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Uttar Tolarbagh Model—an Investigation of a COVID-19 Case Led to the First Localized Community Approach for Containment of COVID-19 in Dhaka City, Bangladesh, March–May 2020

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Abstract

On 23 Mar 2020, Uttar Tolarbagh, a two-square-kilometer walled-in area in Dhaka, was locked down to contain a COVID-19 outbreak. We evaluated whether localized restrictions on entry and exit points could prevent the spread of COVID-19. We traced contacts and conducted active surveillance from 20 Mar to 10 Apr 2020. Contacts were those within one meter of a confirmed COVID-19 case for ≥15 minutes between two days before and 14 days after the onset of symptoms. We collected swabs from all persons with respiratory symptoms. The positivity rate was calculated by dividing the number of positive samples by the total number of samples tested. The Uttar Tolarbagh House, Flat Owners' Association and the religious teacher of Masjidul Ahsan, the only mosque in Uttar Tolarbagh, discouraged local gatherings and ensured social distancing during mosque prayers. We identified 400 contacts; 156 were symptomatic and 16 tested positive, of whom eight were hospitalized and two died. SARS-CoV-2 PCR positivity rates among symptomatic contacts were 40% (2/5) before containment, 10% (15/152) during containment, and 0% (0/33) after containment. The last case's disease onset date was 5 April, and Uttar Tolarbagh remained COVID-19 free until 12 May 2020. Social distancing was observed by the field investigation team on the roads and within the mosque during the lockdown. Our findings suggest that the neighborhood lockdown, isolation of cases, quarantine and contact tracing, evacuation of COVID-19 patients, and community engagement helped to contain COVID-19 transmission in a densely populated area of Dhaka City.

Keywords: COVID-19, SARS-CoV-2, localized lockdown, contact tracing, outbreak

Introduction

At the beginning of the coronavirus disease 2019 (COVID-19) pandemic in Bangladesh, only travelers and their close relatives were infected.[1] The first reported cases were imported and sporadic; however, clusters were detected within two months. When clusters of cases were reported, the Institute of Epidemiology, Disease Control and Research (IEDCR), the government program responsible for investigating and controlling outbreaks, implemented non-pharmaceutical interventions to contain the disease and prevent further spread.[2] This policy was based on interventions implemented in China, Italy, and India. These countries used lockdowns, which were effective in reducing transmission.[3–5]

Through 12 May 2020, IEDCR investigated every reported COVID-19 case to describe the scope and magnitude of the pandemic and traced contacts to reduce transmission. On 20 March, a 73-year-old male with multiple comorbidities died from COVID-19. He was the second person in Bangladesh to die from the disease. He lived in Uttar Tolarbagh, which is close to

the heart of Dhaka, the capital of Bangladesh. When IEDCR was notified, an investigation team was formed to identify other cases and contacts and to quarantine contacts. During the investigation, another 76-year-old male died in Uttar Tolarbagh on 22 Mar 2020. He was a contact of the first death case in Uttar Tolarbagh and tested positive for COVID-19. On 23 March, Uttar Tolarbagh was locked down by local officials in consultation with the IEDCR field investigation team in an attempt to contain the outbreak. The lockdown was lifted on 30 May 2020. This report describes the localized containment approaches and determines if these activities reduced or stopped transmission.

Methods

Study Design

We used a mixed-methods approach to evaluate five approaches to contain COVID-19 in a community.

Location and Timeframe

Uttar Tolarbagh is an urban community with an area of about two square kilometers and approximately 4,000 residents. A brick wall that is two meters high forms the border of Uttar Tolarbagh, and only one single-lane road passes through the community (Figure 1). Local officials started the containment on 23 March and ended it on 12 May 2020.

