Original Research Article

Assessment of the non-pharmaceutical interventions that contained the spread of COVID-19 in Shibchar, Madaripur, Bangladesh 2020

Abstract

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 in Madaripur District. A team from the Bangladesh Ministry of Health and Family Welfare investigated the cluster, established active syndromic surveillance for respiratory diseases, and implemented control activities. 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 34/139 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. Active surveillance by health authority, prompt isolation of cases, quarantine of contacts and establishing a containment zone

to focus mitigation efforts prevented further transmission of the virus from this first COVID-19 cluster in Bangladesh.

Key words

Isolation, quarantine, containment, COVID-19

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). On 11 March 2020 the World Health Organization (WHO) declared a global pandemic due to COVID-19 (2).

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 stopped 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 and assesses 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:

1. Face-to-face contact with a probable or confirmed case within 1 meter and for more than 5 minutes;
2. Direct physical contact with a probable or confirmed case; or
3. 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.

The containment zone

Shibchar is subdistrict of Madaripur District 130 km southeast of Dhaka. The containment zone is about 76 km^2 with a population of near hundred thousand. Containment started on 19 March and ended on 3 April. The main economy of Shibchar is farming and fishing. The sub-district has a natural border consisting of the Arial Kha River on the west and south and a national highway on the east and north. The borders and entry points were maintained by the police.

Data collection

A team 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 (10). 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 quarantine of contacts followed a Standard Operating Procedure 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 monitored household isolation, quarantine, and community containment. Local administrative and health departments assisted with containment.

Surveillance

Community health workers conducted house-to-house searches in the containment area for people with COVID-19 like symptoms from 13 March to 15 April. After this date, passive surveillance for COVID-19 is being conducted for the duration of the pandemic.

Ethics

This response was to an imminent public health emergency. 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.

RESULTS

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

Case 01 was a male in his 30's who departed Milan, Italy at 10 pm on 6 March 2020 and arrived in Dhaka, Bangladesh on 7 March at 5 pm. He traveled with case 07 and another person who was negative for COVID-19. Case 01 developed mild cough and malaise on 5 March 2020 and 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 traveled to a 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. 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). Of his two travel companions from Italy, only one, case 07, was COVID-19 positive, and lived in the same town. Case 07 developed symptoms seven days after his return to Bangladesh and was RT-PCR positive 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 11 March 2020. He had no other probable exposures to SARS-CoV-2 in Italy. Therefore, we concluded that case 07 contracted COVID-19 from case 01. All contacts of case 07 were quarantined at home and no one of them developed any COVID-19 symptoms.

Case 01 spread COVID-19 to six other people with a secondary attack rate of 18% (6/34) (Figure 1).

