Asadi H, Gouya M-M, Nabavi M, et al. The communicable diseases surveillance system in Iran:
18 558 challenges and opportunities. *Arch Iran Med* 2019
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COREQ (CONsolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
<i>Personal characteristics</i>			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	
Occupation	3	What was their occupation at the time of the study?	
Gender	4	Was the researcher male or female?	
Experience and training	5	What experience or training did the researcher have?	
<i>Relationship with participants</i>			
Relationship established	6	Was a relationship established prior to study commencement?	
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	
Interviewer characteristics	8	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	
Domain 2: Study design			
<i>Theoretical framework</i>			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	
<i>Participant selection</i>			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	
Sample size	12	How many participants were in the study?	
Non-participation	13	How many people refused to participate or dropped out? Reasons?	
<i>Setting</i>			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	
<i>Data collection</i>			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	
Repeat interviews	18	Were repeat interviews carried out? If yes, how many?	
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	
Field notes	20	Were field notes made during and/or after the interview or focus group?	
Duration	21	What was the duration of the interviews or focus group?	
Data saturation	22	Was data saturation discussed?	
Transcripts returned	23	Were transcripts returned to participants for comment and/or	

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction?	
Domain 3: analysis and findings			
<i>Data analysis</i>			
Number of data coders	24	How many data coders coded the data?	
Description of the coding tree	25	Did authors provide a description of the coding tree?	
Derivation of themes	26	Were themes identified in advance or derived from the data?	
Software	27	What software, if applicable, was used to manage the data?	
Participant checking	28	Did participants provide feedback on the findings?	
<i>Reporting</i>			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	
Data and findings consistent	30	Was there consistency between the data presented and the findings?	
Clarity of major themes	31	Were major themes clearly presented in the findings?	
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

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Exploring stakeholders' experiences and perceptions regarding barriers to effective surveillance of communicable diseases in a rural district of Pakistan – a qualitative study

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1 **TITLE:**

2 **Exploring stakeholders' experiences and perceptions regarding barriers to**
3 **effective surveillance of communicable diseases in a rural district of Pakistan**
4 **– a qualitative study**

5
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19 ABSTRACT

20 **Objective:** To explore the experiences and perceptions of health system stakeholders of a
21 rural district of Sindh, Pakistan regarding the barriers to effective surveillance of
22 communicable diseases.

23 **Design:** This qualitative descriptive exploratory design comprised in-depth interviews. Both
24 inductive and deductive thematic analysis was applied to identify key themes from the data.

25 **Settings:** The study was conducted in public sector healthcare facilities and the district
26 health office of the rural district of Thatta, in Sindh province, Pakistan.

27 **Participants:** Fifteen healthcare managers and healthcare providers working in the eight
28 public sector primary and secondary healthcare facilities were interviewed using an open-
29 ended in-depth interview guide.

30 **Results:** Key themes that emerged from the data were: poor governance and absence of
31 surveillance policy framework; fragmentation in the health system leading to lack of uniform
32 reporting; inadequate (human) resources that weakened the infrastructure for disease
33 surveillance; hospital-based reporting of cases that led to a predominantly passive
34 surveillance system; paper-based surveillance system as the key determinant of delayed
35 reporting; non-utilization of surveillance data for decision making; absence of local
36 laboratory capacity to complement the detection of disease outbreaks and lack of private
37 sector integration in disease surveillance.

38 **Conclusions:** Poor governance and lack of policy framework were perceived to be
39 responsible for weak surveillance infrastructure. Resource deficiencies including inadequate
40 human resource, paper-based reporting and the absence of local laboratory capacity were
41 considered to result in delayed, poor quality, and incomplete reporting. The lack of private
42 sector engagement was identified as a major gap.

43
44 **Keywords:** surveillance, communicable diseases, health services research, qualitative, rural,
45 Pakistan

46 **Strengths and limitations of this study**

- 47 • The study has explored experiences and perceptions regarding barriers to effective
48 surveillance of communicable diseases in-depth by involving representatives from
49 various levels of the healthcare system including from the public health sector and those
50 working under public-private partnership
- 51 • The inclusion of both healthcare managers and healthcare providers in the study
52 provided deeper insights into barriers at both the stewardship level and the operational
53 level
- 54 • The study is amongst few in Pakistan to adopt a qualitative research approach for
55 exploring barriers to infectious disease surveillance as perceived and experienced by
56 health system stakeholders
- 57 • The study was conducted in a rural district of a developing country, hence study findings
58 should be interpreted in a similar context

60 BACKGROUND

61 Infectious diseases continue to pose threat to the health of the public globally. In developing
62 countries, infectious diseases form a significant portion of the disease burden including
63 HIV/AIDS, tuberculosis (TB), malaria, respiratory infections, hepatitis B & C in adults and
64 pneumonia and diarrhoea in children under five years of age ^{1 2}. In Pakistan, communicable
65 diseases remain a major cause of public health concern with a significant contribution to
66 morbidity and mortality. Conditions like overcrowding, low socio-economic status, poor
67 hygiene and unsafe drinking water and poor awareness of health lead to an environment
68 conducive to disease outbreaks. The Health System of the country is overwhelmed by issues
69 of poor governance and lack of resources resulting in a surveillance system that is ill-
70 equipped at detecting outbreaks of infectious disease ³. Before the devolution of the health
71 system, Pakistan had two main sources to collect data for health indicators namely: 1)
72 health management information system: this was designed to collect data on selected
73 health indicators from health facilities with established reporting lines from provincial to
74 federal health ministry; 2) data from vertical programs such as national TB control program,
75 malaria control program, HIV/AIDS control program amongst others that also reported to
76 federal health ministry ⁴. Following the health system devolution in 2010, administrative
77 powers were devolved to provinces with the district becoming the autonomous unit for
78 defining its health priorities and health planning ⁵. In the new, albeit ill-prepared
79 administrative setup district health information system (DHIS) was established to collect
80 disease-related data from the health facility level ⁶. In all provinces of the country including
81 the Sindh province, DHIS is the only source of information on health indicators of the
82 population based on service delivery data from public sector health facilities. However, the
83 DHIS has remained underutilized for communicable disease surveillance. In the last five
84 years, rural districts of Sindh have witnessed outbreaks of diseases such as measles ⁷ and
85 HIV/AIDS ⁸ while the surveillance system was unable to predict these outbreaks. As per the
86 international health regulations, member states of the World Health Organization have the
87 obligation to develop and strengthen disease surveillance with the help of existing health
88 system resources ⁹. However, the emergence of recent outbreaks has indicated weaker
89 surveillance of communicable diseases more so in rural areas of Pakistan. Moreover, only
90 diseases with global priority (such as COVID-19 and Polio) have managed to get attention,

