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Research Article

Contact Tracing Experience in Controlling the COVID-19 Pandemic in Qatar from April 2020 until June 2021

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Abstract

Background: Case investigation, quarantine, and contact tracing are vital in controlling COVID-19 transmission. Our objective was to evaluate the performance of the Ministry of Public Health's (MOPH) contact tracing team in preventing COVID-19 nationwide. **Methods:** We conducted a SWOT analysis of contact tracing team's performance from April 2020 to June 2021, evaluating their workflow, reporting system, lab test data, team efficiency in the field, and organization. **Results:** During this period, 707,934 swab samples were collected from symptomatic and asymptomatic individuals: 388,815(54.9%) through contact tracing and 319,119(45.1%) through surveys. The daily swabs collected ranged from 1500-4000. On February 28, 2020, Qatar reported its first COVID-19 case. In the first week of March, MOPH team was divided into teams for case investigation and contact tracing, expanded 12 times in number. The MOPH provided extensive support to healthcare workers, including logistical supplies and updates on COVID-19 guidelines through MOPH website. However, staff faced multiple challenges. They worked 16-18 hours/day, 7 days/week, leading to fatigue/exhaustion. Many close contacts and symptomatic patients hesitated to get tested or move to quarantine; many had poor compliance with home isolation and quarantine measures. Some refused to sign an undertaking and comply with MOPH guidelines. **Conclusion:** The Supreme Committee for Crisis Management and the MOPH have taken strategic measures to communicate and deliver information effectively, build community trust, encourage participation in contact tracing, and provide social and financial protections. These measures have successfully controlled COVID-19 infection. Qatar and Singapore were the only countries with a fatality rate below 0.1%.

Keywords: Contact tracing; COVID-19 infection; Fatality rate; Swabbing team; SWOT analysis

Introduction

The COVID-19 pandemic, caused by the SARS-CoV-2 virus, has caused significant disruptions to people's lives across the globe. The number of cases and fatalities has reached unprecedented levels [1]. This highly contagious virus has led to a surge in infections, causing healthcare systems to become overwhelmed and forcing many countries to implement lockdown measures [2,3]. It was a global challenge, with economic, healthcare, social issues, and administration.

Qatar is one of the six countries that form the Gulf Cooperation Council (GCC), with Saudi Arabia, Kuwait, Oman, Bahrain, and the United Arab Emirates. The first case of COVID-19 in Qatar was confirmed on 28 February 2020 among travelers who had returned to the homeland, almost nine weeks after the first cluster was identified in Wuhan, China [4,5]. The fatality rate of COVID-19 varies significantly across different countries. For instance, during the initial pandemic stage, Qatar had the lowest fatality rate at 0.16%, while Kuwait had a rate of 0.67%. However, developed countries such as the USA, Canada, and the UK reported much higher fatality rates of 3.2%, 7.5%, and 15%, respectively (as of 10 August 2020) [4,6]. Countries like France and Belgium have a fatality rate of over 16%. Qatar and Singapore are the only countries with a mortality rate less than 0.1% [7]. This wide variation and low fatality rate are due to prompt government response and patient demographics during a pandemic.

In recent years, Qatar has experienced rapid economic growth and globalization, resulting in a large influx of foreign expatriates from Western, other Middle Eastern, African, and Asian countries. The economic and demographic transition and the resulting dynamic socio-economic and socio-cultural environment may affect the social behaviors in the country; however, how these changes affected the behavioral risk factors and impacts the character of population in the country. Qatar has a dynamic population of approximately 2.8 million residents and citizens, with 88% being expatriate workforce from various nationalities. As a result of the expatriate workforce, 75% of the population is male [8]. According to the evidence, COVID-19 affects males more than females, and the elderly age group is more vulnerable to its adverse effects [9-11]. The pandemic situation is influenced by globalization and ease of travel to and from the country. This type of demographic shift is typical in regions with a large percentage of non-citizen or non-native populations, such as the countries of the Gulf Cooperation Council (GCC). There were no restrictions on travel during the initial period until 30th March 2020. However, on 31st March, all incoming flights to Qatar were suspended, which resulted in almost no visitors or residents coming in. Outbound travel was generally allowed. Still, it decreased significantly due to two factors: 1) global travel restrictions resulting in a sharp reduction in flights, and 2) essential workers, like healthcare professionals, being restricted from taking leave and traveling unless it was urgent or an emergency [4].

An Overview of the First COVID-19 Case from Wuhan, China to Qatar and Rapid Changes during the Pandemic

December 2019	Outbreak detected at Wuhan city, Hubei Province, China.
24th January 2020	Thermal screening at Hamad International Airport and screening for flu like symptoms for passengers coming from China.
30th January 2020	WHO announce public health emergency of international concern (PHEIC).
1-2 February 2020	Guest facility established (Quarantine for returning travelers; All passengers coming from China were quarantined; symptomatic referred to Hamad Medical Corporation).
13th February 2020	Entry screening for all inbound passengers from high-risk countries at Hamad International Airport.
23rd February 2020	Passengers coming from South Korea, China, Iran, S. Korea, Japan, Italy, Macao, Thailand, Hong Kong, Singapore, Malaysia were quarantined in hotels.
28th February 2020	First COVID-19 case confirmed in Qatar.
3rd March 2020	National COVID-19 Call Center was established.
7th March 2020	First documented community transmission case.

8th March 2020	First cluster of cases identified.
9th March 2020	Schools shut and shifted to online education; a travel ban was placed on 15 countries.
11th March 2020	WHO declared COVID-19 as pandemic.
20th March 2020	Public parks and beaches were closed.
23rd March 2020	Restaurants, cinemas, mosques, gyms, wedding centres were closed.
31st March 2020	All incoming flights to Qatar were suspended.

