SARS-CoV-2 vaccination and risk of infectious diseases in hospitalized older patients

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Abstract

Purpose.

Vaccinations, for example flu vaccine, may be a cause of cross-reactive immunostimulation that prevents a larger spectrum of infections. However, whether SARS-CoV-2 vaccinations may also determine this effect is unclear. This study aims, first, to assess the incidence of infections at hospital admission and during the hospitalization in older inpatients vaccinated and unvaccinated against SARS-CoV-2; second, to compare length of hospital stay and in-hospital mortality between vaccinated and unvaccinated individuals.

Methods

. This retrospective study included 754 older inpatients admitted to the Geriatrics and Orthogeriatrics Units of the University Hospital of Ferrara (Italy) between March 2021 and November 2021. Sociodemographic and health-related data, and the diagnosis of infections at hospital admission and during hospitalization were collected from medical records.

Results.

The sample's mean age was 87.2 years, 59.2% were females, and 75.5% were vaccinated against SARS-CoV-2. Vaccinated individuals had a 33% lower odds of intra-hospital infections (OR = 0.67, 95%CI:0.46–0.98) and 40% lower in-hospital death (HR = 0.60, 95%CI:0.39–0.94), also after adjusting for potential confounders, while no significant results emerged about infections at hospital admission. Considering the hospitalization's endpoints, SARS-CoV-2 vaccination was associated with a lower probability of being transferred to long-term care or other hospital departments than returning home (OR = 0.63, 95%CI:0.40–0.99).

Conclusions.

In older inpatients, SARS-CoV-2 vaccination may reduce the risk of intra-hospital infectious diseases not caused by SARS-CoV-2 and all-cause in-hospital mortality. The vaccination coverage in the older population could limit not only the onset and severity of COVID-19 but also the occurrence of other infectious diseases.

Key summary points

Aim. To evaluate the incidence of infections and the in-hospital mortality rate in older inpatients vaccinated and unvaccinated against SARS-CoV-2.

Findings. SARS-CoV-2 vaccination reduced the risk of non-SARS-CoV-2 intra-hospital infections and in-hospital mortality. Cross-reactive immunostimulation may explain these findings.

Message. This research showed the importance of guaranteeing appropriate SARS-CoV-2 vaccination coverage in older population, which could limit not only the incidence and severity of COVID-19 but also the onset of other acute infectious diseases and the risk of in-hospital mortality.

Background

Acute infections are one of the leading causes of hospitalization and death in older people.[1–5] Infections acquired in healthcare settings, in particular, are associated with several adverse outcomes, and recent Italian data showed that, in the pre-pandemic period, their incidence among inpatients aged 65 years and older was around 9.1%.[6, 7]

Interestingly, a slight deflection in the intra-hospital and community-acquired infections caused by non-SARS-CoV-2 pathogens was observed in the general population in the last two years.[8, 9] Beyond the stricter prevention and control measures implemented since the pandemic started, one could argue that, as reported on influenza and pneumococcal vaccinations, also SARS-CoV-2 vaccines may play a protective role against other microorganisms. Indeed, previous studies and meta-analyses demonstrated that the influenza vaccine could significantly prevent the onset of influenza-related pneumonia and reduce the risk of hospitalization in patients over 65 years.[10–13] Similar results emerged regarding the pneumococcal vaccine, whose cross-reactivity was supported by some immunological investigations.[14–17]

In this study, we hypothesized that SARS-CoV-2 vaccination in older patients could reduce the incidence of infections leading to hospital admission and those occurring during hospitalization, even if caused by different pathogens from coronaviruses.

Therefore, the primary aim of this study was to assess the incidence of infectious diseases diagnosed at admission and during the hospital stay among older inpatients who were vs. those who were not vaccinated against SARS-CoV-2. The secondary aim was to evaluate whether having been vaccinated for SARS-CoV-2 infection might positively impact some hospitalization endpoints, such as the length of hospital stay, the discharge setting, and in-hospital mortality.