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3 91 whereas surveillance for diseases of national priority has often struggled to compete for
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5 92 policy space and resources. The scientific literature on infectious disease surveillance in
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7 93 Pakistan is either quantitative in nature or mostly has discussed the implementation of
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9 94 models like the disease early warning system (DEWS) for surveillance¹⁰⁻¹². However, there is
10
11 95 a dearth of literature regarding the challenges that healthcare managers and providers face
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13 96 when implementing disease surveillance programs and perceptions and experiences of
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15 97 these healthcare professionals regarding barriers to effective surveillance of infectious
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17 98 diseases are less well studied in Pakistan. Such information will not only give an in-depth
18
19 99 insight into the challenges faced in infectious disease surveillance but also inform the policy
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21 100 makers with recommendations for addressing those challenges. Hence, we conducted this
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23 101 study to explore the experiences and perceptions of health system stakeholders of a rural
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25 102 district of Sindh, Pakistan regarding the barriers to effective surveillance of communicable
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27 103 diseases.

104 **METHODS**

105 **Study design and setting**

106 This study used a qualitative descriptive exploratory design to explore the perceptions and
107
108 experiences of district health system stakeholders regarding the barriers to an effective
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110 surveillance system for communicable diseases in the rural district of Thatta located in the
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112 province of Sindh, Pakistan. Thatta is situated approximately 100 kilometres from the
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114 provincial capital of Karachi. It is a predominantly rural district with an approximate
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116 population of 1 million^{13 14}. Health indicators including maternal mortality ratio and
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118 neonatal mortality rate are amongst the worst in the country^{15 16}. The situation of the
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120 healthcare system of Thatta is comparable to any other rural district of Pakistan with
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122 inadequate infrastructure and resources. There exist primary and secondary healthcare
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124 facilities in the district and there is also a private healthcare system in the district comprising
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126 general practitioner clinics and small hospitals. The study was conducted from February 15
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128 to April 30, 2022, in eight public sector primary and secondary healthcare facilities in the
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130 district.

131 **Study participants**

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3 120 We used purposive sampling to select study participants. Eligible participants were
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5 121 healthcare managers and healthcare providers working in the eight public sector primary
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7 122 and secondary healthcare facilities. Healthcare managers were those working at the district
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9 123 level and were responsible for the management of health services. Healthcare providers
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11 124 were the doctors responsible for the provision of clinical care at selected healthcare
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13 125 facilities. Participants included both males (n = 12) and females (n = 3). The age range of
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15 126 study participants was 29 – 57 years. The experience of study participants with the district
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17 127 health system ranged from 5 – 30 years.

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19 128 We used the 'saturation principle' to determine the sample size for the study. Upon
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21 129 researchers' observation, with further interviews yielding no new or significant findings,
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23 130 data collection was stopped. This resulted in 15 in-depth interviews with healthcare
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25 131 managers and healthcare providers.

26 132 **Data collection**

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29 133 The data were collected using an open-ended interview guide. The guide comprised
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31 134 questions and probes regarding perceptions and experiences about the current state of
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33 135 communicable disease surveillance and challenges in infrastructure and financing for
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35 136 surveillance, barriers in data reporting, timeliness of reporting, and quality of reported data.
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37 137 The guide was developed following a thorough literature review and the researchers' own
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39 138 experience and expertise on the subject. The guide was piloted before data collection.
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41 139 Based on the pretest results, researchers gained new insights and revised the interview
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43 140 guide by adding further questions and probes. The interviews were conducted by the first
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45 141 author (IN) having research experience in health systems, communicable diseases, and
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47 142 qualitative research. The first author moderated the interviews along with note-takers. The
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49 143 interviews were conducted in the local language (Sindhi) and were audiotaped. A debriefing
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51 144 session was held after each interview to reflect on the participants' responses. The
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53 145 interviews took place in health facilities at a time suitable for study participants with each
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55 146 interview lasting about 40 – 50 minutes.

55 147 **Researchers' reflexivity**

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57 148 In qualitative research, research findings are liable to be influenced by researchers' interest
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59 149 and understanding of the topic. In this study, researchers were not the staff of the health
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3 150 facilities where the study was conducted. However, due to the research team's four years of
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5 151 work experience in the district, they were not considered outsiders by the study
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7 152 respondents but rather someone familiar with the district health system and interested in
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9 153 exploring their views. Moreover, researchers used reflexive notes during data collection that
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11 154 fed into the interpretation of study findings to minimize researcher bias.

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13 155 Researchers had knowledge of the health system and infectious diseases research which
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15 156 influenced the development of the interview guide, however, while pre-testing the guide
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17 157 researchers gained new knowledge which informed the revision of the interview guide.