Study Population

A suspected case was defined as a resident of Uttar Tolarbagh who developed fever, cough, sore throat, or respiratory distress between 20 Mar and 30 May 2020. A probable case was defined as a suspected case who had contact with a confirmed case. A confirmed case was defined as any person who tested positive for reverse transcriptase-polymerase chain reaction (RT-PCR) (Da An Gene Co. Ltd, China) for COVID-19 and met the probable or suspected case definition. A contact was defined as any person who did not wear a mask and came within one meter of a confirmed case for ≥15 minutes between two days before and 14 days after onset of the case's symptoms. When someone thought that they might have COVID-19, local authorities instructed them to report this to the house committee for people living in apartment buildings or to the designated community leader for residents of other dwellings.

Data Collection

The field team investigated the outbreak and response from 20 Mar to 30 May 2020. Field team members interviewed suspected and probable cases in person using a semi-structured questionnaire that captured information regarding demographics, socioeconomic status, symptoms, signs, treatment, living situations due to the lockdown of Uttar Tolarbagh, and whether they were isolated. Samples were collected from symptomatic contacts and community members during interviews. Confirmed cases were interviewed by telephone.

We interviewed close relatives of cases that died to identify contacts. We interviewed confirmed cases who were alive and/or their close relatives to identify contacts. We also interviewed contacts to cross-check the contact event, as stated by the cases or their close relatives. All identified contacts of the confirmed cases were followed up daily for 14 days after their last exposure.

The field team conducted active surveillance for COVID-19 by visiting door to door within the community from 5 April to 11 April to screen people with symptoms to rule out suspected cases, which may have been missed by passive surveillance (the community hotline).

Approaches

Five containment approaches were implemented, guided by national recommendations for Nipah virus control and reports of containment strategies used in China.[6] These approaches were applied in a phased manner as the situation evolved.

Phase 1 (20 March): Initial localized containment

Local authorities initiated containment by locking down the building where the first confirmed case resided. Movement was restricted, and security personnel controlled entry through the main gate.

Phase 2 (20 March): Case finding through contact tracing and active surveillance

On the same day, authorities initiated systematic identification of suspected and probable cases through contact tracing, door-to-door active searches, and testing of symptomatic individuals.

Phase 3 (20 March): Isolation, quarantine, and referral of cases

Contacts of confirmed cases were instructed to quarantine at home. Confirmed cases were either isolated at home if symptoms were mild or referred to a dedicated COVID-19 hospital if they had severe illness or comorbidities.

Phase 4 (20 March): Establishment of event-based surveillance

A community hotline was established to identify additional suspected cases. Individuals reporting symptoms compatible with COVID-19 were assessed, and specimens were collected for confirmatory testing.

Phase 5 (23 March): Expansion of containment and restriction of gatherings

Following confirmation of the second case, containment was expanded to the entire Uttar Tolarbagh area. The main entrance gate was locked and the second gate was permanently closed; mass gatherings and meetings were prohibited, and movement within public and private spaces was restricted. Although no lockdown was imposed on the mosque—initially considered the suspected epicenter—authorities limited the number of people allowed to attend prayers to reduce crowding.

Qualitative Investigation

An anthropologist interviewed residents, regular mosque attendees, and local social groups in Uttar Tolarbagh in person and interviewed confirmed cases by telephone. The interviews were recorded and transcribed verbatim. Data were coded inductively by creating codes, which were organized into themes and subthemes.

Laboratory Investigation

Nasopharyngeal and oropharyngeal swabs were collected from Uttar Tolarbagh residents who developed fever, cough, sore throat, or respiratory distress from 20 Mar to 30 May 2020, and were tested within 24 hours by RT-PCR for severe acute respiratory syndrome coronavirus 2 at the IEDCR. Residents who tested positive were retested 14 days later to confirm they were no longer infectious.

Data Analysis

We conducted a descriptive analysis of demographic data and clinical information of COVID-19 cases and contact follow-up indicators. Positivity rates were calculated by dividing the number of positive samples by the total number of samples tested up to 12 May and expressed as a percentage. The numerator was the number of initial positive test results. Attack rates were calculated by dividing the number of positive samples by the total number of contacts identified through 12 May and expressed as a percentage. A spot map of buildings in which the confirmed COVID-19 cases lived in Uttar Tolarbagh was made using Google Maps.