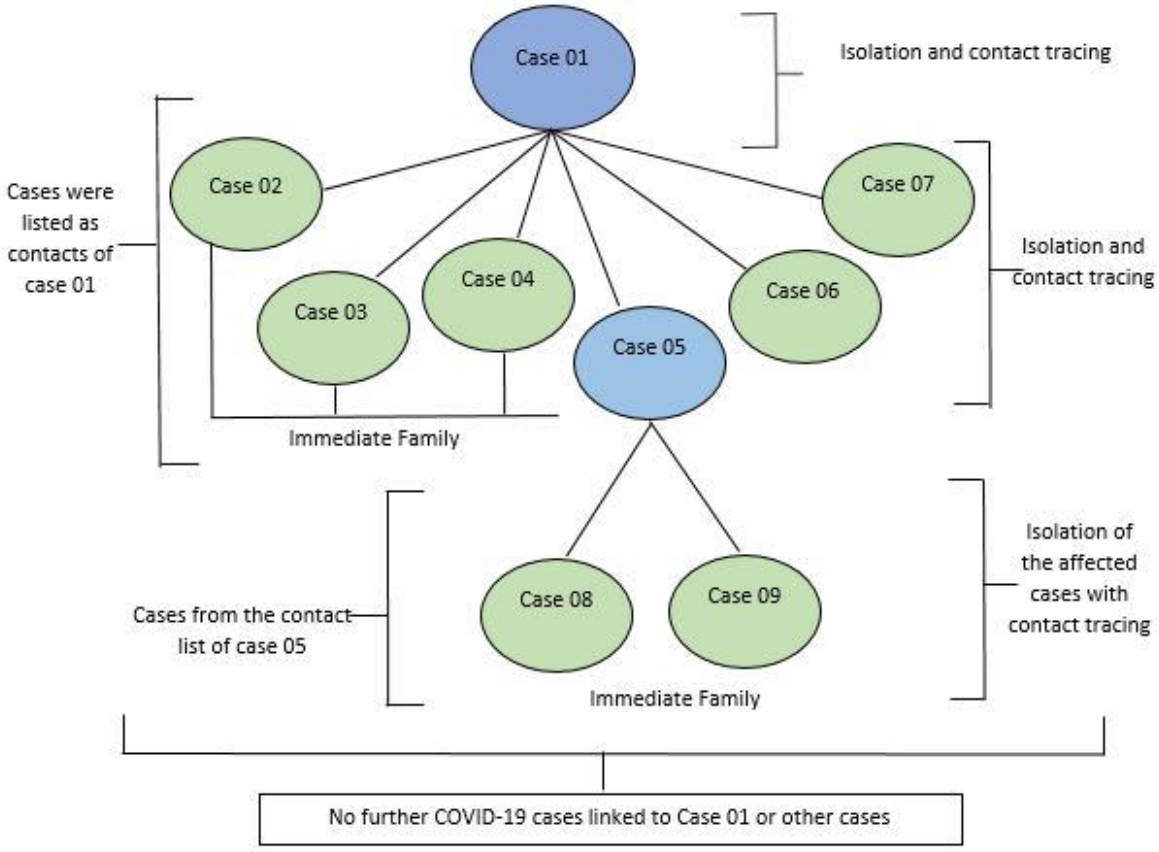

Figure 1. COVID-19 cluster of cases at Shibchar, Madaripur, Bangladesh, March 2020

All cases had direct contact with the index case except case 08. Case 02-04 were family members and lived in the same house as case 01. Case 02 developed symptoms on 12 March whereas, case 03 and case 04 developed symptoms on 13 March. Case 01 visited the house of case 06 on 10 March and on 17 March case 06 developed symptoms.

The most common symptoms of the eight COVID-19 cases were fever and cough (Table 1). There was one symptomatic 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

Case 05 visited case 01's house on 9 March, stayed there from 9 to 11 March, and developed symptoms on 13 March. Case 08 and case 09 were household members of case 05. Case 08 was asymptomatic and had close contact with case 05. While 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 a hospital for minimum fourteen days.

Contact tracing

All contacts were advised to maintain strict quarantine at home for 14 days. There were no new cases when the investigation ended in the last week of April 2020 (Figure 1). Isolation of the cases and 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

The condition of case 06 deteriorated and was referred to a higher center in Dhaka on 21 March 2020. 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 (15). 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).