18 158 **Patient and public involvement statement**

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20 159 Patients or the public were not involved in the design, or conduct, or reporting, or
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22 160 dissemination plans of our research

23 161 **DATA ANALYSIS**

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25 162 We used both inductive and deductive methods to perform data analysis. The analysis
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27 163 approach used a combination of interviews with study participants facilitated by field
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29 164 observations. Researchers' background knowledge of health systems and infectious disease
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31 165 research guided the process of data collection and analysis using the deductive method.
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33 166 However, during the analysis new themes emerged that were analysed using the inductive
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35 167 method. All audio tapes were transcribed from Sindhi to English and interview notes were
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37 168 written. Manual content analysis was performed where interview notes and notes from
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39 169 audio transcripts were read and re-read to identify patterns in data. Manual codes were
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41 170 assigned to identified patterns in data which were subsequently grouped and classified into
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43 171 main themes. All the authors and field team members read the themes, and discrepancies
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45 172 were discussed during the interpretation and analysis of data. The themes emerging from
46
47 173 the analysis were shared and discussed with study participants for their comments.

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51 52 176 **RESULTS**

53
54 177 Data analysis identified a number of core themes from in-depth interviews. Where
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56 178 appropriate, direct quotes from the interviews have been used to ensure rigour in the data
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58 179 reporting. To avoid identifying specific individuals, the participants have been allocated
59
60 180 aliases. Table 1 summarizes the themes and codes that emerged from the data.

Table 1. Themes and codes emerging from data

Themes	Codes
The absence of a surveillance policy framework and poor governance leads to an ill-defined disease surveillance system	<ul style="list-style-type: none"> • Lack of provincial policy on infectious disease surveillance • Lack of laws • Lack of surveillance standards • Lack of resource planning leading to dysfunctional digital information systems • Lack of planning to ensure integrated surveillance of infectious diseases
Fragmentation in the healthcare system is a hindrance to a uniform reporting system	<ul style="list-style-type: none"> • Poor coordination between health system stakeholders • Lack of integration between different levels of health facilities • Lack of defined reporting lines for surveillance data • Different organizations managing various levels of health facilities in the district
Inadequate resources translate to poor disease surveillance	<ul style="list-style-type: none"> • Inadequate provision of facilities and equipment • Lack of dedicated human resource for surveillance • Lack of financial support • Lack of dedicated line item for surveillance in provincial/district budget
In the current system surveillance is predominantly passive	<ul style="list-style-type: none"> • Hospital-based surveillance • Surveillance data collected from patients presenting to hospitals • Lack of human resource to conduct surveillance in communities • Low level of surveillance activities outside hospitals
Paper-based reporting is a key determinant of delayed disease reporting	<ul style="list-style-type: none"> • Surveillance data compiled on hard copies • Hard copies are delivered from health facilities to the district health office

	<ul style="list-style-type: none"> • No dedicated human resource to transfer health facility reports to the district health office
Surveillance data is underutilized for evidence-based decision making	<ul style="list-style-type: none"> • Monthly report submission by health facilities to the district health office is mandatory • No feedback was provided from the district health office to facilities on submitted reports • Submitted reports are not reviewed for data errors • No one from the district or provincial makes monitoring visits to check the fidelity of reported data
Lack of laboratory testing capacity takes a toll on disease surveillance	<ul style="list-style-type: none"> • There is no laboratory capable of conducting tests for diseases under surveillance • Samples are sent to a regional laboratory for testing
The lack of integration of the private sector in disease surveillance is a major gap	<ul style="list-style-type: none"> • At the provincial or district level, no measures are taken to bring surveillance data from the private health sector into the mainstream • The private health sector does not report surveillance data to the district health office or provincial health department except in case of COVID

181

182 **The absence of a surveillance policy framework and poor governance leads to an ill-**
 183 **defined disease surveillance system**

184 All study participants unanimously pointed out the lack of a comprehensive policy
 185 framework for disease surveillance. A respondent mentioned that despite that following
 186 devolution in the health system where the province has the autonomy of decision-making,
 187 no initiative regarding disease surveillance policy has been taken. As a result, there is a lack
 188 of clarity in reporting disease-related data, coordination between different stakeholders,
 189 and meaningful analysis of data and its use for taking action.

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3 190 *“National health policy emphasizes the importance of disease surveillance and having such a*
4 *system in place; however, it is up to provinces to develop detailed guidelines for disease*
5 191 *surveillance and ensure its implementation which is not happening! [Participant 14].”*
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9 193 Provincial disease surveillance and response unit

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12 194 One of the study respondents mentioned that a digital information system named Provincial
13 Disease Surveillance and Response Unit (PDSRU) was developed in 2016 with the support of
14 195 donor money. The PDSRU had all the communicable diseases of importance listed and the
15 196 system was expected to be linked up with secondary hospitals in the province for regular
16 197 data collection. However, the PDSRU unit has remained dysfunctional and has not been
17 198 utilized for the purpose it was built for.
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23 200 *“It is very unfortunate that we got the donor money to establish a surveillance system in the*
24 201 *province, but we didn’t plan for resources to make the system functional [participant 5].”*
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28 202 District health information system

