Original Research Article

Case investigation, contact tracing and containment prevents spread of COVID-19 in Shibchar, Madaripur, Bangladesh 2020: An evidence based observational study

Abstract

Background: In December 2019, the COVID-19 pandemic began in Wuhan and quickly spread in China and other countries in the world. The SARS-CoV-2 virus reached Bangladesh in March 2020 and the index case of the first cluster of COVID-19 was reported on 13 March, 2020, in Madaripur District.

Methods: A team from the Institute of Epidemiology Disease Control and Research (IEDCR), of Ministry of Health and Family Welfare, Bangladesh investigated the cluster, established active syndromic surveillance for respiratory diseases, and implemented control activities.

Results: The index case traveled from Italy to Bangladesh and developed respiratory symptoms and sought medical treatment in Dhaka. He was diagnosed with COVID-19 and transferred and isolated in a hospital on the day of diagnosis. We followed up his contacts as soon as we got their names and contact information. We quarantined 34 among 139 contacts, rest of them were missed contacts. The attack rate among the index cases' contacts was 18% (6/34). Eight cases in Madaripur District with COVID-19 were epidemiologically linked to the index case. The most common symptoms were fever (100%) and cough (86%). One case was asymptomatic. The Bangladesh influenza pandemic containment plan was modified for COVID-19 mitigation which included establishing a containment zone, mobilizing the local administrative authorities, and obtaining support from local community, religious and political leaders. Active case search in the containment zone identified new cases. No new cases were linked with the nine COVID-19 cases.

Conclusion: Active surveillance by health authority, prompt isolation of cases, quarantine of contacts and establishing a containment zone to focus mitigation efforts supported the prevention efforts for further transmission of the virus from this first COVID-19 cluster in Bangladesh.

Keywords: Isolation, quarantine, containment, COVID-19, Bangladesh

INTRODUCTION

The COVID-19 was first reported in Wuhan, China on 27 December 2019. In the following weeks, COVID-19 quickly spread to other regions in China and the world. The first case of COVID-19 outside of China was reported in Thailand on 13 January 2020 and COVID-19 reached Bangladesh when two Bangladesh residents returned from Italy on 8 March 2020 (1)(2). On 11 March 2020 the World Health Organization (WHO) declared a global pandemic due to COVID-19 (3).

The SARS-CoV-2 virus is transmitted from human to human through droplet or fomites and has a basic reproduction number (R_o) between 2-3 (3,4). When R_o is below one, an outbreak cannot be sustained and will end. R_o can be reduced by rapidly isolating people with COVID-19 and quarantining their contacts. Contact tracing begins with interviewing someone diagnosed with COVID-19 to identify everyone they contacted during their infectious phase. The contacts must be quarantined and tested for COVID-19 as soon as possible. A good measure to demonstrate if mitigation activities, surveillance, and contact tracing is successful is when all new COVID-19 cases are on the list of contacts.

Containment strategies help prevent the spread of infectious diseases. The plan to contain pandemic influenza contains a localized geographical containment strategy that includes identifying active cases, restricting their movement, and isolating and quarantining their contacts (5). Singapore, India, and Vietnam implemented containment strategies when community spread

of COVID-19 was first detected and successfully stopped transmission of COVID-19 in small communities (6-9).

The Government of Bangladesh has a policy to investigate people diagnosed with COVID-19 and trace their contacts. A cluster of COVID-19 cases in Shibchar Upazilla, Madaripur district was reported to the Ministry of Health and Family Welfare (MoHFW) on 13 March 2020. This paper describes the transmission of COVID-19 in this cluster and the interventions that to prevent the transmission of COVID-19 in the Upazilla.

METHODS

This study involves two parts. The first part consists of a case report of COVID-19 and the tracing and resolution of their contacts from 13 March to 15 April 2020. The second part describes the containment interventions from 20 March to 3 April 2020.

