

## Abstract

**Background:** Bon Secours Cork, an acute private 340 bed hospital, including a new mechanically ventilated unit and an older naturally ventilated unit, provides elective/acute medical and surgical, including paediatrics and oncology, services. In January 2021, the CoViD surge proved challenging, despite implementation of recommended measures.

**Methods:** A review of preventative measures and cases was undertaken. Results: In January 2021, 982 inpatient and 1731 day cases including 1,748 surgical procedures were managed. There was no difference in the preventative measures undertaken in either unit. All patients were screened pre/on admissions and nursed in single on-suite rooms. Unscheduled care cases were admitted to both sides and nursed in the CoViD pathway pending results and rescreened at 72-hour intervals. In January 7,808 swabs were processed including 2,379 staff screens. Healthcare associated transmission was not identified in staff or patients in the new, mechanically ventilated unit. Four instances of nosocomial transmission occurred in the naturally ventilated unit and involved 43 staff and 10 definite and 4 possible nosocomial cases. There was no patient-to-patient transmission. Outbreak 1 involved 26 staff and 8 patients. Outbreak 2 involved 15 staff and 1 definite nosocomial case. Extensive contact tracing on both units failed to identify exposed staff/patients as ‘close contacts’. Both outbreaks were controlled by screening/cohorting of cases and admission to 1 area was suspended. FFP2/3 mask use was instituted. Infected staff were identified elsewhere however no nosocomial transmission was identified. Vaccination of frontline healthcare workers commenced on 9th January and assisted in the outbreak control, achieved within 10 days

**Conclusion:** Mechanical ventilation appears to have played a role in the reduction of nosocomial spread amongst staff and ultimately patients. The importance of vaccination is recognised however the risks of SARS CoV2 variant spread should not be underestimated, and an effort should be made to reach a National consensus on methods to improve ventilation of current facilities.

## Introduction and Aims: What we know so far and what we still must learn

Coronavirus disease 2019 (COVID-19) was formally declared a global pandemic on 11 March 2020 by The World Health Organisation (WHO) <sup>1</sup>. Since then, there has been a plethora of research investigating the disease’s exact mode of transmission, and what exactly can be done to slow that transmission. There is a spate of information available that, though plentiful, is often confusing and contradicting. We are now a year into the pandemic, with the debate of “droplet vs airborne” transmission very much still ongoing.<sup>2</sup> Initial assumptions that the virus had no airborne potential transmission have been met with a growing body of evidence that such transmission is at the least possible in certain circumstances – this was reflected by the CDC’s acknowledgment in late 2020 <sup>2,3</sup>. It is however fair to say that the majority of infections are transmitted through close contact, and not the airborne route. The CDC recognise three primary circumstances in which this occurs; enclosed spaces, prolonged exposure to respiratory particles, and inadequate ventilation or air handling – allowing a build up of suspended small respiratory droplets and particles. It is this final circumstance which is the focus of this project and an area which has the potential to have a large impact in our ongoing campaign against the virus.

It is important to look at all routes of disease spread, though studies have shown that fomite transmission appears unlikely to have a large impact in real-life conditions.<sup>4</sup> Although the application of masks can have a clear impact on the advancement of COVID-19, the use of respirator masks vs surgical masks outside of aerosol generating procedures is less certain. There is a paucity of head-to-head trials examining the two, with the few available studies showing low quality evidence of a lack of statistical difference between the two methods (outside of aerosol generating procedures) and a need for more research.<sup>5-7</sup> The effectiveness of the novel COVID-19 vaccinations is well supported <sup>8</sup> and has been implicated with success in our own hospital group. However, studies on ventilation and its importance in stopping the spread of COVID-19 are lacking. This study aims to add to that discussion.

## Methods: Our Facilities

Bon Secours Cork is an acute, private 340 bed hospital that employs over 1000 staff and admits about 35,000 patients every year. The hospital has an older naturally ventilated unit and a newer unit completed in July 2019 whose ventilation is outlined below. The new unit contains both surgical wards, the cancer ward and the cancer infusion ward, theatre, and a 10 bed CCU. The older unit consists primarily of medical wards, a pediatrics’ ward and radiology. Of note, there was no difference in terms of staffing across the sites and no agency staff are employed.