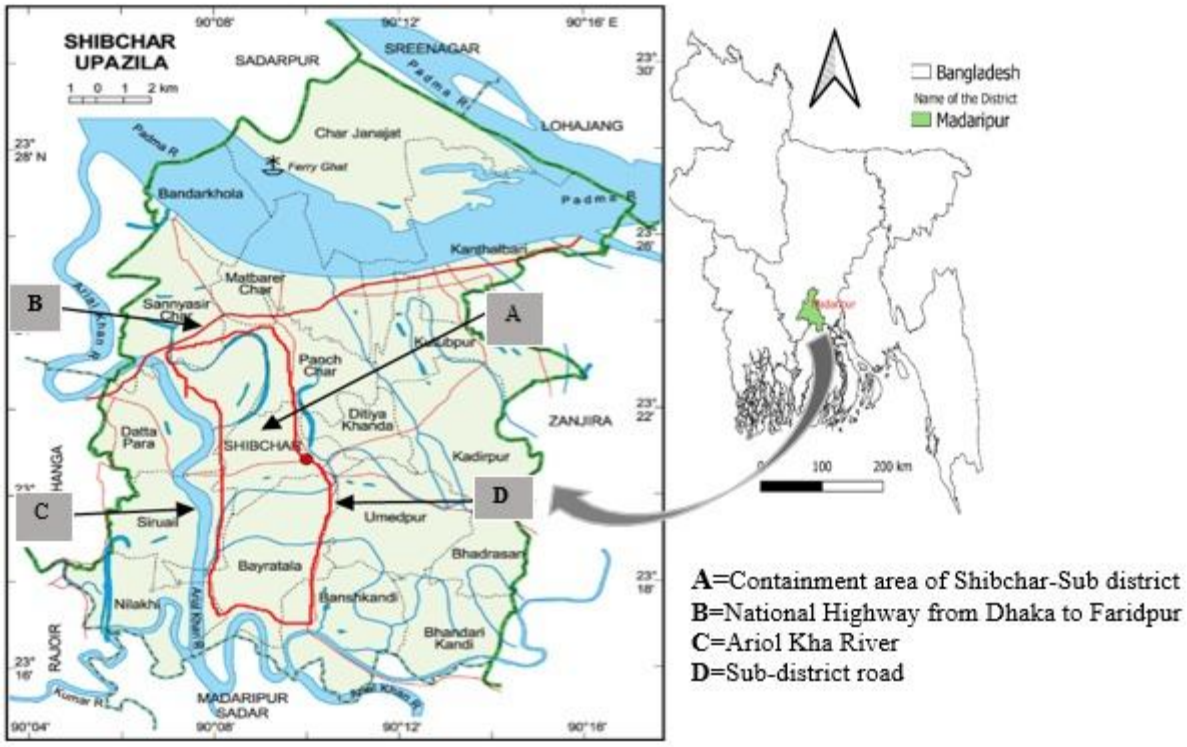

Figure-2: Map showing the containment area of Shibchar Upazila of Madaripur District, Bangladesh

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. 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 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. This was a sign that transmission was contained. To reduce further spread, Bangladesh implemented the first rapid containment plan in the upazilla. Administrative and political commitment, community mobilization and participation, strong involvement of media and active surveillance successfully stopped transmission of COVID-19 during the infective period of the COVID-19 cases in Shibchar Upazilla.

The first COVID-19 case at Shibchar Upazilla, Madaripur District was identified on 8 March 2020. The case returned from Italy where there was community spread of COVID-19. This case had no secondary spread, so it was considered as an isolated case. On 13 March we identified a cluster of cases in Madaripur. These two cases were from different parts of Madaripur District and we could not identify any link between these cases. From 13 to 17 March, we 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 a local hospital. He stated that he spent most of his time with his family members after returning from Italy. Subsequent cases were his relatives or friends who had long or and 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 (16). 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 (17–19). Moreover, contact tracing is an effective tool in gathering information about an epidemic in other infectious diseases such as avian influenza (20). In this outbreak investigation, isolation of the index case and contact tracing helped identify subsequent cases. These cases had less contacts and helped make contact tracing timely and manageable. Strict isolation of the cases with quarantine of the contacts and follow up limited the spread to two generations.

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

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

There were some missed contacts in our study. The index case used public transport to travel from his residence to Dhaka. This accounted for most of the missing contacts and was a major limitation of our contact tracing activity and containment effort throughout the country.

This report describes one of the first COVID-19 clusters in Bangladesh and interventions to control the spread of this disease. Rapid identification of the case followed by containment, timely and thorough contact tracing, and effective community mobilization prevented further spread beyond two generations of transmission of COVID-19in this community.

REFERENCES

1. First 3 cases of coronavirus confirmed in Bangladesh | Dhaka Tribune [Internet]. [cited 2020 Jun 28]. Available from: https://www.dhakatribune.com/health/coronavirus/2020/03/08/iedcr-3-affected-with-coronavirus-in-bangladesh
2. WHO. WHO Timeline - COVID-19 [Internet]. WHO Timeline - COVID-19. 2020 [cited 2020 Jun 28]. p. https://www.who.int/news-room/detail/27-04-2020-wh. Available from: https://www.who.int/news-room/detail/27-04-2020-who-timeline---covid-19
3. Coronavirus COVID-19 (SARS-CoV-2) | Johns Hopkins ABX Guide [Internet]. [cited 2020 Jun 28]. Available from: https://www.hopkinsguides.com/hopkins/view/Johns_Hopkins_ABX_Guide/540747/all/Coronavirus_COVID_19__SARS_CoV_2
4. Park SE. Epidemiology, virology, and clinical features of severe acute respiratory syndrome-coronavirus-2 (SARS-COV-2; Coronavirus Disease-19) [Internet]. Vol. 63, Korean Journal of Pediatrics. Korean Pediatric Society; 2020 [cited 2020 Jun 28]. p. 119–24. Available from: /pmc/articles/PMC7170784/?report=abstract
5. World Health Organization. WHO Interim Protocol : Rapid operations to contain the

initial emergence of pandemic influenza. 2007. p. 1–44.

