

Further Information About Vaccine Breakthrough COVID-19 Cases of Our Hospital

1. Further Information About This Vaccine Breakthrough COVID-19 Cluster with a 88% Attack Rate

1.a Materials and Methods

We used the following criteria stipulated by the Secretary- Ministry of Health of Sri Lanka to identify high risk exposures [Reference 6]. Any face-to-face contacts with known or probable COVID-19 cases within 1m distance for >15 minutes whilst one or both parties were not wearing a surgical (or a better) mask, any direct physical contact without wearing appropriate personal protective equipment (PPE) and hand sanitizing, presence when a confirmed or probable COVID-19 case was generating aerosols, any splashing of secretions of such a person on face, any other interaction with such a person without appropriate PPE. In addition we looked for any exposure to such a person in a closed space >15 minutes. HCW who were tested positive for COVID-19 were managed at intermediate care centers (COVID-19 ICC) or were hospitalized in July-August 2021. HCW who had high risk exposures were home quarantined for 14days and tested for COVID-19 before they were released from quarantine. We have verified all SGs vaccination status, dates and batch numbers of the vaccines by checking the hospitals vaccination records.

Standard Q-SD Biosensor rapid antigen test (RAT) kit (SD Biosensor, Suwon-si, Korea) was used for RATs mentioned here. Quantitative reverse transcription-polymerase chain reaction (RT-PCR) tests were done at the Veterinary Faculty of the Peradeniya University using Bio-Rad CFX96 Touch machines (Bio-Rad Laboratories, Inc. Hercules, USA). Combined nasal and throat swabs are taken at our hospital for testing those days. The authors studied this cluster as part of their regular work and kept records.

1.b Further details of SGs: We have inquired about 10 underlying medical conditions as per CDC protocol and documented [Reference7]. We in addition looked for hypertension, dyslipidemia,

bronchial asthma or chronic obstructive pulmonary diseases, heart diseases and any other significant medical problem they had. Pre-existing medical conditions of the 35 vaccine breakthrough cases (including the IC) were as follows. Eight had type2 diabetes mellitus and another one got diagnosed of diabetes mellitus at the COVID-19 ICC. Eight had hypertension and another one got diagnosed of hypertension at the COVID-19 ICC. 10 were on statins (for dyslipidemia). Two were on treatment for ischemic heart diseases and one each had a heart valve replaced, bronchial asthma, on thyroxine after thyroidectomy, depression and a past breast cancer. Among the five SGs tested negative by the first and repeat RT-PCR tests two had type2 diabetes and one of them was on statins for dyslipidemia as well and one has epilepsy.

We asked whether they were tested positive for COVID-19 in the past.

All 42 SGs did not have any history of diagnosed COVID-19 in the past. However the family members of one SG were infected with COVID-19 three months ago. He was RT-PCR tested as a contact of his family and tested negative. During this episode also he was tested negative by the initial and second RT-PCR tests.

Workers of our hospital including SGs were vaccinated with two doses of 0.5ml of the ChAdOx1 nCoV-19 (Covishield) vaccine administered 13 weeks apart. Batch numbers were 4120z025 (first dose) and 4120z028 (second dose). ChAdOx1 nCoV-19 (AZD1222) is a replication-deficient chimpanzee adenovirus-vectored vaccine expressing the full-length SARS CoV-2 spike glycoprotein gene. Covishield is the trade name of ChAdOx1 nCoV-19 manufactured by Serum Institute of India.

Both unvaccinated SGs were 27 years old men and had symptomatic COVID-19 and one of them had to be sent to a hospital from the ICC for one day due to severity of symptoms.

1.c Why Index case (IC) came forward and reported the illness: As mentioned in the manuscript IC was reluctant to report her illness initially. On day7 of the illness IC staying at a boarding place wanted to visit her home. Before that she wanted to be sure that she is free from COVID-19. Hence she told about her illness to her superior and came to see the authors and was directed for testing.

1.d Maintenance of the cold chain: Covishield vaccines were stored at our hospital for 1-2 days and brought to the site of vaccination inside the hospital in standard cold boxes. After vaccine arrived at our hospital, storing temperature was monitored by a Berlinger Freeze-tag. The hospital obtains vaccines from the regional medical supply division-Kandy which in turn is supplied by the national storage facility. In both places vaccines are stored in cold rooms and temperature is constantly electronically monitored. We checked and there was no evidence of the break of the cold chain at regional and national level. First dose of the vaccine arrived at our hospital within two days of arriving Sri Lanka.