COVID-19 is mainly transmitted through respiratory droplets and airborne particles, so it is crucial to break the chain of human-to-human transmission to control its spread [12]. To control the spread of the virus, it is essential to promptly detect cases, isolate and test them, provide care, and do contact tracing and quarantine if necessary [13]. Qatar had already implemented comprehensive plans to identify and manage COVID-19-infected individuals before the first case was reported. The Ministry of Public Health's existing identification and track n trace mechanism, which had previously proven effective during the Middle East respiratory syndrome coronavirus outbreak, was expanded and put on high alert [4,14,15]. In a previous successful experience, the Supreme Committee for Crisis Management (SCCM) and the Ministry of Public Health in Qatar effectively executed and implemented a contact tracing system to promptly identify and report cases of COVID-19. The committee recognizes Contact Tracing as an essential public health measure to fight COVID-19 and has implemented it alongside other measures. The effective application of Contact Tracing measures can reduce transmission and significantly impact the outbreak's spread. Qatar's contact tracing involves identifying people who have been in contact with confirmed cases. The goal is to identify positive cases as early as possible, including those who do not show symptoms, to break the chains of transmission and prevent further spread of the infection in the community. Early detection of positive cases plays a crucial role in slowing down the spread of the virus. It also allows for timely treatment, which can help prevent potential complications that may arise in patients suffering from existing medical conditions. Qatar has successfully maintained one of the world's lowest COVID-19 mortality rates. "It is of utmost importance that the public cooperate with us. Providing accurate information when contacted and agreeing to get tested as soon as possible minimizes the risk on both the contact themselves and their families and colleagues," statement of the Head of Vaccination at MOPH and COVID-19 Contact Track and Trace Lead Dr Soha Shawqi Albayat [16].

Qatar possesses a resilient healthcare infrastructure that is well-equipped to tackle any obstacles. With the help of a robust health system, effective measures, cooperation from citizens and residents, and their commitment to follow preventive measures, the State of Qatar has been able to move past the peak of the Coronavirus and flatten the curve. Although the transmission of the infection is under control, there are still some reported cases. The pandemic has overwhelmed and disrupted the healthcare system, exposing inefficiencies in the workflow and hidden weaknesses. This Supreme Committee for Crisis Management has been regularly monitoring and reviewing indicators. A three-phase plan is in place to re-impose restrictions if needed. People's commitment to preventive measures is crucial in limiting the virus's spread. Socializing without proper caution has been identified as the country's primary source of spreading COVID-19. As the pandemic spreads rapidly worldwide, it has become necessary to enforce mandatory quarantine for all travelers returning to the State of Qatar until further notice. The Supreme Committee for Crisis Management urges all citizens and residents to follow preventive measures such as wearing masks, maintaining a safe distance, and washing hands [17].

During the pandemic period, MOPH established a digital contact tracing team to interview the patients over the phone and identify the close contacts. The main objective of this process is to identify people who have come into contact with the infected individual, also known as the "Index case," and interrupt the spread of the causative agent to vulnerable individuals who are not immune. Contact tracing is a well-established public health intervention strategy and has successfully in reduced mortality rate compared to global data [18], the spread of various infectious diseases [19].

Contact tracing is a process that includes several steps: It is the process of identifying, assessing, and managing people who have been exposed to a disease to prevent onward transmission.

Definition: A contact is defined as anyone with the following exposures to a COVID-19 confirmed case from 2 days before to 14 days after the case's onset of illness/day of testing [12,13]:

- Being within one meter of a COVID-19 case for >15 minutes without any personal protective equipment (PPEs).

- Direct physical contact with a confirmed Covid-19 case.
- Providing direct care for patients with Covid-19 infection without using proper personal protective equipment (PPE).

Identifying contacts: this is done through a telephonic interview with the index patient to find out who they have been in contact with; all the interviews have been conducted virtually over the phone, and the reports collected has been recorded digitally in the health information systems record. For in-person interviews, contact tracers must maintain a safe distance (>1 meter), conduct interviews in well-ventilated areas or outdoors, and wear a medical mask according to standard and preventive measures. The contact tracing team should interview all contacts, request them to self-isolate, and provide support during quarantine for testing if required [12]. In some situations, identifying, monitoring, and quarantining all contacts may not be feasible. In general, duration and location of exposure determine the risk of transmission, although all contacts who meet the definitions above are at risk of infection [20]. WHO recommends a 14-day supported quarantine after contact with a confirmed case to reduce transmission risk [21]. Most cases develop symptoms within 14 days of exposure, with a median incubation period of 5-6 days [22]. It is essential to prioritize the follow-up actions:

1. Contacts at a higher risk of SARS-CoV-2 infection based on their degree of exposure to break chains transmission; and
2. Contacts at a higher risk of developing severe COVID-19 disease to ensure early referral to healthcare.

The primary objective of this study was to evaluate the performance of the Ministry of Public Health's contact tracing team in containing COVID-19 transmission countrywide at both institutional and field levels.

Methods

A SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) was done to evaluate the performance of contact tracing data collected at the organizational and field levels in the Ministry of Public Health from April 2020 to June 2021. The study involved individuals who actively participated in the Contact Tracing Team of the Ministry of Public Health and the swab collection field team during the study period. We evaluated the 'strengths,' 'weaknesses,' 'opportunities,' and 'threats' involved at an organization and field level. This qualitative and descriptive study utilized the following four components to contain the spread of COVID-19 nationwide to do a SWOT analysis.