6. Ng Y, Li Z, Chua YX, Chaw WL, Zhao Z, Er B, et al. Evaluation of the Effectiveness of Surveillance and Containment Measures for the First 100 Patients with COVID-19 in Singapore — January 2–February 29, 2020. MMWR Morb Mortal Wkly Rep [Internet]. 2020 Mar 20 [cited 2020 Oct 16];69(11):307–11. Available from: http://www.cdc.gov/mmwr/volumes/69/wr/mm6911e1.htm?s_cid=mm6911e1_w
7. Dabla-Norris E, Gulde-Wolf A-M, Painchaud F. Vietnam's Success in Containing COVID-19 Offers Roadmap for Other Developing Countries. IMF News [Internet]. 2020 [cited 2020 Oct 16];1–5. Available from: https://www.imf.org/en/News/Articles/2020/06/29/na062920-vietnams-success-in-containing-covid19-offers-roadmap-for-other-developing-countries
8. World Health Organization. Responding to COVID-19 - Learnings from Kerala. Tech Rep [Internet]. 2020 [cited 2020 Oct 16];(July). Available from: https://www.who.int/india/news/feature-stories/detail/responding-to-covid-19---learnings-from-kerala
9. Menon JC, Rakesh PS, John D, Thachathodiyl R, Banerjee A. What was right about Kerala's response to the COVID-19 pandemic [Internet]. Vol. 5, BMJ Global Health. BMJ Publishing Group; 2020 [cited 2020 Oct 16]. p. 3212. Available from: www.tradineconomics.com
10. IEDCR. Suspected COVID-19 Case Report and Laboratory Test Request Form_updated_04.04.2020 [Internet]. 2020. Available from: https://old.iedcr.gov.bd/website/images/files/nCoV/Suspected COVID-19 Case Report and Laboratory Test Request Form_updated_04.04.2020.pdf

11. World Health Organization. Global surveillance for COVID-19 caused by human infection with COVID-19 virus [Internet]. World Health Organization. 2020 [cited 2020 Jun 28]. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-

12. WHO. Contact tracing in the context of COVID-19. WHO Guidel [Internet]. 2020;2019(May, 10):1–7. Available from: https://www.who.int/publications-detail/contact-tracing-in-the-context-of-covid-19

13. WHO. Considerations for quarantine of contacts of COVID-19 cases. World Heal Organ [Internet]. 2020 [cited 2021 Jan 7];(August):19082020. Available from: https://www.who.int/publications/i/item/considerations-for-quarantine-of-individuals-in-the-context-of-containment-for-coronavirus-disease-(covid-19)

14. WHO. Considerations in the investigation of cases and clusters of COVID-19. Who2020 [Internet]. 2020 [cited 2021 Jan 7];(March):1–4. Available from: https://www.who.int/publications/i/item/considerations-in-the-investigation-of-cases-and-clusters-of-covid-19

15. World Health Organization. WHO Interim Protocol : Rapid operations to contain the initial emergence of pandemic influenza [Internet]. WHO. World Health Organization; 2007 [cited 2020 Nov 15]. p. 1–44. Available from: http://www.who.int/influenza/resources/documents/draftprotocol/en/

16. Kucharski AJ, Klepac P, Conlan A, Kissler SM, Tang M, Fry H, et al. Effectiveness of isolation, testing, contact tracing and physical distancing on reducing transmission of SARS-CoV-2 in different settings. medRxiv [Internet]. 2020 [cited 2020 Jun 27];2020.04.23.20077024. Available from: www.thelancet.com/infectionPublishedonline

17. Swanson KC, Altare C, Wesseh CS, Nyenswah T, Ahmed T, Eyal N, et al. Contact tracing performance during the Ebola epidemic in Liberia, 2014-2015. PLoS Negl Trop Dis [Internet]. 2018 Sep 1 [cited 2020 Jun 27];12(9). Available from: /pmc/articles/PMC6152989/?report=abstract

18. Saurabh S, Prateek S. Role of contact tracing in containing the 2014 Ebola outbreak: A review. Afr Health Sci [Internet]. 2017 [cited 2020 Jun 27];17(1):225–36. Available from: /pmc/articles/PMC5636234/?report=abstract

19. Klinkenberg D, Fraser C, Heesterbeek H. The effectiveness of contact tracing in emerging epidemics. PLoS One [Internet]. 2006 [cited 2020 Jun 27];1(1). Available from: www.plosone.org

20. Td Eames K, Webb C, Thomas K, Smith J, Salmon R, Mark J, et al. Assessing the role of contact tracing in a suspected H7N2 influenza A outbreak in humans in Wales [Internet]. Vol. 10, BMC Infectious Diseases. 2010 [cited 2020 Jun 27]. Available from: http://www.biomedcentral.com/1471-2334/10/141