1.e An Unusual case in this cluster: There was one baffling special case. He is a pentagenarian on treatment for bronchial asthma and tested positive by RT-PCR on July 16th with a Ct value of 33.56. He was admitted to COVID-19 ICC two days later and was discharged from that after 10 days. He remained asymptomatic and developed fever, nasal congestion and runny nose, sore throat and fatigue on August 6th. As symptoms progressed he sought treatment and on August 10th and undergone a RT-PCR again. The test was positive with a Ct value 14.40. The government has started home isolation at that time. He was home isolated under the supervision of the medical officer of health of his area of residence and did not report his new illness to the hospital public health unit. His four family members living with him were tested negative 11th day after his first PCR. His incubation period is abnormally long. The last day this SG was amongst other SGs was July 16th. Thus the serial interval (time gap between the onset of symptoms in the primary and secondary case) is also unusually long. Most feasible explanation to this is that he may have been re-infected likely by Delta variant of SARS-CoV-2 at the ICC during his last days as he has mingled with infected people from different areas with all levels of infectivity inside the ICC. By the third week of July, when he was at the ICC a considerable proportion of COVID-19 cases in Sri Lanka were of Delta variant. Although the minimum time gap between the first and second infection among 23 previously reported such cases is longer we still believe that this is a possibility [<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8054490/>]. There is a case report of an immunocompetent HCW getting an Alpha VOC breakthrough infection despite of a past infection,

subsequently getting two doses of Covishield vaccination and confirmation of seroconversion. After all of this she developed a severe COVID-19 breakthrough reinfection with the Delta VOC [<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8418387/>]

2. Interesting Vaccine Breakthroughs COVID-19 Cases Occurred at Our Hospital After the Present Outbreak

We would like to mention a few interesting vaccine breakthrough cases involving our hospital workers that happened after we finished the original study since that information further support our key messages and conclusions. Available evidence indicates that Omicron VOC has become the dominant SARS-CoV-2 variant circulating in Sri Lanka by the fourth week of January 2022 [<https://www.sjp.ac.lk/covid-19/82-new-omicron-cases-recorded-from-sri-lanka-latest-sars-cov-2-variant-report-by-department-of-immunology-and-molecular-medicine/>]. 189 vaccine breakthrough cases (among approximately 1900 workers of the hospital) with symptoms that bothered the patient were reported to us during February 2022. Out of 189 only one immunocompromised person needed intensive care treatment. All 189 HCW have completed their primary series (had received two dose of ChAdOx1 nCoV-19, COVID-19 vaccine BIBP, mRNA-1273 vaccine or BNT162b2). Out of that 153 have received a third (booster) dose of BNT162b2 vaccine in early November 2021 as well. We believe that there should have been much more mild symptomatic and asymptomatic vaccine breakthrough cases that were undiagnosed in February 2022. That was due to the severe shortage of test kits in the country during this time and interest to get tested was low in the public due to various reasons. We know that some diagnosed cases among our hospital's workers were not reported to us as well.

Other than our main cluster (July 2021) there were 9 and 11 documented vaccine breakthrough cases respectively in June and July among some 1800 plus employees of our hospital who have completed their primary series and there were 62 in August 2021(with the Delta VOC wave).

We briefly describe a small vaccine breakthrough cluster of HCW all who received two doses of ChAdOx1 nCoV-19 vaccine with our SGs plus a third (booster) dose of BNT162b2 vaccine in early November 2021. The cluster started in the last week of January 2022. A HCW in her fifties without any past medical problem (index case=IC2) developed symptomatic COVID-19 with 6 symptoms. Three days later IC2's husband (received three doses) also developed symptomatic COVID-19. However their two children tested negative twice. Three co-workers had eaten and chattered with IC2 without masks three consecutive days before the day IC2 tested positive. Two of them had no other risky exposures 14 days before they developed symptoms. One of the two is in her fifties and other than bilateral quadriceps tendonitis, she was previously healthy. She had travelled with IC2 in the same car with closed windows as well. She developed symptoms and tested positive two days after IC2 and had five symptoms. None of her contacts tested positive. The other HCW in her forties also developed symptoms and tested positive on the same day and had seven symptoms. Other than mild mitral valve prolapse, she had no past medical problems. Out of her high risk contacts, her husband (two doses of vaccine) developed symptoms and tested positive. Their child also had same symptoms but was not tested due to shortage of testing facilities. The third co-worker developed symptoms 12 days after IC2 tested positive, and was tested positive. However she had other high risk exposures four and three days before she tested positive. Hence we cannot include her to this cluster with certainty. Communal dining at cramped places, disregarding the risk of infection from fully vaccinated co-workers and hesitancy to report COVID-19 like symptoms early contributed to making of this cluster.

We have noted four other interesting cases of HCW in their thirties and with no past medical problems. All have received two doses of ChAdOx1 nCoV-19 vaccine with SGs. One of them had a symptomatic breakthrough infection in May 2021 and the other three in August 2021. There was another HCW in his fifties and healthy, who received same vaccines in the same time. He had a symptomatic breakthrough infection in July 2021 and while being treated got diagnosed of hypertension. All of them received a BNT162b2 booster in November 2021 but all five had another symptomatic breakthrough infection in the last week of January or in February 2022 and they have

infected their family members as well. In July-August 2022 we noticed three healthy doctors getting symptomatic COVID-19 within two months after the fourth (second booster) dose.

Those indicate the importance of maintaining non pharmacological preventive measures even among basically healthy HCW vaccinated with 2-4 doses of vaccines until the end of this pandemic.