Contact tracing is a complex process that includes several steps:

Master List Team: The team obtains the list of all laboratories confirmed cases from the HMC virology lab. They check these records for any duplication or missing information. If any missing information needs to be corrected, they notify the concerned authorities, such as Ministry of Interior (MOI). The list is then divided into two categories based on the index case's nationalities and spoken language preferences: Arab and non-Arab.

Operational Group: Each possible contact should be reached by phone or in-person to confirm if they meet the definition of a Contact. If they do, they should be advised on what action to take, including quarantine.

The team is made up of medical professionals with diverse backgrounds who are trained to conduct digital contact tracing interviews. To avoid language barriers, team members are of different nationalities. The Arab and Non-Arab teams have male and female members who work in shifts and are supervised by a team leader. The shift team supervisor for contact tracing then distributes the list among the team members. The contact tracing team interviews and calls the focal person and their close contacts. The team collects demographic information and records it for the Master List Team. They verify and examine the records for any missing data essential for contact tracing. The master list is shared daily with the team supervisor using a Microsoft Excel workbook.

After compiling a list, they sent it to the swabbing team in the field for further action.

Preparation for Contact visit: The Operational and Swabbing Teams worked together to arrange COVID-19 testing for all the suspected cases of COVID-19 or close contact.

Dispatch list: At the end of each shift, the Operational Team creates a list per zone number and geographic location and sends it to the swab team in the field twice daily. The relevant field teams arrange the tasks by zone numbers and priority.

Contact Management/ Mobile Swabbing Team: It comprised doctors, nurses, and paramedical staff and was temporarily located in each zone to help implement infection control measures. The swabbing stations are open for two shifts every day throughout the week.

After sending the dispatch list to the swabbing team, all identified contacts are to be swabbed within 48 hours. Contacts must sign an undertaking form with legal implications and quarantine at home after being swabbed.

Home visit and swabbing: The swabbing team collects nasopharyngeal and oropharyngeal swabs from contacts through home visits. These swabs are sent to the Virology Department of Hamad Medical Cooperation (HMC) National Reference Lab for laboratory confirmation tests.

Teams were dispatched to visit identified contacts and conduct assessments to determine if their home was appropriate for

quarantine. During these visits, the team members were required to wear complete personal protective equipment (PPE) and swab the identified contacts. If the home was deemed unsuitable for quarantine, the team reported to the operational team for referral of the close contact to a designated facility. Team members were also required to collect consent signatures and submit the undertaking documentation to the Ministry of Interior (MOI) and the Ministry of Public Health (MOPH). Anyone with COVID-19 symptoms was referred to the Primary Health Care Corporation (PHCC) if required.

Before returning, the team reviewed all information, forms, and samples collected during the visits. The samples were promptly labeled and delivered to the Hamad Medical Corporation (HMC) lab.

Specimens' collection

- Collect both Nasopharyngeal and Oropharyngeal swabs in the same vial with transport medium.
- Label the specimen with the appropriate code, store it in an ice box with frozen cold packs, and maintain the chain of custody until it is delivered to the virology lab.
- Discard Personal Protective Equipment (PPE), report to the Ministry of Public Health, and send confirmation of the tasks completed.

Screening of the Swabbing Team

The members of the swabbing team underwent weekly COVID-19 screenings through PCR tests.

Data Management

The Data Management team was responsible for compiling and analyzing the Contact Tracing team data. They prepared daily and weekly reports to monitor the progress and fluctuations in the number of cases during this period. The information for each contact was collected and added to a database that was updated daily for future reference and analysis.

The data team performed the following tasks:

- Developed a data entry sheet and entered the data from the swabbing teams.
- Compiled all the entered data into one master sheet.
- Analyzed the data and produced reports to help the higher authority develop or adjust the control intervention for the pandemic based on the result.
- Prepared weekly and quarterly reports.
- Made a comprehensive report to describe the activities and actions needed.
- If a contact was found to be a case, the change in status was linked to a case database (line list) through a common identifier.

Data Analysis

Primary data was collected from active members of the Contact Tracing Team and the swab collection field using convenient sampling methods. The primary data was analyzed using frequency and percentage. For qualitative data, interviews were conducted with the members of the contact tracing team and ensured that all relevant details were captured to achieve the objectives. Secondary data refers to all the records used by the Ministry of Public Health (MOPH) during the pandemic.

The SWOT analysis technique was used to identify strengths, weaknesses, opportunities, and threats to evaluate the performance of the contact tracing team at different levels. This technique analyzed internal factors, such as the program's strengths and weaknesses, and external factors, like opportunities and threats related to the project [23]. It was divided into MOPH level (leaders, operational team, and data team) and Field level (swabbing team).

Understanding the performance of contact tracing for COVID-19 was crucial, which is why having key performance indicators (KPIs) is essential. These KPIs were measured at different stages of the contact tracing pathway and used to assess how well a system was performing. By tracking KPIs over time, we could make informed policy decisions, improve the quality of contact tracing programs, and manage resource needs. Global consultation with key partners was underway to develop detailed KPIs with initial benchmarks, updated regularly as new evidence was compiled. Each indicator's threshold depended on the local transmission scenario and the timeliness and completeness of contact tracing and quarantine. Contact tracing could effectively reduce the reproductive number below one, provided the time between a case's symptom onset and quarantine of at least 80% of their contacts does not exceed three days [24,25].

Results

In the early stages of the pandemic, Qatar's contact tracing team encountered numerous difficulties in controlling the spread of COVID-19. However, a few weeks after the first confirmed case was reported in the country, Qatar successfully overcame all these challenges with a systematic approach implemented by the Supreme Committee for Crisis Management (SCCM) and the Ministry of Public Health (MOPH). The challenges are as follows:

- Lack of sufficient trained staff and logistical support (transportation, phones, computers).

