Open Peer Review on Qeios

Hospital-Onset and Community Delta and Omicron SARS-CoV-2 Infections

Zvi Shimoni[1], Talya Finn[2], Jonathan Lellouche[2], Paul Froom[3]

1 Ariel University
2 Laniado Hospital
3 Tel Aviv University

Funding: No specific funding was received for this work.

Potential competing interests: No potential competing interests to declare.

Abstract

Background: Previous studies indicated an increased risk of hospital-onset SARS-CoV-2 infections during the Delta and Omicron waves. Limitations in past research included the failure to compare hospital and general population infection rates and inadequate criteria for defining hospital-onset infections.

Objective: To assess the risk of hospital-onset SARS-CoV-2 infections during the Delta and Omicron waves, comparing rates in the hospital setting to the general population.

Methods: The study was conducted at Laniado Hospital, Israel during the Delta wave (August-September 2021) and Omicron wave (January 1-31, 2022). Patients admitted with respiratory symptoms or positive tests were isolated in a dedicated ward. Hospital-onset infections were identified as patients testing negative upon admission but positive during their stay. Rates were compared with community infection rates and those reported in other centers.

Results: Hospital-onset infections were higher during the Omicron wave but were consistently lower than expected based on general population data. Relative to the general population, in-hospital onset infections were below 50% during the Delta wave and below 15% during the Omicron wave. The rate was lower than that reported elsewhere that used methods that didn't include patient segregation.

Conclusions: Despite not universally using high-filtration masks or conducting repeated PCR testing, hospital-acquired infections were minimized by segregating patients in dedicated wards. The study suggests patient segregation in specialized wards is the most effective component in preventing in-hospital transmission.

Zvi Shimoni[1], **Talya Finn**[2], **Jonathan Lellouche**[3], **Paul Froom**[4]

[1] *The Adelson School Of Medicine –Ariel University, Israel and Sanz Medical Center, Laniado Hospital, Netanya, Postcode 4244916, Israel, zshimoni@laniado.org.il*

[2] *Infectious Disease Unit, Sanz Medical Center, Laniado Hospital, Netanya, Postcode 4244916, Israel tfinnfried@laniado.org.il*

[3] *Medical Laboratory, Sanz Medical Center, Laniado Hospital, Netanya, Postcode 4244916, Israel*

jlellouche@laniado.org.il

[4] *Clinical Utility Department, Sanz Medical Center, Laniado Hospital, Netanya, Postcode 4244916, Israel; And School of Public Health, University of Tel Aviv, Israel, froomp@gmail.com*

Address for Correspondence: Prof. Paul Froom MD, Clinical Utility Department, Sanz Medical Center, Laniado Hospital, Netanya, Postcode 4244916, Israel; froomp@gmail.com, Tel: 972506261353, Fax 97246243302. ORCID: 0000-0001-5126-8590

Short title: Hospital-onset Sars-Cov-2 infections

Introduction

During the Delta and Omicron waves, the risk of hospital-onset SARS-CoV-2 infections has been reported to be higher than that of previous variants[1][2][3][4] and to be diminished by using high filtration masks, improved patient segregation, and repeated testing.[1][2] For example, in the United Kingdom, the use of high filtration masks and improved segregation methods reduced hospital-onset infections from 4.0% to 2.6%.[2] However, these studies were limited by their failure to compare the risk of SARS-CoV-2 infections in hospitals with those in the general population; failure to segregate all inpatients with SARS-CoV-2 infections; and by defining hospital-onset SARS-CoV-2 infections as those occurring 5 – 8 days after admission[2][3] thereby underestimating the risk, as the median incubation periods for the Delta and Omicron variants are around 3 days.[5][6]

The objective of the present study was to avoid these limitations. We explore the risk of hospital-onset SARS-CoV-2 infections during the Delta and Omicron waves when infection rates in the general population were higher than those of previous variants and compare the rates of hospital-onset SARS-CoV-2 infections with those in the population.

Materials and Methods

Setting: The study was conducted in the emergency wards and departments of internal medicine of the Laniado Hospital, a regional 400 beds hospital in Israel during the Delta wave from August to September 2021, and the Omicron wave from January 1st to January 31st, 2022.