Results

The index case was a 73-year-old male who lived in Uttar Tolarbagh and had no travel history outside the community for more than a month prior to the onset of symptoms. The second case was a 76-year-old male with no travel history outside Uttar Tolarbagh in the month prior to the onset of symptoms. Both cases were members of the mosque welfare committee and were known for consistently offering prayers in the front row of the mosque. An additional 15 confirmed cases were identified during the study period. All 17 confirmed cases lived in one of nine apartments in five buildings (Figure 1). Multiple cases were identified within several families. Among the confirmed cases, 17 (100%) had fever, 6 (35%) had cough, and 3 (18%) had difficulty breathing (Table 1).

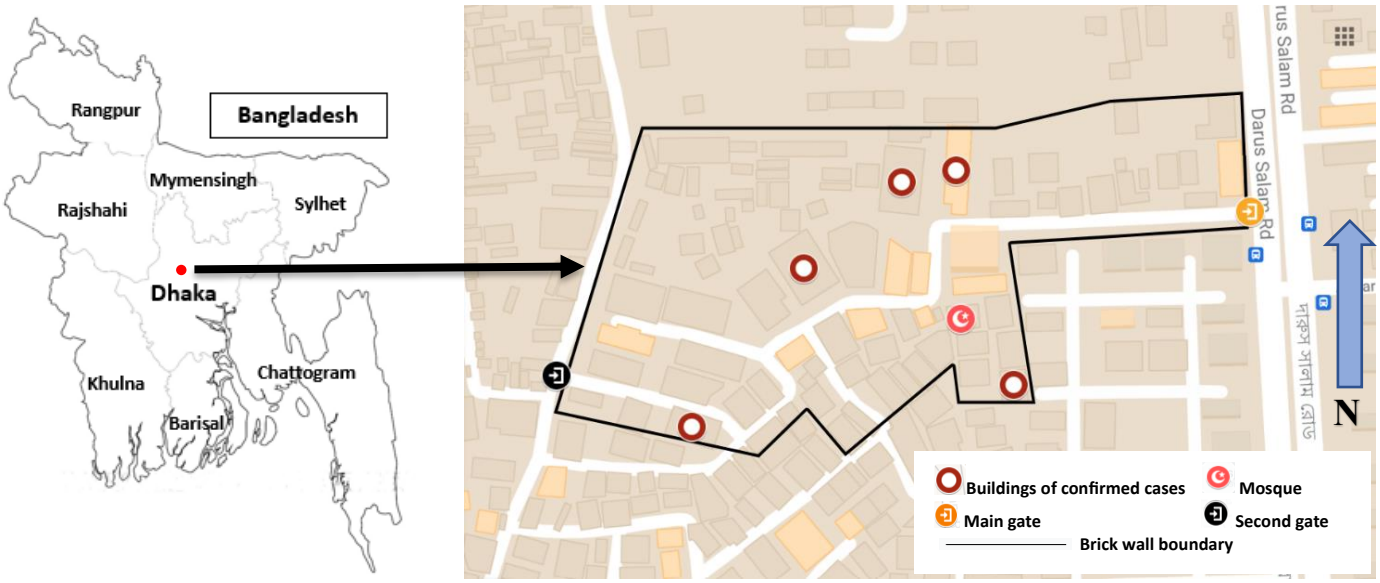

Figure 1. Map of Bangladesh (left) and Uttar Tolarbagh in Dhaka City (right), showing buildings with confirmed COVID-19 cases, 20 Mar–10 Apr 2020

Table 1. Clinical information of confirmed COVID-19 cases in Uttar Tolarbagh, Dhaka City, Bangladesh, 20 Mar–30 May 2020 (n=17)

Clinical information	n (%)
Signs and symptoms	
Fever	17 (100.0)
Cough	6 (35.3)
Difficulty breathing	3 (17.6)
Sore throat	2 (11.8)
Altered consciousness	2 (11.8)
Pneumonia	1 (5.9)
Myalgia	1 (5.9)
Comorbidities*	
Yes	6 (35.3)
No	11 (64.7)
Hospitalized	
Yes	8 (47.1)
No	9 (52.9)
Admitted to intensive care unit†	
Yes	1 (6)
No	7 (94)
Died	
Yes	2 (11.8)
No	15 (88.2)