Air changes per hour (ACPH) is a measure of the air volume added to or removed from a space in one hour, divided by the volume of the space <sup>9</sup> and is the commonly used measurement of air flow rate relative to the room size. For example, for aerosol generating procedures, the HSE recommend that patients be placed in a well-ventilated single room e.g. mechanically ventilated with **6-12 air changes per hour, or naturally ventilated rooms.**<sup>10</sup> In our newer unit all corridors are have a minimum of 6 ACPH, nurses’ stations have a minimum of 10 ACPH and the bedrooms are naturally ventilated. Our critical care unit has 15 ACPH and 2 isolation rooms with associated anterooms. In the older unit however, the ventilation involves no air changes. We hypothesise that this disparity in ventilation was a contributing factor in the two outbreaks of COVID-19 seen in the hospital in January 2021.

## Methods: January Outbreak

Ireland’s 7-day average for COVID-19 cases peaked on the 10<sup>th</sup> January with 6532 cases.<sup>11</sup> In our facility, throughout the month of January, 982 inpatients and 1731 day cases including 1748 surgical procedures were performed. During this time, there were 198 medical patients admitted acutely via the MAU to medical wards, 69 patients admitted acutely to the cancer ward and 88 acute surgical admissions. On the 28<sup>th</sup> January, our numbers had peaked, with 184 in-patients, of which 77 were in COVID-19 isolation, and 31 were confirmed to be COVID-19 positive.

January saw two outbreaks in our facilities, with both occurring in the older unit. Isolates have been referred for whole genome sequence typing which should allow a fuller evaluation of transmission pathways. There was no healthcare associated transmission in patients in the new unit, despite there being no difference in preventative measures undertaken in either unit. In the month of January, 7 staff members on that side were found to be positive. Six cases were community acquired and 1 case was possibly acquired from a colleague that the HCW had contact regular with. Following this staff through out the new unit were screened on a rolling basis for 3 weeks, with no other staff were identified. In the old unit however two separate outbreaks were seen and transmission was also found to have occurred on 2 other wards involving 2 possible and 2 indeterminate cases and 2 HCWs. These did not meet the definition of an outbreak. The first outbreak involved 26 staff members with 8 definite nosocomial cases. Of note there was no known cases of COVID-19 on the ward when the outbreak occurred. The second outbreak involved 15 staff and 1 definite, 1 possible and 2 indeterminate nosocomial cases.

European centre for disease control (ECDC) surveillance definitions were used to determine the possible source of these infections. Definite hospital-associated (HA-COVID-19) is defined as symptom onset on day > 14 after admission. Probable healthcare associated COVID-19 is when symptom onset occurs on day 8-14 after admission or symptom onset on day 3-7 and a strong suspicion of healthcare transmission. Indeterminate association (IA-COVID-19) is defined as symptom onset on day 3-7 after admission, with insufficient information on the source of infection to assign to another category <sup>12</sup>. Of the total nosocomial cases 14 were determined to be definite/probable HA-COVID-19 and 2 were deemed indeterminate (IA/HA-COVID-19) although these numbers may change when typing is available.

The two outbreaks occurred predominantly in St. Brigid’s ward and St. Finbarr’s ward, with St. Finbarr’s ward being our designated COVID-19 ward for the cohort of positive cases. Both wards are in the old unit. The graph above highlights the outbreak as it occurred in St. Brigid’s with large numbers of confirmed nosocomial transmission.