- Initially, there were only 15-20 MOPH staff conducting case investigations, arranging for contact tracing, answering hotlines, conducting airport testing, and managing quarantine facilities.
- Staff worked 16-18 hours/day, 7 days a week, to manage the first wave of community cases leading to fatigue and exhaustion.
- Maintaining an adequate stock of high-quality PPE was an additional challenge due to the global shortage.
- Stress and concern amongst contact tracing staff when going to test contacts of positive cases.
- Lack of a proper case definition at the onset and formally documented guidelines for track and trace.
- Changing advice about who should be tested, the duration of quarantine and isolation required
- Slow/insufficient intersectoral coordination.
- Lack of adequate quarantine facilities and delays in transferring patients.
- Repeated COVID-19 tests remained positive for long periods in some patients.
- Fear and stigma regarding COVID-19 in the community.
- Refusal of family members to be separated from each other.
- Rumors regarding testing, treatment, and quarantine facilities.
- Many close contacts and symptomatic patients were afraid to be tested or moved to quarantine facilities.
- Poor compliance with home isolation and quarantine/Refusals to sign an undertaking.

Figure 1 illustrates that 707,934 individuals were tested by the national track n trace team. Of these, 388,815 (54.9%) were tested as part of contact tracing, while the rest, 319,119 (45.1%), were tested as part of survey.

Figure 1: Reasons for swabbing in Qatar from April 2021 to June 2021

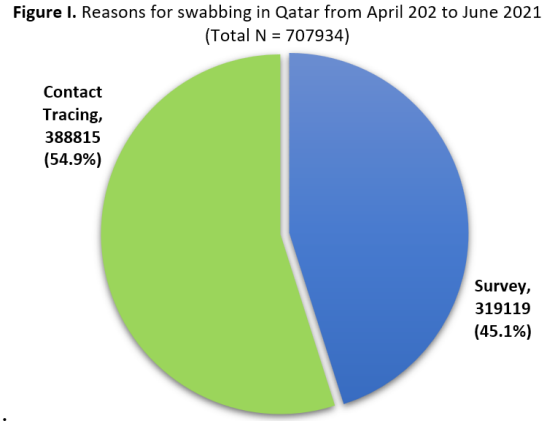

Table 1 shows that a total of 309 individuals participated in contact tracing activities. Among them, 210 (68.0%) were male, out of which 17 (5.5%) were from MOPH institutions and 193 (62.5%) were working at the field level. Only 99 (32.0%) were females, with 15 (4.9%) working in MOPH institutions and 84 (32.0%) working at the field level. A significant proportion of the individuals were 277 (94.5%) involved in survey activities.

Gender	Institution n (%)	Field n (%)	Total n (%)
Male	17 (5.5%)	193 (62.5%)	210 (68.0%)
Female	15 (4.9%)	84 (32.0%)	99 (32.0%)
Total	32 (10.4%)	277 (94.5%)	309

Table 1: Workforce distribution of contact tracing team by Institution and Field by Gender during the COVID-19 pandemic from April 2020 to June 2021 (N= 309).

Figure 2 illustrates the trend of data collection for swabbing by the contact tracing team. The number of swabs collected daily ranges from 1500 to 4000. During the third week of April 2020 and the first week of February 2021, the team collected over 3,000 swab samples daily.

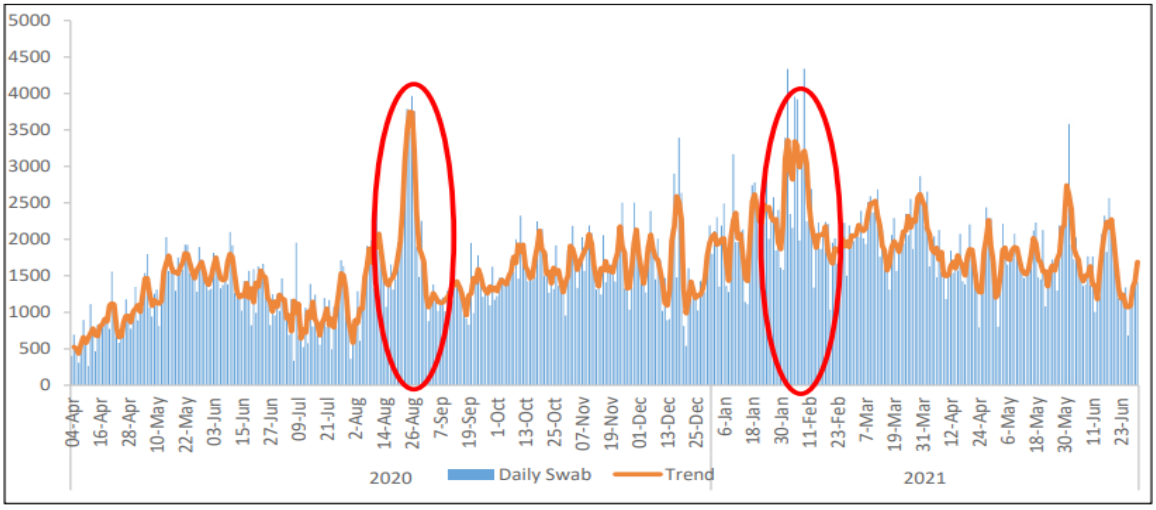

Figure 2: Swabbing data collected by contact tracing teams from April 2020 to June 2023.