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30 203 One of the respondents said that the DHIS was developed and implemented in 2010⁶. It was
31 204 meant to collate service delivery data from primary and secondary health facilities with a
32 205 monthly reporting frequency. The data is collected on paper at the health facility level and a
33 206 hard copy of the monthly DHIS reporting form is handed over physically by each facility to
34 207 the district health office. There, a computer operator enters the data into the digital portal
35 208 of DHIS which then can be viewed on a dashboard.
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42 209 In its current state, DHIS is the only functional health information system that has up-to-
43 210 date disease information. But a study respondent pointed out that this information remains
44 211 underutilized for disease surveillance as there is hardly any review and feedback on the
45 212 reported data from higher levels (i.e., district health office or provincial health department).
46 213 Moreover, since the data is collated and shared at the end of each month, its utility for
47 214 detecting disease outbreaks is limited.
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53 215 *“DHIS data can be a very good source of passive surveillance, but we need to increase the*
54 216 *reporting frequency from monthly to weekly and have regular reviews of the reported data*
55 217 *[Participant 5].”*
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59 218 Communicable Disease Control unit
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3 219 A study respondent mentioned that for infectious diseases, a Communicable Disease
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5 220 Control (CDC) unit was established at the provincial level in 2015. The intent was to
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7 221 integrate all the vertical (disease-specific) programs under one roof for planning, resource
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9 222 allocation and public health interventions. Under the CDC unit, blood-borne diseases like
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11 223 HIV/AIDS, hepatitis C and hepatitis B could be looked after single-handedly when addressing
12
13 224 the mode of spread, designing interventions and surveillance. Unfortunately, at the district
14
15 225 level, the CDC unit lacks infrastructure (e.g., dedicated building and office space, computers,
16
17 226 and internet), dedicated human resources (district focal CDC person) and a plan ensuring
18
19 227 how the integration of various diseases can take place.

20
21 228 *“Having CDC presents an immediate opportunity for syndromic surveillance; we should not*
22
23 229 *waste this opportunity [Participant 10].”*

24 25 230 **Fragmentation in the healthcare system is a hindrance to a uniform reporting system**

26
27 231 Under the public-private partnership (PPP), the public sector healthcare system in Thatta
28
29 232 has been contracted out to various private providers. Under PPP, these providers are
30
31 233 responsible for providing health services on a day-to-day basis while the health department
32
33 234 provides a budget¹⁷.

34
35 235 One of the study respondents mentioned that in the Thatta district extensive contracting
36
37 236 out of health services has been done and that each level of health facility (i.e., primary, and
38
39 237 secondary) is managed by a different private partner. Distinct reporting lines and a lack of
40
41 238 data-sharing mechanisms between private partners have given rise to fragmentation within
42
43 239 the district health system.

44
45 240 *“Primary level facilities are supposed to be linked with secondary level facilities for referrals*
46
47 241 *and reporting of disease-related data, however, there are so many partners with each*
48
49 242 *having its reporting line. This has negatively affected the reporting of disease surveillance*
50
51 243 *[participant 10].”*

52
53 244 A healthcare manager pointed out that in the Thatta district, surveillance for vaccine-
54
55 245 preventable diseases (VPDs) is conducted by the district health office with the district
56
57 246 surveillance coordinator as the focal point. Whereas notifiable diseases are reported by the
58
59 247 focal persons of the disease-specific programs with a flow of information that is separate
60

1
2
3 248 from that of VPDs. This vertical nature of surveillance of different diseases is inefficient in
4
5 249 terms of resource utilization as it creates parallel systems where surveillance activities are
6
7 250 carried out in siloes. These inefficiencies in turn create a weaker surveillance system and put
8
9 251 the population at higher risk for communicable disease outbreaks.

10
11 252 *“Every disease-specific program such as that of tuberculosis, malaria etc reports its data in*
12
13 253 *isolation, how can we have an integrated disease surveillance system in this situation?*
14
15 254 *[Participant 7].”*

255 **Inadequate resources translate to poor disease surveillance**

256 A healthcare manager highlighted the dearth of human resource for surveillance in the
257 district. He mentioned that in the district health office, there is only one person (district
258 surveillance coordinator) who is tasked to coordinate for surveillance of vaccine-
259 preventable diseases (VPDs), data reporting and data entry into DHIS for all eight public
260 sector health facilities of the district. The increased workload results in delayed data entry
261 and delay in data transfer to district health stakeholders. Not only that he lacks a team of
262 dedicated individuals for surveillance, but he also has no provision of transportation for
263 reaching out to health facilities and communities for active surveillance. Most of the time,
264 he has to rely on making telephone contact with each in charge of health facilities to get
265 disease-related information.

266 All the study respondents mentioned that reporting for VPDs is mandatory and health
267 facilities are required to send weekly reports (even for no cases called ‘zero reports’) of
268 VPDs to the district surveillance coordinator. But due to a lack of resources e.g.,
269 transportation and dedicated surveillance staff, the reports from various health facilities in
270 the district often get delayed.

271 *“Expecting one person to lead disease surveillance in the district, in the absence of*
272 *transportation and adequate human resource is too much to ask [Participant 2].”*

273 A district healthcare manager pointed out that for notifiable diseases, the district focal
274 persons of disease-specific programs have the responsibility of reporting data. The primary
275 role of the focal person is program implementation which involves numerous tasks from
276 planning and implementing to monitoring and reporting program activities. In absence of

1
2
3 277 adequate human resource, focal persons primarily rely on data reported as part of program
4
5 278 implementation. This has limitations namely 1) this is a form of passive surveillance rather
6
7 279 than active; 2) reporting of program data takes place at specific intervals whereas
8
9 280 surveillance requires continuous monitoring of disease cases and prompt action. Many
10
11 281 study respondents believed that these limitations lead to a disease surveillance system that
12
13 282 struggles with the timely detection, and reporting of disease outbreaks.

14 15 283 **In the current system, surveillance is predominantly passive**

16
17 284 Study respondents pointed out that since the data collection is passive as it is collected
18
19 285 largely from those patients that present to health facilities, hence it is a form of passive
20
21 286 surveillance rather than active surveillance.