**Comorbid conditions included diabetes mellitus, hypertension, cardiovascular disease, chronic kidney disease and chronic obstructive pulmonary disease. †Only hospitalized cases.*

Contact Tracing

Contact tracing began when the first COVID-19 case in Uttar Tolarbagh was diagnosed on 20 March and ended on 24 April as there were no confirmed cases after 5 April. We identified 400 contacts of confirmed cases, of whom 156 were tested, and 16 were positive. Three (5%) of the 120 contacts of the first confirmed case tested positive for COVID-19 (Figure 2 & 3).

Contact Findings

COVID-19 was detected in 15% (5/33) of regular mosque attendees, 5% (1/17) of the community contacts, and 9% (10/106) of household contacts (Table 2).

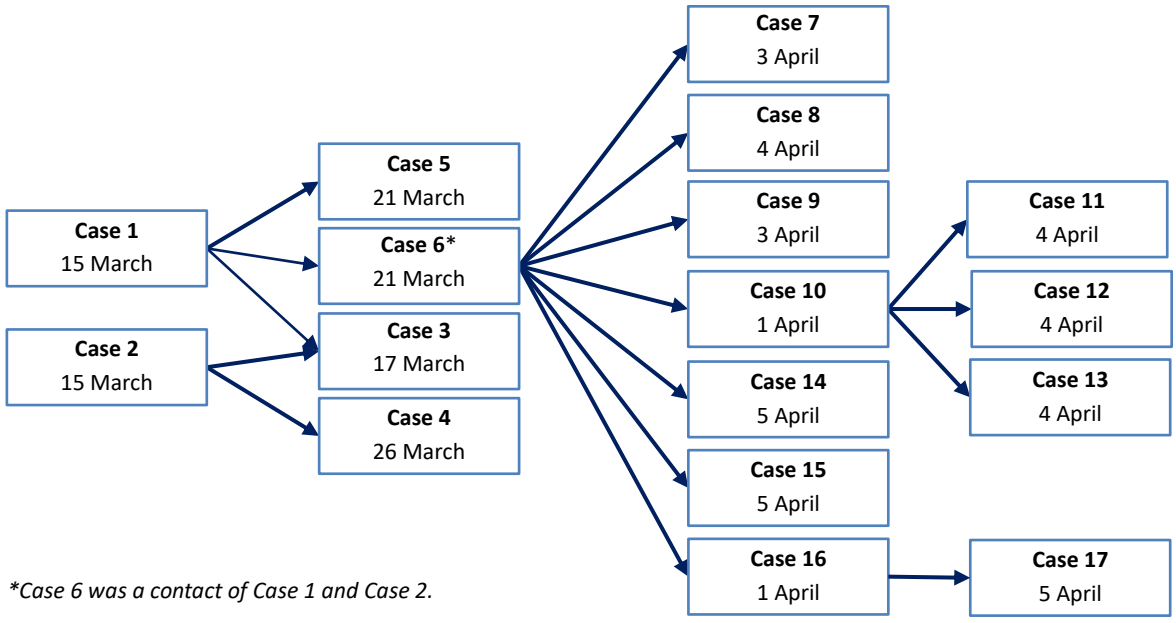

Figure 2. Diagram showing COVID-19 transmission from index case by date of symptoms onset in Uttar Tolarbagh, Dhaka City, Bangladesh, 20 Mar–30 May 2020