ST BRIGIDS WARD JANUARY OUTBREAK

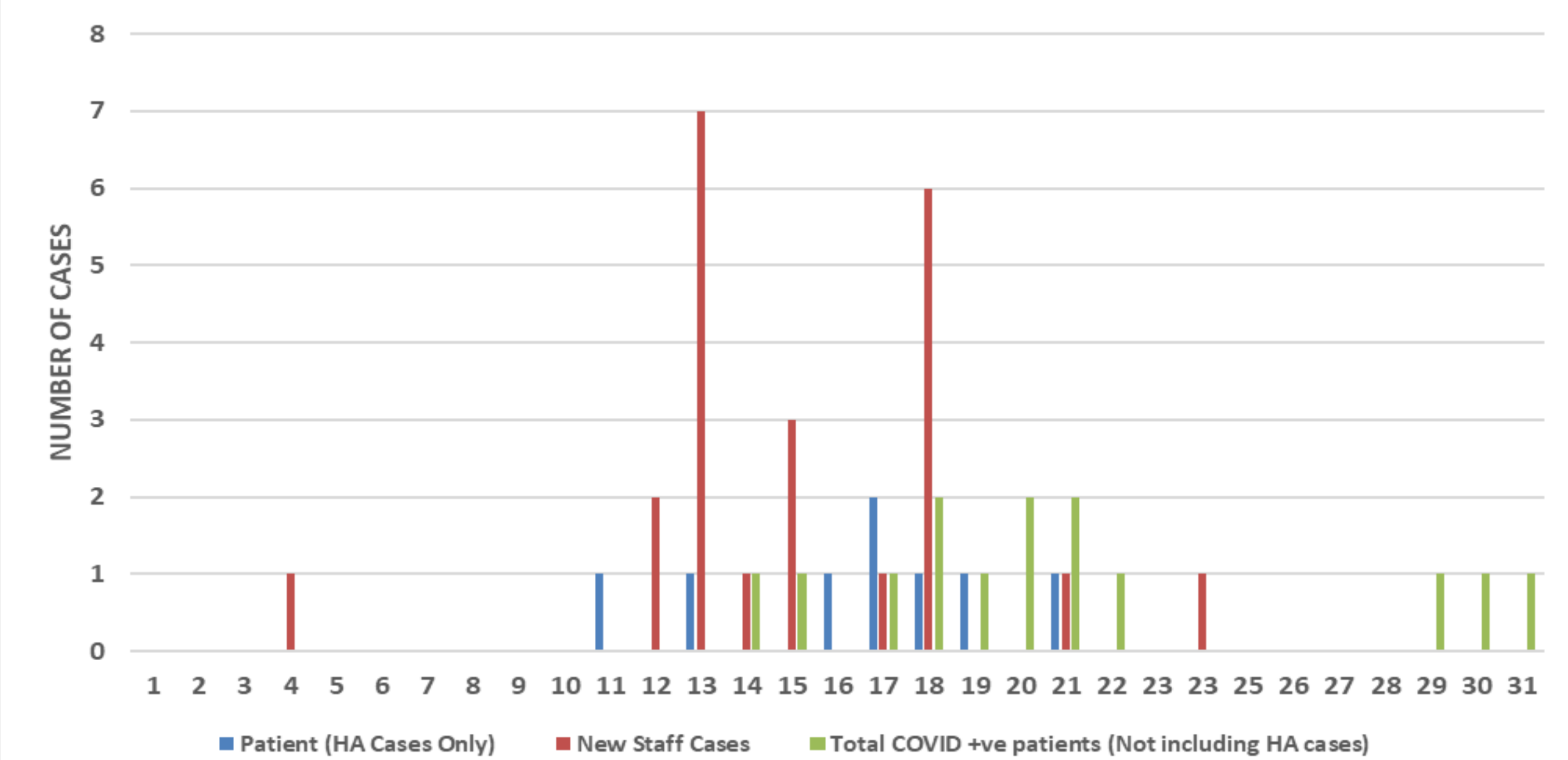


Table 1. Nosocomial transmission in St Brigid’s ward in January 2021

## Methods: Preventative Measures

Several preventative measures were already in place prior to the two outbreaks seen in January. This included the division of patients into two separate pathways. Mandatory PPE differed between the two groups. If a patient was placed on the “COVID pathway”, then staff were required to wear full gown, gloves, FFP2 masks and a visor, while if on the “Non-COVID pathway” staff were instructed to wear a plastic apron, surgical mask, gloves and a visor.