22
23 287 *“We could be missing out on outbreaking at the community level since there is no one going*
24
25 288 *and actively screening the community members [Participant 1]”*

26
27
28 289 Respondents attributed the lack of community-based active surveillance to the lack of
29
30 290 resources and mentioned that there is a need to increase resource allocation for
31
32 291 strengthening active surveillance.

33
34 292

35 36 293 **Paper-based reporting is a key determinant of delayed disease reporting**

37
38
39 294 Several study respondents attributed the delayed reporting of surveillance data to paper-
40
41 295 based reporting. The system for reporting health-related data from health facilities to the
42
43 296 district health offices in Pakistan is paper-based for both VPDs and notifiable diseases. The
44
45 297 health facility in charge fills out a zero-reporting form (for VPDs) or a case report (for a
46
47 298 notifiable disease). A physical copy of this report is then sent to the district surveillance
48
49 299 officer. This often gets delayed as someone must visit the health facility or district
50
51 300 surveillance coordinator to deliver the physical copy of the report. To prevent delay,
52
53 301 telephonic contact often plays a key role, however, it is not a feasible way to disseminate
54
55 302 the information to all the relevant stakeholders.

56
57 303 *“We should have a digital system with a dashboard which can show data in real-time. We*
58
59 304 *will avoid delayed reporting forever [participant 2].”*

305 **Surveillance data is underutilized for evidence-based decision making**

306 Most study respondents mentioned that data verification is essential to ensure its fidelity.
307 To ensure data quality, monitoring and supervision of field staff and the facility healthcare
308 staff sending data need strengthening. But all respondents agreed that in the existing
309 system of disease surveillance, there is an emphasis on data collection only. No monitoring
310 and supervision are happening from the district or provincial levels. Other than the
311 circumstances where a suspected or confirmed case of disease under surveillance is
312 reported, there is no action taken to verify the authenticity and quality of routinely reported
313 data.

314 *“Despite that, the data is regularly collected through DHIS and other channels, it is rarely
315 reviewed or utilized for analysis or action [Participant 12].”*

316 **Lack of laboratory testing capacity takes a toll on disease surveillance**

317 All the study respondents showed their concern regarding poor laboratory capacity for
318 surveillance in the district. Among the eight public sector health facilities in the Thatta
319 district, only two have clinical laboratories. However, none of these laboratories is equipped
320 to conduct testing for any of the VPDs or notifiable diseases in the district. Biological
321 samples collected from suspected patients are sent to a regional laboratory that is based in
322 the capital city of the country (laboratory at National Institute of Health, Islamabad) situated
323 at least 1000 kilometres from Thatta district.

324 A healthcare manager pointed out that the absence of a fully equipped laboratory nearby
325 calls for measures to ensure proper storage and transportation of biological samples. This
326 not only is resource-intensive but adds to the delays in the system staggered by issues of
327 delayed reporting.

328 *“Provincial health department should, at the least, take measures to build a laboratory in the
329 province so that disease surveillance can be made a little more efficient [Participant 6].”*

330 **The lack of integration of the private sector in disease surveillance is a major gap**

331 All the study respondents considered the absence of private-sector integration as an
332 important gap. The private health sector is a major stakeholder in service delivery and
333 caters to approximately 70% healthcare needs of the population. Unfortunately, however,

1
2
3 334 the service delivery data of the private health sector is not integrated into the DHIS of the
4
5 335 public health sector. In fact, the government is still lagging in taking measures to regulate
6
7 336 the private health sector in Sindh province.
8

9 337 One of the respondents said that integration of data from the private sector in the health
10
11 338 information system is essential to ensure effective disease surveillance as currently, a
12
13 339 significant chunk of the population's disease burden remains to be captured.
14

15 340 *“Our disease surveillance will be at a loss from capturing the true disease burden unless it*
16
17 341 *integrates data from the private health sector [Participant 6].”*
18

19 20 342 **DISCUSSION**

21
22 343 Our study explored multifaceted barriers to effective surveillance of communicable diseases
23
24 344 in a rural district of Pakistan. Our study showed that the lack of policy guidelines at the
25
26 345 provincial level was fundamental to ineffective disease surveillance and poor data reporting.
27
28 346 Poor stakeholders' coordination led to a lack of sharing of surveillance data hampering the
29
30 347 surveillance efforts. Due to poor resource planning, the digital information systems i.e.,
31
32 348 PDSRU and DHIS built using donor resources were underutilized. Having the district
33
34 349 surveillance coordinator as the sole person responsible for surveillance activities in the
35
36 350 district, in absence of additional resources, was considered a major resource gap by study
37
38 351 respondents. Most study respondents were concerned about the predominantly passive
39
40 352 nature of existing district surveillance. Paper-based reporting together with inadequate
41
42 353 human resource was considered an important cause of delayed reporting in surveillance.
43
44 354 The lack of laboratory testing capacity in the district was another determinant for delayed
45
46 355 reporting. There was an increasing emphasis on collecting data than using it for predicting
47
48 356 outbreaks or taking measures to control these. The absence of inclusion of infectious
49
50 357 disease surveillance data of private sector data in the district surveillance was identified as
51
52 358 another major gap by study respondents.

53
54 359 Despite that a decade has elapsed since the health system in Pakistan was devolved, the
55
56 360 pace of provinces taking charge of health planning and resource generation has remained
57
58 361 rather sluggish. A study respondent mentioned that despite the increasing infectious
59
60 362 disease outbreaks in Sindh and other provinces in recent years i.e., measles, HIV/AIDS and
the global COVID pandemic, initiatives regarding comprehensive guidelines and laws for

1
2
3 364 disease surveillance are still lacking. Studies from Nigeria and Zambia show that the laws
4
5 365 related to public health surveillance existed but were considered to be outdated and/or
6
7 366 poorly implemented¹⁸. Studies from Iran and Palestine concluded that having laws and
8
9 367 policies for disease surveillance enable governments to allocate funds for establishing
10
11 368 surveillance programs and that health authorities should play a lead role in ensuring their
12
13 369 implementation^{10 19}.