Figure 3 shows the high positivity rate among the middle age group. A positivity rate of 14.7% was reported among 30-34 years old, 12.9% among 35-39 years old, and 5% among those above 55 years old.

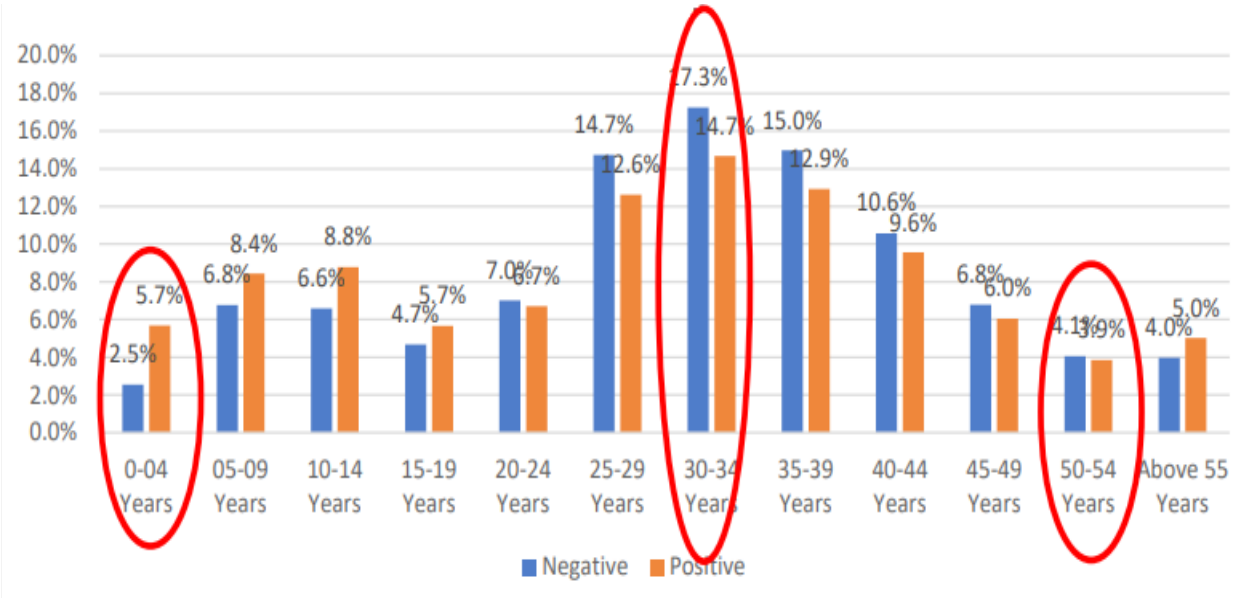

Figure 3: The COVID-19 positivity rate by age group from April 2020 to June 2021.

Figure 4 shows that there are eight municipalities in Qatar. Al Dawha had the highest COVID-19 positivity rate (41.1%), followed by Al Rayyan (32.1%), while Al Shamal had the lowest (0.4%) indicated in Figure 4.

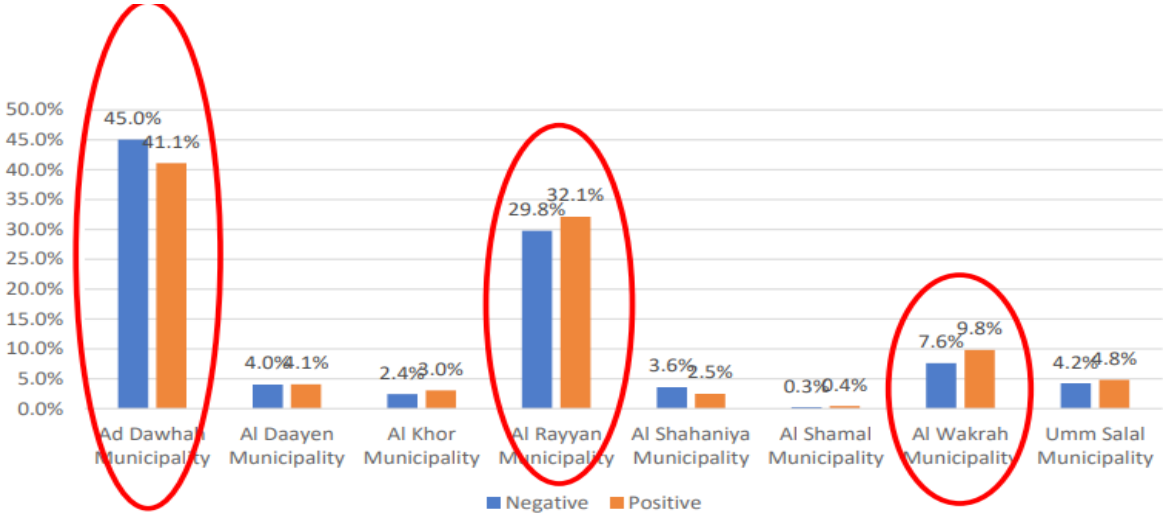

Figure 4: Positivity rate by Municipalities in Qatar during the COVID-19 pandemic from April 2020 to June 2021.

Contact Tracing Indicators: There are three primary leading indicators to consider when measuring the activities:

First indicator: Timeliness

Based on analysis, it is found that 62.4% of the contacts were traced and tested within 48 hours and were considered on time. Another 30.8% of the contacts were identified late, taking 72 hours or more. Only 6.8% of the total contacts were identified very late, taking more than four days. Although the Timeliness indicator requires a percentage greater than 80%, achieving 60% is still an excellent accomplishment considering all the challenges.

Second indicator: Positivity among contacts

During contact tracing, 15% of swabbed contacts tested positive for COVID-19. This indicates the quality of contact identification.