Case investigation and contact tracing

We used the WHO case definitions for COVID-19 cases and contacts (11,12):

Suspected case: A patient with an acute respiratory illness (fever and at least one sign/symptom of respiratory disease, e.g., cough, shortness of breath), and a history of travel to or residence in a location reporting community transmission of COVID-19 disease during the 14 days prior to symptom onset; or a patient with any acute respiratory illness and having been in contact with a confirmed or probable COVID-19 case in the last 14 days prior to symptom onset; **or** a patient with severe acute respiratory illness (fever and at least one sign/symptom of respiratory disease (e.g., cough, shortness of

breath)) and requiring hospitalization) and in the absence of an alternative diagnosis that fully explains the clinical presentation.

Confirmed case: a person with laboratory confirmation of SARS-CoV-2 infection, irrespective of clinical signs and symptoms.

Contact: a person who had any one of the following exposures during the 4 days before and the 14 days after the onset of symptoms of a probable or confirmed case:

Face-to-face contact with a probable or confirmed case within 1 meter and for more than 15 minutes;

Direct physical contact with a probable or confirmed case; or

Direct care for a patient with probable or confirmed COVID-19 disease without using proper personal protective equipment.

Our definition of **missed contact** was a contact of a confirmed COVID-19 case that had exposure to a case but could not be identified or followed up for any reason including any contacts at public places or public transports from where there was no record and they could not be traced out.

The containment zone

Shibchar is subdistrict of Madaripur District 130 km southeast of Dhaka. The containment zone included two wards of Shibchar union and two wards of pachchar and bahertola union of Shibchar upazila with a population of fifteen thousand (10–12). . Containment started on 19 March and ended on 3 April with first cluster of eight cases at Shibchar upazila. The main economy of Shibchar is farming and fishing. The sub-district is surrounded by a

natural boundary consisting of the Arial Kha River on the west and south and a national highway on the east and north to separate from other surrounding administrative areas.

Data collection

A team from the Institute of Epidemiology Disease Control and Research (IEDCR) under the Ministry of Health and Family Welfare (MoHFW), Bangladesh Conducted the investigation. The team comprised of trained field epidemiologists and laboratory technologists and interviewed the index case and traced his contacts according to the MoHFW manual for COVID-19 case investigation (13,14). Interviews were conducted by cell phone and responses recorded on the COVID-19 Case Record Form (15). We collected detailed chronological history of every confirmed case starting from four days prior to their onset of symptoms to two weeks after onset of symptoms to identify potential contacts. Isolation of cases and home quarantine of all identified contacts were ensured following a Standard Operating Procedure (16) which included calling contacts daily for 14 days after last exposure to a confirmed case to ascertain whether they developed COVID-19 symptoms and whether they obeyed isolation or quarantine. Local police with the support from local community and religious leaders monitored household isolation, quarantine, and community containment. Local administrative and health departments also assisted with containment process.

Surveillance

Government community health workers conducted house-to-house active case search with the lead and direct supervision of IEDCR team maintaining the infection prevention control measures(16) including use of personal protective equipment in the containment area for people

with COVID-19 like symptoms from 13 March to 15 April, 2020.. After this date, passive surveillance for COVID-19 by IEDCR and active case search by the local health authority continued for the duration of the pandemic.

RESULTS

Description of index case and subsequent cases of COVID-19,

Case 01 was a male aged 38 years, diabetic. s who departed Milan, Italy at 10 pm on 6 March 2020 and arrived in Dhaka, Bangladesh on 7 March at 5 pm. During his travel he was accompanied with two more persons. We identified both of them as his close contacts. Among them one became positive after few days. Another person was quarantined for 14 days and tested negative for COVID-19 with RT-PCR. Case 01 developed mild cough and malaise on 5 March 2020 followed by fever and weakness on 9 March. Upon arrival in Bangladesh, case 01 returned to his home in Shibchor. He saw a physician on 11 March and was treated for generalized body ache and given medication. On 13 March his symptoms got worse and he traveled to a government hospital in Dhaka. His physician suspected COVID-19 and notified IEDCR on 13 March 2020. A nasal swab collected on 13 March and 14 March he was diagnosed as SARS-CoV-2 positive by RT-PCR test. All the attending physicians and staff who met our case definition were included in the contact list and tested for COVID-19. His travel history was shared with WHO following reporting requirements by the International Health Regulations (IHR).