14 370 Having a dysfunctional PDSRU for reporting surveillance data is a classic example of relying
15
16 371 on donor money instead of concentrating on building local capacity for a functional health
17
18 372 information system. Many respondents termed this unfortunate and emphasized investing
19
20 373 resources in reviving the PDSRU. In a study from China inadequacy of resources at the local
21
22 374 level was identified as an important determinant of a functional digital information system
23
24 375 for disease surveillance. The study reported that the top tier of government invests more in
25
26 376 building digital information systems, but lower levels don't receive enough planned
27
28 377 resources to ensure its implementation²⁰. A functional digital information system has been
29
30 378 found to speed up the reporting, improve data flow and ensure the availability of up-to-date
31
32 379 data for the decision-makers. This eventually leads to early detection of and timely action
33
34 380 against outbreaks¹⁰.

35 381 Respondents in our study found the lack of adequate human resource for surveillance at the
36
37 382 district level as concerning. Literature shows that for surveillance to be effective, adequate
38
39 383 human resource is essential to undertake field-based surveillance and for efficient data
40
41 384 reporting²¹. The resource deficiencies including field-based staff have been shown to
42
43 385 undermine effective disease surveillance^{19 22}. Moreover, putting the burden of surveillance
44
45 386 activities on healthcare staff engaged in service delivery negatively affects their motivation,
46
47 387 performance, and consequently the quality of reporting^{10 20 23}.

48 388 Despite several advantages of contracting out health services that the literature notes, the
49
50 389 structural challenges largely remain unaddressed²⁴. One such challenge is poor
51
52 390 coordination between stakeholders. Many respondents pointed out that having multiple
53
54 391 stakeholders in the same district had been detrimental to disease surveillance due to a lack
55
56 392 of coordination and ambiguous reporting lines. The flow of data is independent of the level
57
58 393 of health facility defeating the notion of integrated disease surveillance. Poor coordination
59
60 394 between stakeholders^{21 22} and between different levels of health facilities¹⁰ have been
395 reported to adversely affect the data reporting for disease surveillance.

1
2
3 396 Many study respondents pointed out the need to strengthen active surveillance in the
4
5 397 district as in the present system, the surveillance was largely hospital-based where the data
6
7 398 was being gathered from patients presenting to health facilities. Literature shows that the
8
9 399 majority of people may opt not to show up for health seeking unless they develop serious
10
11 400 symptoms²⁰. This, in the event of a communicable disease, not only has the potential for
12
13 401 the infection to spread but also leads to a delay in detecting an outbreak. Relying on passive
14
15 402 surveillance only is often dependent on factors including patients' awareness, health-
16
17 403 seeking behaviour and socioeconomic status and hence needs to be supplemented by some
18
19 404 form of active surveillance²³.

20 405 Paper-based reporting in our study came out as an important barrier to timely reporting.
21
22 406 The need for transitioning from slow, staff-reliant and paper-based reporting to the digital
23
24 407 mode of reporting is increasingly recognized in literature^{10 21}. A study from India has
25
26 408 demonstrated improved disease notification and enhanced data reporting due to
27
28 409 transitioning to digital media²⁵.

29 410 Except when a suspected or confirmed case of a disease is detected, data sent from health
30
31 411 facilities is rarely reviewed at higher levels. Respondents in our study pointed out that there
32
33 412 is more emphasis on data collection than its analysis and use. It is evident from the
34
35 413 literature that providing regular feedback to facility staff on the data has been shown to act
36
37 414 as a motivating factor and a performance boost^{10 22}.

38
39 415 Study respondents emphasized the need for having local laboratory capacity to ensure the
40
41 416 timely detection of disease outbreaks. Studies in literature have demonstrated that in
42
43 417 absence of a local laboratory, rapid diagnostics kits (RDTs) may facilitate confirming
44
45 418 outbreak until laboratory test results become available²³ thus preventing delays that may
46
47 419 incur in the transfer of biological samples²².

48
49 420 The extent to which a health system can detect disease outbreaks is dependent on its
50
51 421 capacity to capture patients' data. In Pakistan, the private health sector caters to most of
52
53 422 the population's healthcare needs. However, it is largely unregulated in Sindh province and
54
55 423 in Pakistan in general, leading to a lack of integration of its patient data with the public
56
57 424 sector. Studies show that the poor private sector engagement in disease surveillance is an
58
59 425 important issue hampering the surveillance efforts in many countries including India^{22 25},
60
61 426 Iran²⁶ and China²³.

427 **LIMITATIONS OF THE STUDY**

428 Our study was conducted in a predominantly rural district of Pakistan that is already
429 challenged in terms of resource availability. Hence, when generalizing the study findings,
430 these may be interpreted in a similar context. Due to the researchers' experience and
431 familiarity with the health system of the study district, the possibility of contamination of
432 study results with researchers' own perceptions cannot be completely eliminated, however,
433 objectivity was ensured by note-taking during interviews and the use of interviews' audio
434 recordings to ensure accuracy in data reporting.