Third indicator: The percent of positive COVID-19 cases identified through contact tracing was 91.6%. This information reveals the system's ability to identify the chain of transmission and its efficacy in identifying cases in the community. It further proves that contact tracing plays a crucial role in combating the spread of the virus in the community.

At the Ministry of Public Health (MOPH) and field levels, strength, weakness, opportunities, and threats analysis (SWOT) was conducted by adapting Fred David's strategic management matrix, which illustrates the four major elements of the analysis [23].

Ministry of Public Health (MOPH) level	**Strengths**	**Weaknesses**
Governance support	• Higher Authority support and commitment.	• Delay in the recruiting process in the early stage of the pandemic.
	• Updated Policies and guidelines.	• No prior experience in collaborating with multiple sectors and stakeholders in the context of a pandemic.
	• logistic support, including human resources	• Using existing software SAVES for the documentation of the contacts and ensure the quality of data and compliance.
Human resources	• Multi-nationality workforce. • Training was designed for staff especially those recruited later into the team. • Create multi-task team.	• Shortage of laboratory staff, which has an indirect effect on the timely release of results. • No uniformity in work experience in the context of the pandemic. • Lack of data management and statisticians.
Physical resources	All team members had access to communication tools and computers during their shifts.	• Limited space to accommodate all the teams. • One virology lab at HMC had limited capacity, which later extended to the reference lab. • Global shortage of Personal Protective Equipment (PPE) and swabbing kits.
Activities and processes	• The team in the office and the field was well-organized. • Quarantine individuals who had contact with COVID-19 early on follow-up. • Appropriately executed, data could be collected, managed, and analyzed on time.	• Insufficient identification of connections and incorrect phone numbers or unanswered calls were causing miscommunication. • Recall bias may occur due to the influence of contacts or through negative self-reporting. (All swabs have been taken, but sometimes the information about the contacts' trustworthiness may be incorrect). • Received delayed or incomplete lists from the Case Investigations Team. • Paper-based reporting systems. • Lab results may be delayed due to inconclusive or overwhelming needs. If this happens, the test may need to be repeated or re-swabbed and may require re-entry.
MOPH level	**Opportunities**	**Threats**
	• The Ministry of Interior (MOI) was providing support. (Signing undertaken, decreased number of refusals) • The mobile application was used to collect and share data of individuals in contact with COVID-19 cases. • There was legislation requiring people to wear masks and follow other preventive measures. • MOI assists foreigners or visitors without Qatar ID with identification procedures. • The team consisted of individuals from different nationalities, with efforts to reduce language barriers. • Identified silent areas and high-risk groups through proper screening. • A large amount of data available can be used in future research.	• There have been COVID-19 infections among the staff, and some individuals were not complying with the infection prevention and control measures. • COVID-19 Stigma and refusal to be swabbed and quarantined. • Noncompliance with the quarantine restrictions can result in a chain of transmission. • Community engagement and public support were challenging due to different contexts and multi-nationalities. • The media needed to have effectively communicated the importance of contact tracing, causing delays in some cases. • Operational concerns such as logistical challenges, budget constraints, and the renewal of contracts for our workforce. • Upcoming national and international events like the FIFA World Cup 2022.

Field Level (Swabbing Team)	Strengths	Weaknesses
Governance support	• Collaboration between different sectors and support from higher authorities. • Policies and guidelines that had been set up and put into practice.	• During the early phase, there was a shortage of staff and a delay in the recruitment process.
Human resources	• The workforce was composed of individuals from different nationalities. • Supervisors help improve the team's overall competence and ensure everyone can perform their tasks effectively. • Efficiently manage multiple tasks and highly focused on achieving goals simultaneously.	• The ratio of males to females was not equal. • There needed to be more drivers. • The company could not hire individuals with computer skills and expertise in data management. • The company has a high turnover rate due to using temporary contracts.
Physical resources	• Ensured the location was secure and appropriate for the field teams to be accommodated. • Provided communication tools and vehicles.	• Changing to another internet service provider results in reduced connectivity. • There is currently a shortage of personal protective equipment (PPE), laboratory kits, particularly N95 masks
Activities and processes	• The teams were trained and organized efficiently. • Contact tracing was promptly carried out, and the individual was isolated early. Follow-up procedures were implemented. • Make sure to complete the task as much as possible within the given time frame.	• The identification of contacts is incomplete. • The team working in the field is not meeting the required timeline. • After the community refused to collect the swab, communication with the MOPH and MOI operational teams was required to collect the swab. • Inaccurate information and excessive testing in the workplace. • Incorrect information and excessive testing in the workplace.
Field Level (Swabbing Team)	**Opportunities**	**Threats**
Governess support	• The Ministry of Interior assists (Signing has been completed, and there has been a reduction in the number of refusals) and Incorrect telephone numbers. • Team with people from different nationalities to ensure no language barriers. • Provides health education on COVID-19 and its preventive measures to the contact team, which consists of individuals from different nationalities. • Identifying hot spots and high-risk groups in a community is crucial to plan and implement interventions to address potential issues effectively.	• The field staff has been affected by Covid-19 infection. • Community to face a significant challenge in dealing with negative social stigma associated with COVID-19. • Noncompliance with the infection prevention and control measures. • The various nationalities involved made engaging with the community challenging. • Logistic challenges and budget constraints. • The upcoming events: FIFA World Cup 2022 and a mass gathering.