Following the January outbreak, all patients who were admitted acutely were placed on the COVID pathway for the first 72 hours of their inpatient stay. They were then required to have a minimum of 2 negative PCR swabs and be clinically evaluated before being moved off the COVID pathway. All transfers from other hospitals remained on the COVID pathway regardless of negative swabs for a minimum of 14 days. Patients who were positive for COVID-19 were placed on red/amber pathway for minimum of 14 days, before being clinically assessed for suitability to come off pathway, requiring a minimum of 5 days of being afebrile.

Other preventative measures in place before the outbreaks included: staff symptoms check and sign off when presenting for work, a staff helpline and testing if symptoms occurred, mandatory surgical masks and visors in clinical areas for all staff members, limited number of staff in enclosed spaces such as nurses’ stations, surveillance swabbing every 72 once the outbreak occurred, as well as all patients being swabbed on admission and 72 hours post admission. In an effort to combat the outbreak, on the 13<sup>th</sup> of January FFP2 masks were made compulsory for all staff in clinical areas, replacing the previous mandatory surgical masks. Vaccination of staff commenced on the 9<sup>th</sup> January with the second dose given in the last week of January. This greatly assisted in bringing the outbreaks under control as highlighted in the graph below.

## Discussion and Conclusion

Ventilation in the healthcare setting is a matter of the utmost importance that has frequently been overlooked in the past. In fact, in a 2018 ICU/HDU survey, 52% of ICU/HDU capacity in Ireland has no air management (air exchanges) or treatment (HEPA filtration) isolation room capacity to decrease air-borne transmission of infection. <sup>13</sup> Mechanical ventilation appears to have played a role in the reduction of nosocomial spread amongst staff and ultimately patients. The impact of other preventative measures, including vaccination, was also clearly of consequence. We are presumably still very far from the end of this pandemic, particularly as we deal with the challenges of the new SARS CoV2 variants, and an attempt to improve ventilation in our healthcare settings nationally should be performed. Our study found ventilation to potentially have a profound impact on the spread of COVID-19 in the two outbreaks noted in the Bon Secours Hospital in January 2021.

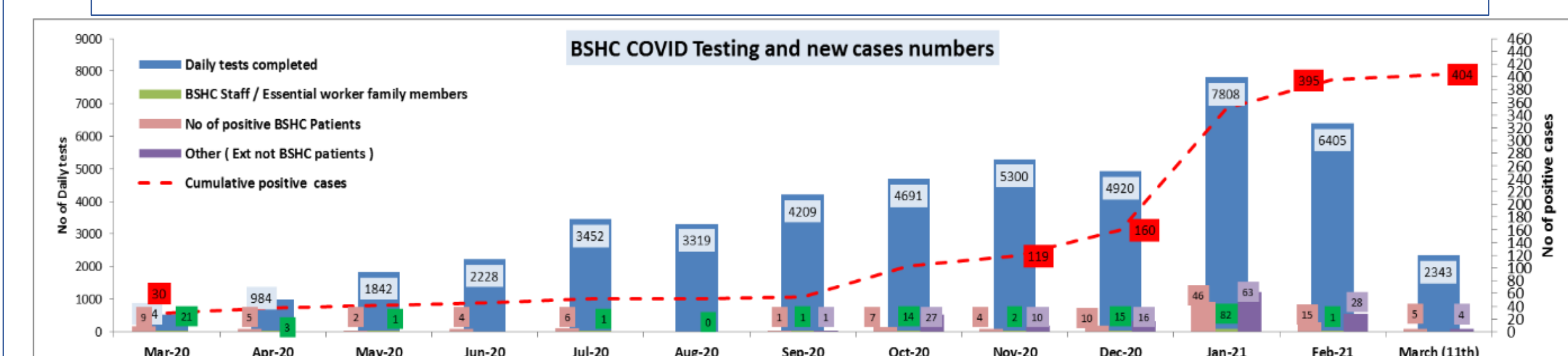


Table 2. BSHC Number of COVID-19 Tests performed and number of positive cases over time

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