435 **RECOMMENDATIONS**

436 The lack of directions from the provincial level regarding infectious disease surveillance
437 necessitates the need for formulation of policy guidelines outlining not just the technical
438 aspects of surveillance but also ensuring adequate resource planning and allocation to
439 establish and sustain effective infectious disease surveillance at the district level. To ensure
440 disease surveillance in the district, there is a need to i) address resource requirements
441 including adequate budget and human resource; ii) engage with the private health sector to
442 capture maximum data of patients presenting to health facilities; iii) build active surveillance
443 into the existing system by having designated human resource, iv) take advantage of the
444 paperless system for data reporting to eliminate reporting delays and make real-time
445 reporting system where data is instantly available after collection.

447 **CONCLUSION**

448 We concluded that poor governance was perceived to lead to underutilization of existing
449 resources for surveillance whereas lack of a policy framework on surveillance was
450 considered to lead to a poor investment of resources in surveillance infrastructure. The
451 absence of resources and inadequate human resource was identified by respondents as the
452 key determinant of delayed and inadequate reporting leading to delayed detection of
453 disease outbreaks. This was further aggravated by the absence of local laboratory capacity.
454 The existing surveillance system was perceived as largely paper-based, slow, and comprised
455 of hospital-based passive surveillance. The lack of private sector engagement in infectious
456 disease surveillance was perceived as a significant gap.

457

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2
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7
8
9 461 **Competing Interests**

10 462 All authors declare that they have no competing interests

11
12 463 **Authors contributions**

13 464 IN, SS, RAS contributed to the plan and design of the study. IN developed the interview
14 465 guide which RAS & RH reviewed and provided feedback. IN led data collection and
15 466 performed data analysis. IN, SS, RAS & RH participated in the interpretation of the results. IN
16 467 drafted the manuscript. SS, RAS, and RH contributed to revisions of the manuscript for
17 468 intellectual content. All authors approved the final version of the manuscript.

18
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20
21
22 469 **Acknowledgement**

23 470 We acknowledge all our participants for their cooperation during the conduct of this study

24
25 471 **Checklist for the appropriate reporting statement**

26 472 We used COnsolidated criteria for REporting Qualitative research (COREQ) checklist while
27 473 writing the manuscript to ensure rigour in reporting the data for qualitative research

28
29 474 **Patient consent for publication**

30 475 Not applicable

31
32 476 **Data availability statement**

33 477 All the data collected as part of this research study are reported in the manuscript

34 478 **Word count:** 5057

35
36 479 **List of abbreviations**

37 480 TB – Tuberculosis

38 481 DHIS – District health information system

39 482 PDSRU – Provincial Disease Surveillance and Response Unit

40 483 CDC – Communicable Disease Control

41 484 PPP – Public-private partnership

42 485 VPDs – Vaccine preventable diseases

43
44 486 **Research Ethics Approval**

45 487 This study involves human participants and was approved by the ethics review committee of
46 488 the Aga Khan University Karachi Pakistan (reference # ERC # 2020-5777-15184). Participants
47 489 gave informed consent to participate in the study before taking part.

490 **References**

- 491 1. Ward JL, Azzopardi PS, Francis KL, et al. Global, regional, and national mortality among young
492 people aged 10–24 years, 1950–2019: a systematic analysis for the Global Burden of Disease
493 Study 2019. *Lancet* 2021;398(10311):1593-618.
- 494 2. Ledesma JR, Ma J, Vongpradith A, et al. Global, regional, and national sex differences in the global
495 burden of tuberculosis by HIV status, 1990–2019: results from the Global Burden of Disease
496 Study 2019. *Lancet Infect Dis* 2022;22(2):222-41.
- 497 3. World Health Organization. Communicable disease surveillance and response - Pakistan 2022
498 [cited 2022 July]. Available from:
499 [http://www.emro.who.int/pak/programmes/communicable-disease-a-surveillance-](http://www.emro.who.int/pak/programmes/communicable-disease-a-surveillance-response.html)
500 [response.html](http://www.emro.who.int/pak/programmes/communicable-disease-a-surveillance-response.html) accessed July 2022.
- 501 4. Ali M, Horikoshi YJPJMR. Situation analysis of health management information system in Pakistan.
502 *Pakistan Journal Medical Research* 2002;41(2):64-9.
- 503 5. Zaidi SA, Bigdeli M, Langlois EV, et al. Health systems changes after decentralisation: progress,
504 challenges and dynamics in Pakistan. *BMJ Glob Health* 2019;4(1):e001013.
- 505 6. Agency JIC. The District Health Information System (DHIS) Project for Evidence-Based Decision
506 Making and Management 2009 [cited 2022 September]. Available from:
507 https://www.jica.go.jp/pakistan/english/activities/activity02_03.html accessed September
508 2022.
- 509 7. Ahmad Z, Zahid HJJotPMA. Threat of a Measles outbreak amidst COVID 19 surge in Sindh,
510 Pakistan-Letter to the editor. *J Pak Med Assoc* 2021;71(10):2488-88.
- 511 8. Siddiqui AR, Nathwani AA, Abidi SH, et al. Investigation of an extensive outbreak of HIV infection
512 among children in Sindh, Pakistan: protocol for a matched case–control study. *BMJ Open*
513 2020;10(3):e036723.
- 514 9. World Health Organization. International Health Regulations 2005 2022 [cited 2022 July]. Available
515 from: [http://apps.who.int/iris/bitstream/handle/10665/246107/9789241580496-](http://apps.who.int/iris/bitstream/handle/10665/246107/9789241580496-eng.pdf;jsessionid=95E436B7F04EA4A8635945E4C684A14C?sequence=1)
516 [eng.pdf;jsessionid=95E436B7F04EA4A8635945E4C684A14C?sequence=1](http://apps.who.int/iris/bitstream/handle/10665/246107/9789241580496-eng.pdf;jsessionid=95E436B7F04EA4A8635945E4C684A14C?sequence=1) accessed July 2022.
- 517 10. Dehcheshmeh NF, Arab M, Foroushani AR, et al. Survey of communicable diseases surveillance
518 system in hospitals of Iran: A Qualitative approach. *Glob J Health Sci* 2016;8(9):44.
- 519 11. Bilal W, Qamar K, Abbas S, et al. Infectious diseases surveillance in Pakistan: Challenges, efforts,
520 and recommendations. 2022;78:103838.
- 521 12. Baig MA, Shaikh BTJAPJoPH. Disease surveillance system: a mandatory conduit for effective
522 control of infectious diseases in Pakistan. 2012;24(4):586-94.
- 523 13. Abbasi IN, Siddiqi S. Overcoming the challenges of community-engaged emergency referrals in a
524 rural district of Pakistan. *J Pak Med Assoc* 2021
- 525 14. Pakistan Bureau of Statistics. Thatta district 2017 [cited 2022 July]. Available from:
526 <https://www.pbs.gov.pk/census-2017-district-wise/results/091> accessed July 2022.
- 527 15. Pasha O, Saleem S, Ali S, et al. Maternal and 347 newborn outcomes in Pakistan compared to
528 other low and middle income 348 countries in the Global Network’s Maternal Newborn
529 Health Registry: an 349 active, community-based, pregnancy surveillance mechanism.
530 *Reprod Health* 2015;350:12.
- 531 16. National Institute of Population Studies Islamabad Pakistan. Pakistan Demographic and Health
532 Survey 2017-18 [cited 2022 July]. Available from:
533 <https://dhsprogram.com/pubs/pdf/FR354/FR354.pdf> accessed July 2022.
- 534 17. Shaikh B, Rabbani F, Safi N, et al. Contracting of primary health care services in Pakistan: is up-
535 scaling a pragmatic thinking. 2010;60(5):387.
- 536 18. Makinde OA, Odimegwu COJPAMJ. A qualitative inquiry on the status and adequacy of legal
537 instruments establishing infectious disease surveillance in Nigeria. *Pan Afr Med J* 2018;31(1)
- 538 19. Abuzerr S, Zinszer K, Assan AJSom. Implementation challenges of an integrated One Health
539 surveillance system in humanitarian settings: A qualitative study in Palestine. *SAGE Open*
540 *Med* 2021;9:20503121211043038.