Case 01 reported 34 contacts and 129 missed contacts (Table 1). As Case 01 used public transport for traveling between Dhaka and his home town and travelers using public transport do

not need to provide any identifiable information, we could not trace out those missing contacts. Of his two travel companions from Italy, case 07, was COVID-19 positive, and lived in the same town.. Case 07 developed symptoms on 14th March. We collected sample from case 07 on 15th March and we received RT-PCR positive result for COVID-19 on 18 March 2020. Case 07 was exposed to case 01 for sixteen hours during their trip to Bangladesh and developed symptoms on 14 March 2020. He had no other probable exposures to SARS-CoV-2 in Italy and he was home quarantined in Bangladesh. Therefore, we concluded that case 07 contracted COVID-19 from case 01. All seven identified contacts of case 07 were quarantined for 14 days at home and no one of them developed any COVID-19 symptoms.

From the identified contacts of Case 01 we diagnosed six more positive cases with COVID-19 from 7-13 April 2020. Case 01 spread COVID-19 to six other people from 7th to 13th March 2020 with a secondary attack rate of 18% (6/34) (Figure 1). Among the six cases, two were child and four were adults. His wife and two children affected first. Subsequent cases were identified from his relatives.

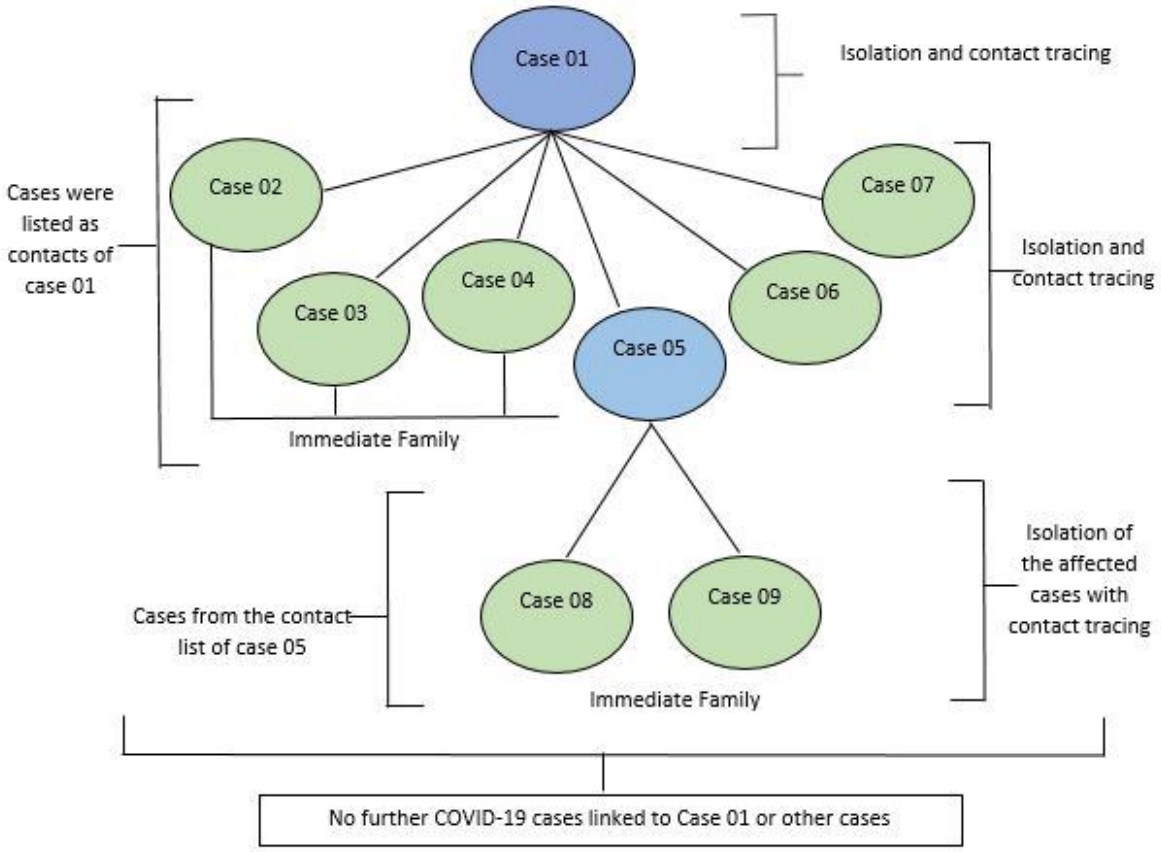

Figure 1. COVID-19 cluster of cases at Shibchar, Madaripur, Bangladesh, March 2020