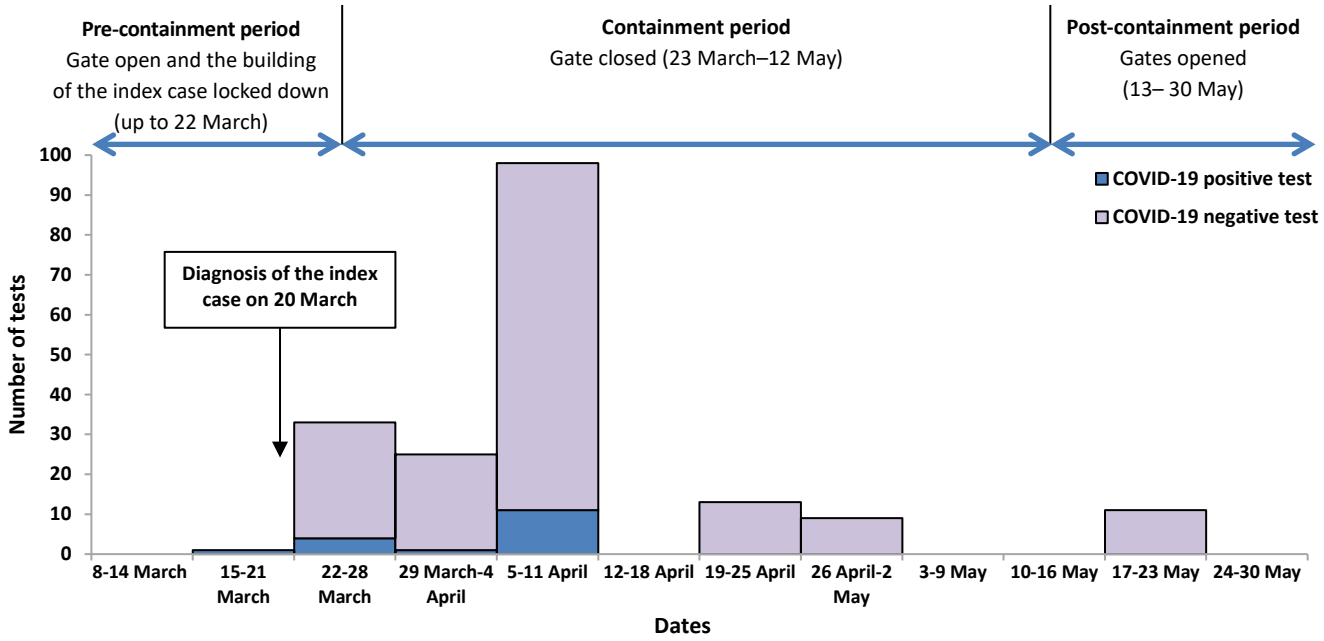

Figure 3. Epidemic curve of COVID-19 cases in Uttar Tolarbagh, Dhaka City, Bangladesh by day of their positive test result, 20 Mar–30 May 2020 (n=17)

Table 2. Positivity rate and attack rate among 156 symptomatic contacts of 17 confirmed COVID-19 cases in Uttar Tolarbagh, Dhaka City, Bangladesh, 20 Mar–12 May 2020

Characteristic	Total contacts	Number of persons tested	Positive by RT-PCR	Positivity rate (%)	Attack rate (%)
Gender					
Male	264	95	11	11	4
Female	136	61	5	8	3
Age group (years)					
11–20	45	13	2	15	4
21–30	62	24	2	8	3
31–40	143	41	5	12	3
41–50	82	47	2	4	2
51–60	56	19	3	16	5
61–70	9	9	1	11	11
71–80	3	3	1	33	33
Case source					
Contact tracing	302	58	5	8	2
Active case search	98	98	11	11	11
Location of contacts					
Community	72	17	1	5	1
Mosque	65	33	5	15	7
Household	263	106	10	9	3

Containment

The positivity rate among suspected cases was 40% (2/5) during the pre-containment period (15–22 March), and 10% (15/152) during the containment period (23 March–12 May). The 152 individuals represent symptomatic contacts identified and tested during containment. After containment (13–30 May), 33 symptomatic individuals from the community who reported through event-based surveillance were tested, and none were positive (0/33). During the study period, 190 symptomatic individuals from Uttar Tolarbagh were tested for COVID-19, of whom 17 tested positive, with an overall percent positivity of 9%. Positivity declined to 12% during 22–28 March and 4–11% through early April (Table 3).

The date of symptom onset of the last confirmed case was 5 April, and no confirmed COVID-19 cases were reported during containment up to 12 May.