Discussion

Supreme Committee for Crisis Management and the Ministry of Public Health have implemented contact tracing during the COVID-19 pandemic. This included establishing teams, recruiting the workforce, coordinating with other sectors, engaging with the community, managing patient data, and reporting, which are as follows:

Coordination: The Ministry of Public Health (MOPH) worked in collaboration with Hamad Medical Corporation (HMC), Primary Health Care Corporation (PHCC), and the ambulance services to establish guidelines for the care process of COVID-19 patients. These guidelines were made available on the MOPH website and were updated regularly for both healthcare workers and the public.

Workforce Management: In order to sustain the contact tracing efforts, MOPH relied on a temporary workforce with temporary contracts. During the initial phase, there was a delay in recruiting staff, but once five swabbing stations were established, it significantly impacted the workload. Additionally, having a team with different nationalities was an added advantage for the country's context. However, the laboratory capacity needed to be improved as we had only one reference lab, resulting in delayed results and an overwhelming workload.

Community engagement: During the initial period of the pandemic, it was crucial to engage with the community. Unfortunately, due to a lack of participation and awareness, COVID-19 cases and contacts were not reported promptly. The media also needed to have sensitized and addressed the community, resulting in a delayed response and fewer cases being reported at the beginning of the pandemic. Many close contacts and symptomatic patients hesitated to get tested or move to quarantine, and some did not comply with home isolation and quarantine measures. Furthermore, some people refused to sign an undertaking and follow the Ministry of Public Health guidelines.

Logistics and Budget: To ensure their continued support, we need support from higher authorities who understand the significance of contact tracing in controlling the pandemic and identifying cases. This involves providing them with necessary resources such as rental cars, lab kits, and consumables.

Use of Technology: During the pandemic, technology played a crucial role in contact tracing. Mobile phones were used to track and identify contacts. The Hamad Medical Corporation (HMC) virology lab shared data via notifications to aid in this identification process. While it was challenging, SAVES served as a valuable source of information, which helped to create a vaccination certificate through the immunization registry.

During the pandemic, many countries implemented contact tracing as a public health measure to decrease the spread of COVID-19. A retrospective cohort study conducted in Portugal to evaluate the effectiveness of contact tracing and quarantine in reducing COVID-19 transmission showed that both measures successfully minimized the duration between symptom onset and laboratory diagnosis and reduced the number of close contacts per case [26]. Effective contact tracing relies on two critical factors: completeness and timeliness. Completeness involves tracing as many contacts as possible, while timeliness entails reaching contacts as quickly as possible following exposure. According to a recent COVID-19 modeling study, contact tracing carried out within 4.5 days of exposure could lead to a reduction of at least 60% in transmission [27]. In the UK, a study investigated the effectiveness of contact tracing in containing COVID-19. The study used a survey of social encounters to determine the probable efficacy of contact tracing and the spread of secondary cases. The results revealed that the current contact tracing strategy can identify a sufficient proportion of infected individuals and prevent further spread. However, its success will depend on the prompt detection of cases and isolation of contacts. However, if new infections are imported rapidly, the system may become overwhelmed due to the burden of tracing many contacts [28].

Generally, contact tracing is more effective in regions with social cohesiveness, such as small jurisdictions with interconnected populations [29-30]. However, it can be difficult to identify contacts in denser populations, and manual contact tracing can be impractical. Electronic contact tracing, such as through mobile apps, has been suggested as an alternative, but this approach has raised privacy concerns [31]. One of the major challenges is that individuals may delay getting tested, and even after testing positive, it may take a few days to confirm the results [30]. Identifying and contacting the close contacts of positive cases can also be difficult, and some contacts may need to follow isolation requirements [32,33].

Conclusion

Contact tracing has played a crucial role in controlling the spread of COVID-19 across the country by adhering to the guidelines issued by the Supreme Committee for Crisis Management and the Ministry of Public Health. As a result, Qatar has one of the lowest COVID-19 fatality rates in the world, at below 0.1%. The Ministry of Public Health has implemented various strategic measures to enhance contact tracing and build trust and engagement among the population. The government has established official communication channels to improve trust between citizens and the government. This was crucial to enhancing the contact-tracing system in the country. Additionally,

appropriate training was provided to contact tracers to ensure accurate contact tracing throughout the country. Furthermore, social, and financial protections have been strengthened for people who contract COVID-19 or need to quarantine as a contact to help reduce economic hardship. This measure is anticipated to motivate more individuals to participate in contact tracing, which is essential in controlling the spread of COVID-19 by breaking the transmission chain and preventing further spread.

Disclosure

Author Contributions

Conceptualization of the study, H.K., S.A., H.E.H.R.A.R.; data cleaning and analysis J.C., K.O., H.M.M., and R.R.; manuscript writing, H.K., J.C., and R.R.; manuscript review, H.K., J.C., R.R., and S.A.; guarantor, H.K., S.A. and H.E.H.R.A.R. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

The study was conducted in accordance with the "COVID-19 Profile in the State of Qatar". It received ethical approval from the Ministry of Public Health (MOPH), Qatar, and the Institutional Review Board (IRB) under the Ethical approval number (ERC-826-3-2020) to conduct research in Qatar from 2020 to 2021. The Ministry of Health granted permission to access and use the data for research purposes. To ensure data confidentiality, personal information such as names and phone numbers were excluded from the extracted data.

Informed Consent Statement

The Health Research Governance Department at the Ministry of Public Health (MOPH) waived informed consent because the study was based on secondary data and the data was already owned by MOPH and no contact with the participants population or no interference in the treatment they receive as the data is historical.

Data Availability Statement

The researchers accessed data through a restricted-access agreement that prevents their sharing with a third party or publicly.

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Conflicts of Interest

The authors declared no conflict of interest.