All cases had direct contact with the index case except case 08. After returning to his hometown, from 7 March 2020, case 01 stayed with his wife and two children. His wife (case 02), aged 25 years, developed COVID-19 like symptoms on 12 March 2020 and their two children (case 03 and 04) aged 2 and 6 years respectively developed symptoms on 13 march 2020.

Case 01 visited his parent's house on 10 March 2020 and stayed there for couple of hours. We included his parents in the contact list of case 01 and quarantined them at home accordingly. His father, age 65 years developed symptoms (case 06) on 17 March 2020. Case

06 was hypertensive and had the history of bronchial asthma. Samples were collected on 18 March 2020 and sent to IEDCR, Dhaka for RT-PCR.

The most common symptoms of the total eight COVID-19 cases were fever and cough (Table 1). There was one asymptomatic case in this cluster.

Symptoms	**Frequency (%) (N=8)**
Fever	100
Cough	75
Headache	50
Body ache	50
Sore throat	37

Table 1. Frequencies of symptoms of the first cluster of COVID-19 cases in Bangladesh, March 2020

Both of case 01's in laws visited his house on 9 March 2020. Father-in-law returned back home after one hour on the same day and mother in law (case 05) of case 01 stayed in their house from 9-11 March 2020. Case 05 returned to her home on 11 March 2020 and developed COVID-19 symptoms on 13 March 2020. She was 50 years old and on antihypertensive medication. The IEDCR team collected samples on 15 March 2020 The daughter in law was the caregiver of case 05. Although she didn't develop any symptoms but as a close contact we collected her sample to perform RT-PCR for COVID-19 on 16 March 2020. Her daughter in law, aged 22 years were

tested positive for COVID-19 and we included her as case 08 in this report. . Case 09, aged 72 years was the husband of case 05 and also father in law of case 01. Case 09 was exposed to case 01 and case 05, the source of COVID-19 was case 05 because case 09 developed symptoms on 29 March 2020, which exceeded beyond the incubation period of exposure with case 01. All the cases were isolated in the isolation wards of different government hospitals for minimum fourteen days.

Contact tracing

We interviewed all the cases over phone as soon as we received the RT-PCR positive result of COVID-19, to identify the contacts. We collected all the information regarding the contacts from the interview. We traced 145 out of 175 contacts from all nine cases. We were able to communicate all the traced contacts and ensured home quarantine for 14 days. We had missed contacts as some cases had travel history using public transport. All the identified contacts were tested for COVID-19 with RT-PCR. . We followed the contacts for 14 days from their exposure with a COVID-19 case. Isolation of the subsequent cases and home quarantine of the contacts narrowed down the number of contacts to follow up (Table 2).

	Contacts Identified	**Missed contacts**
Case 01	34	129
Case 02	41	05
Case 03	41	00
Case 04	11	00
Case 05	24	02

Case 06	08	01
Case 07	07	05
Case 08	05	00
Case 09	04	03
Total	**175**	**145**

Table 2. Number of contacts per COVID-19 case at Shibchar, Madaripur, Bangladesh, March 2020

Among all the cases isolated in the hospital the condition of case 06 deteriorated and was referred to the COVID-19 dedicated Kuwait Moitri Friendship Hospital, in Dhaka on 21 March 2020 for further management. On 25 March the patient died from respiratory distress. The other cases were discharged from the hospital after they remained asymptomatic for three days and were RT-PCR negative for SARS-CoV-2 with two consecutive swab samples on consecutive days.