- 1
2
3 541 20. Yan W, Zhou Y, Wei S, et al. The difficulties of early detection for infectious disease outbreak in
4 542 China: a qualitative investigation. *Journal of Nanjing Medical University* 2008;22(1):66-70.
5 543 21. Angelo M, Ramalho WM, Gurgel H, et al. Dengue surveillance system in Brazil: A qualitative study
6 544 in the federal district. *Int J Environ Res Public Health* 2020;17(6):2062.
7 545 22. Pilot E, Murthy G, Nittas VJGPH. Understanding India's urban dengue surveillance: A qualitative
8 546 policy analysis of Hyderabad district. *Glob Public Health* 2020;15(11):1702-17.
9 547 23. Lu G, Liu Y, Beiersmann C, et al. Challenges in and lessons learned during the implementation of
10 548 the 1-3-7 malaria surveillance and response strategy in China: a qualitative study. *Infect Dis*
11 549 *Poverty* 2016;5(1):1-11.
12 550 24. Lagarde M, Palmer NJCDoSR. The impact of contracting out on health outcomes and use of
13 551 health services in low and middle-income countries. *Cochrane Database Syst Rev* 2009(4)
14 552 25. Prajitha KC, Rahul A, Chintha S, et al. Strategies and challenges in Kerala's response to the initial
15 553 phase of COVID-19 pandemic: a qualitative descriptive study. *BMJ Open*
16 554 2021;11(7):e051410.
17 555 26. Asadi H, Gouya M-M, Nabavi M, et al. The communicable diseases surveillance system in Iran:
18 556 challenges and opportunities. *Arch Iran Med* 2019
19
20
21
22 557
23
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25
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COREQ (CONsolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
<i>Personal characteristics</i>			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	
Occupation	3	What was their occupation at the time of the study?	
Gender	4	Was the researcher male or female?	
Experience and training	5	What experience or training did the researcher have?	
<i>Relationship with participants</i>			
Relationship established	6	Was a relationship established prior to study commencement?	
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	
Interviewer characteristics	8	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	
Domain 2: Study design			
<i>Theoretical framework</i>			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	
<i>Participant selection</i>			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	
Sample size	12	How many participants were in the study?	
Non-participation	13	How many people refused to participate or dropped out? Reasons?	
<i>Setting</i>			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	
<i>Data collection</i>			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	
Repeat interviews	18	Were repeat interviews carried out? If yes, how many?	
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	
Field notes	20	Were field notes made during and/or after the interview or focus group?	
Duration	21	What was the duration of the interviews or focus group?	
Data saturation	22	Was data saturation discussed?	
Transcripts returned	23	Were transcripts returned to participants for comment and/or	

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction?	
Domain 3: analysis and findings			
<i>Data analysis</i>			
Number of data coders	24	How many data coders coded the data?	
Description of the coding tree	25	Did authors provide a description of the coding tree?	
Derivation of themes	26	Were themes identified in advance or derived from the data?	
Software	27	What software, if applicable, was used to manage the data?	
Participant checking	28	Did participants provide feedback on the findings?	
<i>Reporting</i>			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	
Data and findings consistent	30	Was there consistency between the data presented and the findings?	
Clarity of major themes	31	Were major themes clearly presented in the findings?	
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

Once you have completed this checklist, please save a copy and upload it as part of your submission. DO NOT include this checklist as part of the main manuscript document. It must be uploaded as a separate file.