Table 3. Percent positivity of symptomatic persons of Uttar Tolarbagh, Dhaka City, Bangladesh, 15 Mar–30 May 2020

Dates	COVID-19 test results			Percentage of positivity
	Total	Positive	Negative	
15 March–21 March	1	1	0	100*
22 March–28 March	33	4	29	12
29 March–4 April	25	1	24	4
5 April–11 April	98	11	87	11
19 April–25 April	13	0	13	0
26 April–2 May	9	0	9	0
17 May–23 May	11	0	11	0

**Index case*

Qualitative Findings

Since confirmed cases and many probable and suspected cases were identified within the same cluster, people residing in Uttar Tolarbagh perceived that they were stigmatized by others through phone calls or social media posts. We learned that some community members planned to leave the lockdown area of Uttar Tolarbagh at night once the identity of the deceased person and the confirmed case became known. Anxiety increased as the number of infected individuals and deaths in the community rose. Anxiety and fear were more common among those who attended routine prayers in the mosque, an event that occurred five times daily. After repeated awareness programs, people started maintaining personal protection measures as a part of infection control, reflecting a stage of personal commitment to mitigate the disease. Most people wore face masks when they went outside, and most were delighted about the lockdown, which they felt would keep them safe; however, a few people were annoyed by it.

Actions Taken

The Ministry of Health and Family Welfare of Bangladesh identified the approach in Uttar Tolarbagh as a model for other areas and later developed a localized containment approach of red, yellow, and green zones based on the rate of active cases in the community. Red, yellow, and green zones represented high risk (≥30 positive cases/100,000 population), moderate risk (4–29 positive cases/100,000 population), and low risk (≤3 positive cases/100,000 population), respectively. The National Islamic Foundation of Bangladesh declared and issued guidelines on behaving in religious ceremonies for Muslims during the COVID-19 pandemic. For example, they advised older persons and those with comorbidities to pray at home instead of coming to a mosque, emphasized strict personal and public hygiene, such as frequent handwashing, and the practice of social distancing to protect others.

Discussion

Contact tracing and active community engagement helped ensure early detection and isolation of cases and early treatment of patients, which likely limited the spread of COVID-19. In our study, all the new cases were among known contacts of confirmed COVID-19 cases. Other studies in China, Italy, and India have shown that contact tracing and containment within a specified area reduced transmission of COVID-19.[5,7,8]

The attendance of residents at religious gatherings in the mosque may have contributed to the spread of COVID-19 in Uttar Tolarbagh. The index case and the second case were both members of the mosque committee and prayed at the mosque; both developed symptoms on the same day. Case 6 was considered a superspreader because he infected seven contacts at the mosque and at home. Many factors can contribute to a super-spreading event, including immunosuppression, disease severity, viral load, large numbers of asymptomatic cases, and extensive social interactions.[9]

Household and family contacts are at higher risk than other close contacts due to prolonged and close exposure to infected individuals.[10,11] According to the characteristics of families in the study area, most of the members interacted in shared rooms, increasing the risk of disease transmission. Household contacts were the most affected group for COVID-19 infection in this study, suggesting the difficulty of home quarantine. Other studies in Thailand, India, and the United States have shown that household contacts have the highest risk of developing COVID-19.[5,12,13]

The reduction in the spread of COVID-19 was concurrent with the containment. The percentage of COVID-19 positive tests decreased after the third week, as community members began accepting the containment approach and maintained infection prevention and control measures. China, Italy, and India followed a containment strategy to eliminate the local transmission of COVID-19 outbreaks.[5,7,14] The

containment strategy was highly successful in China, with very few new daily cases reported since March 2020. Italy's containment strategy helped manage the pandemic initially, but the strategy was implemented late, leading to a rapid increase in cases, indicating limited long-term effectiveness. For India, the containment strategy was less effective due to high population density, limited resources, and challenges in enforcing lockdown measures.[15]