Containment

A containment plan was developed with the local administrative and health authority and the MoHFW by modifying an existing WHO plan for responding to an H1N1 pandemic (17). To create the containment zone, we first marked the location of residence of the index case and his

contacts on a map. Then we established the borders of the containment area by using natural barriers such as rivers and the national highway and sub-district roads (Figure 2).

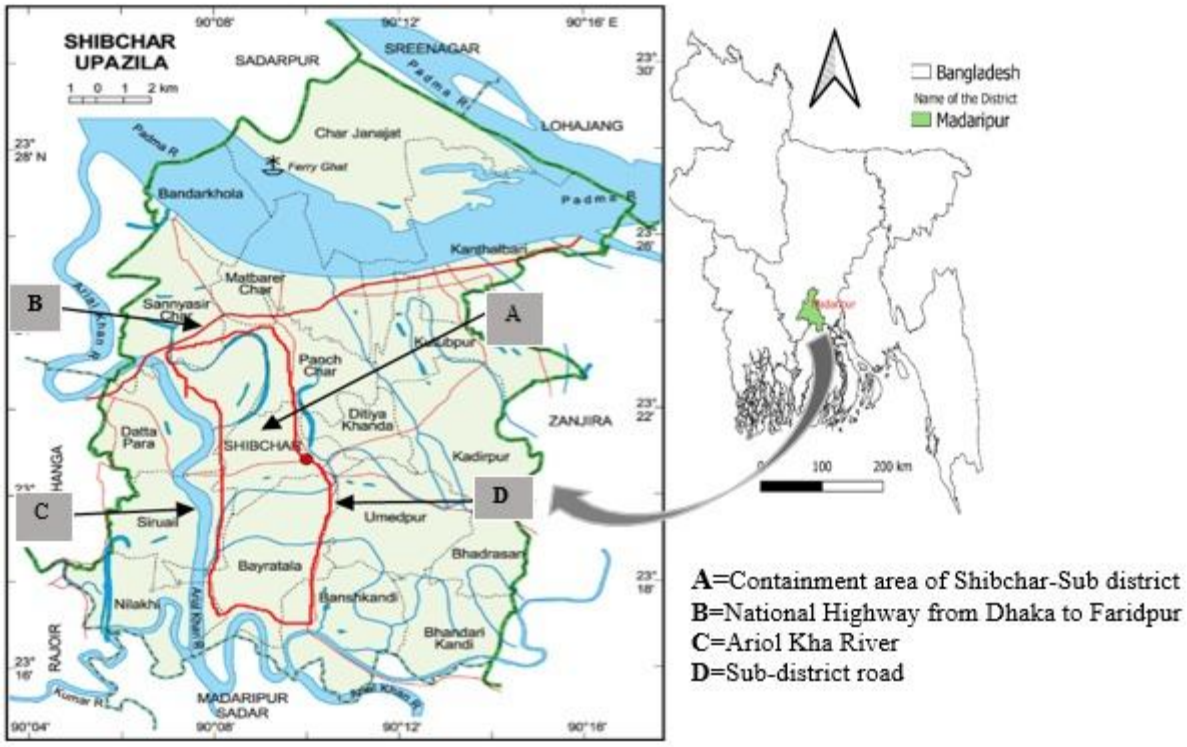

Figure-2: Map showing the containment area of Shibchar Upazila of Madaripur District, Bangladesh

The containment plan restricted entry and exit from the containment zone. Local authorities enforced this restriction. Some pharmacies and grocery shops were identified and kept open from early morning to evening every day to provide essential goods. Pharmacists were instructed to report if the identify any suspected fever cases. A COVID-19 coordination team discussed community awareness on importance of containment with teachers and political, religious, and other community leaders. Local media and religious centers gave continuous announcements to stay home. Local administration provided support for medical emergencies in the containment zone.

Community health care workers visited the local community daily to find suspected cases in the containment zone. Nasal and throat swabs were collected from suspected cases in the community for RT-PCR testing. A “flu corner” was established in the hospital to separately test, treat, and confine any person with ILI symptoms. A dedicated ambulance service was available to transport suspected and confirmed COVID-19 patients to higher centers for medical care. An isolation facility was identified outside the containment zone. Ambulance support from the district hospital was provided to transport patients and samples in the containment zone. Training on contact tracing and infection prevention and control were given to the rapid response team at district and sub-district level. SOPs were developed to operate the isolation and quarantine facility.