Methods

Study design and population

This is an observational retrospective study involving patients ≥ 65 years admitted to the Geriatrics and Orthogeriatrics Units of the University Hospital of Ferrara (Italy) between March 2021 and November 2021. The study protocol was approved by the local ethical committee (Independent Ethics Committee of the Area Vasta Emilia Centro, protocol number: 881/2022/Oss/AOUFe).

All the patients consecutively admitted during the study period were assessed for recruitment. Inclusion criteria were: *a)* having received two-doses SARS-CoV-2 vaccination at least three weeks before hospital admission; *b)* having received a single dose of SARS-CoV-2 vaccine because of a previous (or subsequent) SARS-CoV-2 infection, confirmed by clinical records; *c)* having not been vaccinated against SARS-CoV-2 and not reporting a previous SARS-CoV-2 infection.

Exclusion criteria were: *d)* having received two-doses SARS-CoV-2 vaccination since lesser than three weeks before hospital admission; *e)* having received only a single dose of SARS-CoV-2 vaccine with no previous (or subsequent) SARS-CoV-2 infection.

Therefore, enrolled patients were classified into two groups: vaccinated (inclusion criteria *a* or *b*) *vs* unvaccinated patients (inclusion criteria *c*).

From the 962 patients who accessed the Geriatrics and Orthogeriatrics Units of the University Hospital of Ferrara (Italy) between March 2021 and November 2021, we excluded those with exclusion criteria *d* (n = 52) and *e* (n = 156), obtaining asample of 754 patients.

Data collection

The patients' data were obtained from the hospital database system (software SAP®) and digitized clinical records (software CUP 2000®). For each patient, we collected information on socio-demographic (age, sex), pre-hospital setting (home, nursing home, long-term care, other hospital units), medical history (arterial hypertension, diabetes, cerebrovascular diseases, cardiovascular diseases, chronic lung diseases, gastrointestinal disorders, chronic kidney failure, osteoarticular and rheumatic diseases, dementia and other neurodegenerative diseases, neoplasia, and psychiatric disorders), polypharmacy (defined as the use of 5 or more chronic medications per day, before admission),[18, 19] use of immunosuppressive drugs and corticosteroids, acute illness and laboratory data at hospital admission (hemoglobin, leukocytes, neutrophils, lymphocytes, total protein, albumin, creatinine, electrolytes, C-reactive protein, procalcitonin), and some in-hospital therapies (number of antibiotics, the necessity of oxygen support). Data on SARS-CoV-2 vaccination status (type of vaccine performed, number of doses received, date of the last vaccine dose) were obtained by hospital medical records. Moreover, we recorded information from the multidimensional geriatric assessment performed routinely at ward admission, including the evaluation of functional status through the Basic Activities of Daily Living (BADL) and Instrumental Activities of Daily Living (IADL) scales, and cognitive performance using the Short Portable Mental Status Questionnaire (SPMSQ).

Study outcomes

Acute infectious diseases at hospital admission and during the hospital stay were identified from medical records and coded according to the International Classification of Diseases, 9th revision, as reported in Supplementary Table 1.

As secondary outcomes, we considered the length of hospital stay, in-hospital all-cause mortality, and discharge destination (home, long-term care [LTC], nursing home [NH], transfer to another hospital ward).

Statistical Analysis

Participants' demographic and clinical characteristics were described through mean and standard deviation or median and interquartile range (IQR) for the quantitative variables and frequency and percentage for the categorical variables. The characteristics of vaccinated and unvaccinated patients were compared by Student's t-test for quantitative variables with normal distribution, Kruskal-Wallis test for quantitative variables without normal distribution, and Chi-squared test for categorical variables.

The associations of SARS-CoV-2 vaccination status with intra-hospital infections and discharge destination were evaluated by binary and multinomial logistic regression analysis, respectively. The strength of these associations was expressed by odds ratio (OR) and 95% confidence interval (95%CI). Regarding the discharge destination, coming back to the pre-admission setting (home or NH) was considered as the reference outcome, while alternative outcomes included discharge to an LTC or other acute wards, new admission to a NH, and in-hospital death.