Interventions: Patients referred to the Emergency ward with a positive outpatient PCR or respiratory symptoms or who tested positive on rapid microfluidic immunofluorescence assay for SARS-CoV-2 Ag (LumiraDx, Alloa, UK), were isolated in a SARS-CoV-2 unit in the Emergency ward. A polymerase chain reaction (PCR) test (Xpert® Xpress SARS-CoV-2; Allplex™ 2019-nCoV Assay, Seegene Inc, Seoul, Republic of Korea) test was done and those requiring hospitalization

with a positive test were segregated in a dedicated SARS-CoV-2 ward. On the first hospital day, all the other patients had a PCR, and if positive, were also moved to the SARS-CoV-2 ward.

The staff did not wear high-filtration (N95-fitted) masks outside the SARS-CoV-2 ward and not all the staff had been vaccinated. There were up to three patients per room, with at least 1.5 meters between beds and curtains that were drawn only during morning rounds and treatments. Patients were required to wear surgical masks in the Emergency department but not after admission. During the Delta wave, visitation rights were restricted, while during the Omicron wave, patients were allowed one visitor who was required to wear a mask and use the hand sanitizer dispenser at the end of each bed.

Outcome measures: "Hospital-onset infections" were defined as those who had a negative test on admission and a positive PCR during hospitalization.

Analysis: We calculated the proportions and 95% confidence intervals of patients triaged correctly and the rates of hospital onset infections per 10,000 hospitalization days were compared to those observed in the community[7].

Ethical approval: The local Hospital Review Board (0034-20-LND) approved the study without the need for patient informed consent.

Results

Hospital onset infections per 10,000 hospital days were higher during the Omicron wave but remained lower than expected for both periods based on cumulative positive PCR testing in the general population (Table 1). Only two patients in each wave had a new infection after exposure to another patient with a positive PCR.

Table 1. Hospital onset SARS-COV-2 19 infections during the Delta and Omicron waves.

	Omicron wave n (%, 95% CI)	**Delta wave n (%, 95% CI)**
Patients hospitalized without SARS-CoV-2	1013	1486
Age, years (mean + standard deviation)	73± 17	71±18
Women (n (%)	467(46.1)	721(48.5)
Hospital onset infections		
Patients		
Cases/hospitalization days	11/15195	13/44580
Rate per 10,000 days (95% confidence limits)	7 (4-13)	3 (2-5)
Rates in the general population	56*	7.5*

*based on cumulative reported daily new cases during the study periods divided by 9 million (Israel population).https://www.worldometers.info/coronavirus/country/israel/

Discussion

The main finding of this study is that relative to the general population, the rates for in-hospital onset infections were less than 50% during the delta wave, and less than 15% during the Omicron wave, associated with patient segregation in dedicated wards without the use of high-filtration (N95) masks outside those wards or repeated PCR testing.

Our rate of 0.7 hospital onset infections per 1000 hospital days is slightly lower than the 0.87 observed in a US regional hospital system that did not segregate all infected patients during the Omicron wave.[3] The difference might be even more significant because we included all those with a new positive PCR test whereas they included only those 5 days or more after admission. It is impossible to differentiate between hospital and community-acquired infections, but perhaps with the short incubation periods of the recent SARS-CoV-2 variants[5][6] inclusion of all patients with a positive PCR after admission is preferable because of it's simplicity and inclusiveness.

The validity of the comparison of hospital-onset infections to those detected in the general population is uncertain. SARS-CoV-2 is commonly diagnosed in the general population in symptomatic persons or in those with a positive PCR after exposure to a symptomatic patient. We did not perform repeated PCR testing in the hospital and therefore, may have missed asymptomatic cases estimated to comprise about 30% of patients with Omicron variants.[8] On the other hand, because of daily close follow-up of the patients it is likely that symptomatic cases were more likely to be identified in the hospital.

It is possible that the hospital-onset infection rates would have been still lower if the hospital staff had used N95 masks in the general wards. However, the potential advantage of universal N95 over medical masks must be balanced against their higher costs, associated discomfort, and the logistic challenges.[9] Certainly, the masks might be essential if patients are not segregated[10], especially in areas where clusters are observed![1]

We conclude that the most essential component in preventing hospital acquired infections is patient segregation in dedicated wards.

Acknowledgments

No financial support and no conflicts of interest. We thank Prof. Jochanan Benbassat for his help in interpreting the data, providing critical revisions and in the drafting of the manuscript.

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