Volunteers from the community purchased and delivered groceries to residents. Local political leaders, with the support from the administrative authority, ensured food and other necessary items for day workers. The local community leaders, media and administrative authority was actively involved in risk communication.

DISCUSSION

Epidemiological, clinical and laboratory data confirmed that this was the first cluster of COVID-19 cases in Bangladesh. The index case travelled from Italy to Bangladesh on 7 March 2020. After confirmation as a COVID-19 case we conducted contact tracing and identified eight cases from the contact list of the index case.. To reduce further spread, Bangladesh implemented the first rapid containment plan from 19 March to 3 April 2020 in the upazilla. Administrative and political commitment, active involvement of the all level of health care workers and local health authority, community mobilization and participation, strong involvement of media and

active surveillance with the guidance of the IEDCR team supported the containment effort (Figure 3).

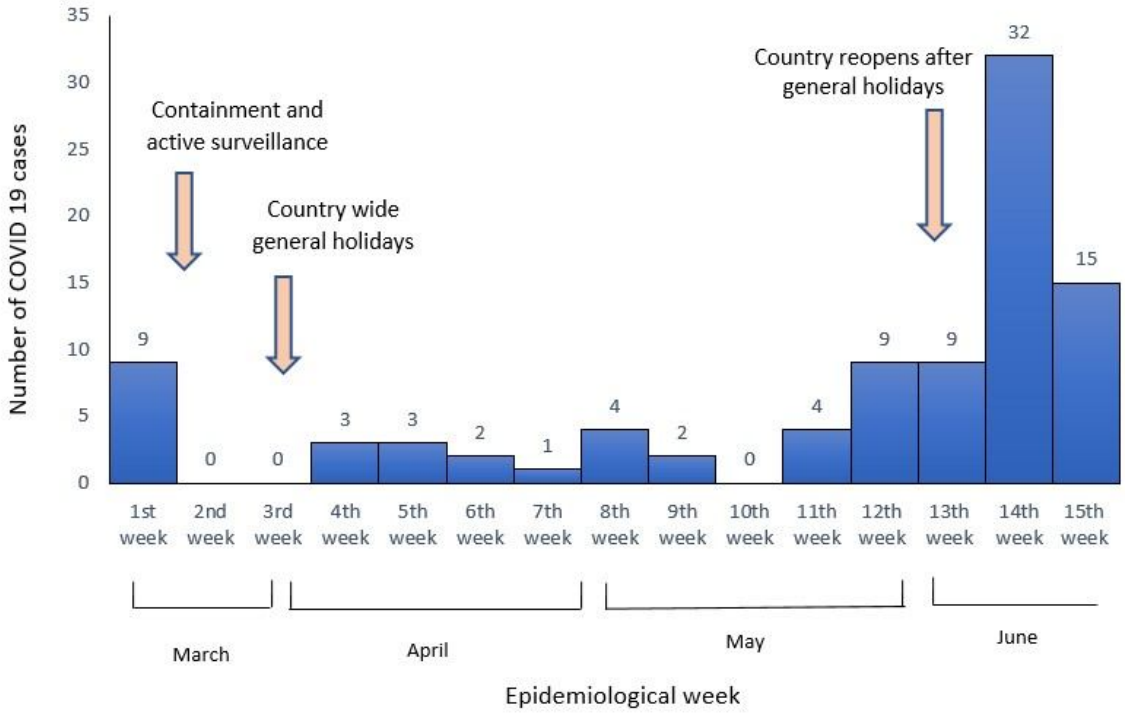

Figure-3 Number of COVID-19 cases according to epidemiological week from March 2020 to June 2020

Our study involved investigation of first cluster outbreak of COVID-19 in Bangladesh at Shibchar upazila. Although the first COVID-19 case at Shibchar Upazilla, Madaripur District was identified on 8 March 2020 but there were no secondary spread from that isolated case. On 13 March 2020 we identified a cluster of COVID-19 cases in Madaripur. These two incidents were from different parts of Madaripur District and we could not identify any link between them. From 13 to 17 March, 2020 IEDCR team identified six COVID-19 cases in Shibchar Upazila of Madaripur District. From their history we established same possible exposure of the subsequent

cases. Therefore, we can consider this event as an early cluster of COVID-19 cases at Madaripur District.