References

1. COVID-19 Excess Mortality Collaborators (2022) Estimating excess mortality due to the COVID-19 pandemic: a systematic analysis of COVID-19-related mortality, 2020-21. Lancet 399: 1513-1536.
2. Lacobucci G (2020) Covid-19: UK lockdown is "crucial" to saving lives, say doctors and scientists. BMJ 368: m1204.
3. Remuzzi A, Remuzzi G (2020) COVID-19 and Italy: what next? Lancet 395: 1225-1228.
4. Al Kuwari HM, Abdul Rahim HF, Abu-Raddad LJ, Abou-Samra AB, Al Kanaani Z, et al. (2020) Epidemiological investigation of the first 5685 cases of SARS-CoV-2 infection in Qatar, 28 February-18 April 2020. BMJ Open 10: e040428.
5. WHO (2020) Archived: WHO timeline - COVID-19.
6. Worldometer (2020) Coronavirus updates.
7. Liang LL, Tseng CH, Ho HJ, Wu CY (2020) Covid-19 mortality is negatively associated with test number and government effectiveness. Sci Rep 10: 12567.
8. World population review (2020) Qatar Population.
9. Huang C, Wang Y, Li X, Ren L, Zhao J, et al. (2020) Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet 395: 497-506.
10. Wu C, Chen X, Cai Y, Xia J, Zhou X, et al. (2020) Risk factors associated with acute respiratory distress syndrome and death in patients with coronavirus disease 2019 pneumonia in Wuhan, China. JAMA Intern Med 180: 934-943.
11. Zhou F, Yu T, Du R, Fan G, Liu Y, et al. (2020) Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. Lancet 395: 1054-1062.
12. World Health Organization (2021) Critical preparedness, readiness, and response actions for COVID-19 (Interim Guidance).
13. World Health Organization (2021) Contact tracing in the context of COVID-19 (Interim Guidance).
14. Nour M, Alhajri M, Farag EABA, Al-Romaihi HE, Al-Thani M, et al. (2017) How Do the First Days Count? A Case Study of Qatar Experience in Emergency Risk Communication during the MERS-CoV Outbreak. Int J Environ Res Public Health 14: 1597.
15. Farag E, Nour M, Islam MM, Mustafa A, Khalid M, et al. (2019) Qatar experience on One Health approach for middle-east respiratory syndrome coronavirus, 2012-2017: A viewpoint. One Health 7: 100090.
16. Effective contact tracking tracing to COVID-19 in Qatar (2020) Effective contact tracking and tracing key to Qatar's COVID-19 response: MoPH | The Peninsula Qatar
17. Statement by the Supreme Committee for Crisis Management of COVID-19 in Qatar.
18. Ministry of Public Health (MOPH), Qatar (2020) System Enhancement and Transformation Team (SETT), HP/CDC, MOPH-Qatar, COVID-19 Contact Tracing Handbook 2nd Version.

19. Centers for Disease Control and Prevention (2021) Interim Guidance on Developing a COVID-19 Case Investigation & Contact Tracing Plan: Overview.

20. Thompson HA, Mousa A, Dighe A, Fu H, Arnedo-Pena A, et al. (2020) Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Setting-specific Transmission Rates: A Systematic Review and Meta-analysis. Clin Infect Dis 73: e754-e764.

21. World Health Organization (2020) Considerations for quarantine of individuals in the context of containment for coronavirus disease (COVID-19): interim guidance.

22. McAloon C, Collins Á, Hunt K, Barber A, Byrne AW, et al. (2020) Incubation period of COVID-19: a rapid systematic review and meta-analysis of observational research. BMJ 10: e039652.

23. Subramaniam M (2016) SWOT Analysis Discover New Opportunities, Manage and Eliminate Threats SWOT analysis.

24. Kretzschmar M, Rozhnova G, Bootsma M, van Boven M, van de Wijgert JHHM et al. (2020) Impact of delays on effectiveness of contact tracing strategies for COVID-19: a modelling study. Lancet Public Health 5: e452-e459.

25. Juneau CE, Briand AS, Collazo P, Siebert U, Pueyo T (2020) Effective Contact Tracing for COVID-19: A Systematic Review. Glob Epidemiol 5: 100103.

26. Malheiro R, Figueiredo AL, Magalhães JP, Teixeira P, Moita I, et al. (2020) Effectiveness of contact tracing and quarantine on reducing COVID-19 transmission: a retrospective cohort study. Public Health 189: 54-59.

27. Centers for Disease Control Prevention (2019) Prioritizing COVID-19 Contact Tracing Mathematical Modeling Methods and Findings. Washington: US Department of Health and Human Services 2020.

28. Keeling MJ, Hollingsworth TD, Jonathan AM (2020) Efficacy of contact tracing for the containment of the 2019 novel coronavirus (COVID-19). J Epidemiol Community Health 74: 861-866.

29. World Health Organization (2021) Operational guide for engaging communities in contact tracing. Technical report.

30. Lash RR, Moonan PK, Byers BL, Bonacci RA, Bonner KE, et al. (2021) COVID-19 Case Investigation and Contact Tracing in the US, 2020. JAMA Netw Open 4: e2115850.

31. Cho H, Ippolito D, Yu YW (2020) Contact tracing mobile apps for COVID-19: Privacy considerations and related trade-offs. arXiv: 11511.

32. Lewis D (2020) Why many countries failed at COVID contact-tracing-but some got it right. Nature 588: 384-387.

33. Gardner BJ, Kilpatrick MA (2021) Contact tracing efficiency, transmission heterogeneity, and accelerating COVID-19 epidemics. PLoS Comput Biol 17: e1009122.