For Bangladesh, a lower-middle-income country and one of the world's most densely populated, the implementation of containment measures faces challenges. Ambulance personnel frequently do not want to enter contained areas to evacuate severe COVID-19 cases or non-COVID-19 patients. Consequently, some patients were evacuated by personal means, some without proper protective measures, and getting an ambulance within a short notification time was often challenging. In Australia, the COVID-19 pandemic severely strained the Emergency Medical Services, leading to a marked deterioration in ambulance response times.[16] Beyond emergency transport, maintaining uninterrupted supplies of food, medicines, and household essentials during lockdowns was also difficult, particularly in densely populated urban neighborhoods and informal settlements. Overcrowding and multigenerational households further complicated adherence to quarantine and physical distancing guidelines. Religious practices posed additional challenges as mosques could not be fully closed due to their social and religious significance, and controlled and limited daily prayers continued, with small groups maintaining distancing and using personal protective equipment. Similar difficulties in enforcing and sustaining containment measures have been documented elsewhere.[5,7,14] Improvised and timely measures taken with proper coordination may help the country fight COVID-19. The government was not able to mitigate the situation alone; individual efforts from the citizens, direct involvement of the nation's public health experts, and international assistance were urgently needed.

Limitations

This study has several limitations. First, there were only 17 confirmed cases, likely too few from which to make definitive conclusions or recommendations. Second, different case detection methods were used during the study—namely, contact tracing and active surveillance—and so detection may have been low, and there may have been some bias from the differential case detection. Third, asymptomatic and minimally symptomatic COVID-19 cases are common, and many of these cases were not detected by either passive or active surveillance in this study. Fourth, no statistical measures were provided in this manuscript, so it is difficult to assess the importance of some of the findings. Fifth, the study lacked a comparison group, preventing any conclusions from being drawn about the effectiveness of the containment measures implemented.

Overall, the Uttar Tolarbagh model demonstrates that localized, community-based containment guided by national policies and adapted to local contexts may be a practical and effective approach for containing outbreaks of COVID-19 and possibly for other infectious diseases.

Recommendations

High-risk close contacts should be isolated or quarantined and monitored by local authorities. All stakeholders should assess the quantity and quality of these local quarantine places in the area for proper planning. Local authorities should strengthen the social distancing policy in public areas to prohibit religious or other gatherings.

To reduce COVID-19 transmission, we recommend that persons with COVID-19 isolate at home until they are no longer infectious and that exposed persons be quarantined to monitor for symptoms and avoid onward transmission. We recommend that a qualitative study be conducted to determine the acceptance of this approach.

Conclusion

This manuscript describes localized containment approaches and their effect on COVID-19 transmission. Community transmission of COVID-19 in Uttar Tolarbagh declined following implementation of containment measures, suggesting that a combination of lockdown, restricted mobility, mosque-based regulation, systematic contact tracing, quarantine and isolation, and community-driven event-based surveillance helped reduce transmission.

Our findings suggest that household and religious gatherings posed the greatest risk of spread, underscoring the need for strict adherence to social distancing in both domestic and religious settings. Community engagement was critical, though challenges of stigma, fear, and misinformation initially hindered cooperation. These appeared to be gradually mitigated through the visible implementation of public health measures.

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Author Contributions

Md. Faruk Ahmad: Conceptualization, methodology, investigation, project administration, data curation, formal analysis, visualization, writing—original draft, writing—review & editing. **Mallick Masum Billah:** Methodology, visualization, writing—review & editing. **Alden Keith Henderson:** Validation, visualization, writing—review & editing. **Mahbubur Rahman:** Methodology. **M Salim Uzzaman:** writing—review & editing. **ASM Alamgir**: Conceptualization. **Manjur Hossain Khan:** Validation. **Tahmina Shirin:** Resources. **Meerjady Sabrina Flora:** Conceptualization, funding acquisition, resources, supervision.

Ethical Approval

This response was exempt from Institutional Review Board review because it was a response to an acute public health event. Verbal informed consent was obtained before interviews or the collection of samples.

Informed Consent

Verbal informed consent was obtained before interviews or COVID-19 sample collection.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest

No conflicts of interest by all authors.

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Declaration of Generative AI and AI-assisted Technologies in the Writing Process

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