Although, two COVID-19 cases travelled from Italy to Bangladesh, we assumed that case 01 was the index case. We examined his travel history and identified that subsequent cases were exposed to the index case or linked with this case. After case 01's return to Bangladesh, he visited his friends and family. He was aware he was ill; he had mild symptoms and sought medical treatment at Shibchar upazila health complex. He stated that he spent most of his time with his family members after returning from Italy. He also mentioned that he wore mask while he went outside of his home. Subsequent cases were his relatives or friends who had long and/or multiple exposures with case 01.

In controlling spread of infectious diseases, containment is an important fundamental strategy. Rapid containment strategy was developed during this cluster investigation at Shibchar. Natural boundaries of the containment zone physically demarcated the boundaries and helped maintain strict containment. Involvement of multiple stakeholders to implement the containment strategy further reinforced isolation of suspected cases and quarantine of contacts. Moreover, containment efforts were aided by the implementation of non-pharmacological interventions such as social distancing, avoiding crowds and confined areas, staying home, and wearing a face mask.

Contact tracing is an effective public health tool in controlling an infectious disease outbreak (18). Contact identification and managing the contacts can break the chain of transmission of the disease. In the West Africa Ebola Disease outbreak, contact tracing reduced transmission in Liberia during 2014-15 (19–21). Moreover, contact tracing is an effective tool in gathering information about an epidemic in other infectious diseases such as avian influenza

298 (22). In this outbreak investigation, isolation of the index case and contact tracing helped identify
299 subsequent cases. These cases had less contacts and helped make contact tracing timely and
300 manageable. Strict isolation of the cases with quarantine of the contacts and follow up limited the
301 spread to two generations.

302 Community mobilization and risk communication can augment the effectiveness of the
303 contact tracing in any infectious disease outbreak. Culturally accepted and community motivated
304 interventions adapt interventions to the local situation and help communities accept actions to
305 reduce the transmission of disease. In Shibchar Upazilla, community leaders and the local
306 administrative and health authority supported community sensitization. This helped with the
307 efforts for controling the spread of COVID-19 by effective use of isolation, quarantine, and
308 containment. In addition, local and national media advocated acceptance of the prevention
309 strategies.

310 The number of cases at Shibchar Upazilla remained low in the weeks after the
311 commencement of containment. Active searches for suspected cases with isolation of contacts
312 and contact tracing by the local health authority further strengthen the process of slowing down
313 transmission.

314 There were some missed contacts in our study. The index case used public transport to
315 travel from his residence to Dhaka. This accounted for most of the missing contacts and was a
316 major limitation of our contact tracing activity. During that period IEDCR is the only institute to
317 perform RT-PCR for COVID-19 disease. We monitored for positive cases from missed contacts
318 of case 01 for next fourteen days. Moreover, we also monitored the surveillance data of
319 Madaripur district whether we had any cases linked with case 01. But nott such cases were
320 reported. .

Conclusion:

This report describes one of the first COVID-19 clusters in Bangladesh and interventions to control the spread of this disease. The subsequent cases after case 01 were identified rapidly. Furthermore, all the subsequent cases were from the home quarantined contacts. Rapid identification of the case followed by containment, contact tracing and effective community mobilization supported to break the chain of transmission of virus from the particular cluster.

Ethical Approval and consent :

This response was to an imminent public health emergency. IEDCR is the mandated institute of the Government of the Bangladesh responsible for outbreak investigation and response and communicable disease surveillance. Moreover, Directorate General of Health Services identified IEDCR as the focal institute for COVID-19 response. The IEDCR Institutional Review Board has a policy that response to all public health emergencies is exempt from human subjects review. We obtained verbal informed consent from all the cases and contacts before interviews commenced and collection of biological samples. Permission has been obtained from the Director IEDCR for publication of de-identified national surveillance data.

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