The association between SARS-CoV-2 vaccination status and in-hospital mortality was assessed through Cox regression analysis and expressed as hazard ratio (HR) and 95%CI after checking the proportionality hazard assumption.

The models obtained by both logistic and Cox regressions were adjusted for potential confounders in the studied associations. In particular, Model 1 was corrected for age, sex, and pre-hospital setting. Model 2 also included the number of chronic diseases, polypharmacy, chronic use of immunosuppressive or corticosteroid drugs, and BADL. Model 3 was further adjusted for specific acute illnesses diagnosed at hospital admission that could have substantially impacted the study outcomes: anaemia, falls/fractures, stroke/transient ischemic attack, and infections.

Results

As shown in Table 1, the mean age of the 754 patients was 87.2 years, 59.2% were females, and 71.8% were admitted from home. The mean number of chronic diseases was 5.2, and 78.5% of patients reported polypharmacy. Overall, the median pre-hospital BADL and IADL were 2 (IQR: 0–4) and 0 (IQR: 0–2), respectively. Of the total sample, 569 (75.5%) were vaccinated against SARS-CoV-2; of these, 96% received two doses of vaccine, 1.9% were administered a single dose of the vaccine because they had a previous or subsequent COVID-19, and 2.1% got a two-doses vaccination plus a booster dose. Most of the participants were vaccinated with a messenger RNA vaccine (73.1% Pfizer-BioNtech and 24.6% Spikevax), while the minority with a viral vector vaccine (2.1% Vaxzevria and 0.2% Janssen).

Table 1

Demographic and clinical characteristics of the study population according to SARS-CoV-2 vaccination status

	Overall (N = 754)	Unvaccinated (N = 185)	Vaccinated (N = 569)	*p*-value
Demographic characteristics				
Sex (female), n (%)	446 (59.2)	115 (62.2)	331 (58.2)	0.383
Age (years), mean (SD)	87.2 (5.6)	86.4 (6.2)	87.5 (5.4)	**0.021**
Pre-hospital setting				
Home, n (%)	541 (71.8)	133 (72.3)	408 (71.7)	**0.006**
Nursing home, n (%)	91 (12.1)	19 (10.3)	72 (12.7)	
LTC, n (%)	9 (1.2)	5 (2.7)	4 (0.7)	
Family home, n (%)	53 (7.0)	6 (3.3)	47 (8.3)	
Other hospital units, n (%)	59 (7.8)	21 (11.4)	38 (6.7)	
Cognitive and functional status				
SPMSQ, median (IQR)	6 (2–8)	6 (2–8)	6 (2–8)	0.903
BADL, median (IQR)	2 (0–4)	1 (0–2)	1 (0–4)	0.209
IADL, median (IQR)	0 (0–2)	0 (0-1.25)	0 (0–3)	0.323
Chronic diseases				
Arterial hypertension, n (%)	651 (86.3)	163 (88.1)	488 (85.8)	0.495
Diabetes, n (%)	195 (25.9)	53 (28.6)	142 (25)	0.368
Cerebrovascular diseases, n (%)	414 (54.9)	88 (47.6)	326 (57.3)	**0.026**
Cardiovascular diseases, n (%)	507 (67.2)	126 (68.1)	381 (67)	0.842
Chronic lung diseases, n (%)	173 (22.9)	40 (21.6)	133 (23.4)	0.695
Gastrointestinal diseases, n (%)	382 (50.7)	97 (52.4)	285 (50.1)	0.639
Chronic kidney failure, n (%)	277 (36.7)	71 (38.4)	206 (36.2)	0.656
Osteoarticular diseases, n (%)	337 (44.7)	88 (47.6)	249 (43.8)	0.412
Rheumatic diseases, n (%)	55 (7.3)	17 (9.2)	38 (6,7)	0.328
Dementia, n (%)	374 (49.6)	95 (51.4)	279 (49)	0.643

BADL, Basic activities of Daily Living; IADL, Instrumental Activities of Daily Living; SPMSQ, Short Portable Mental Status Questionnaire; SD, Standard Deviation. Bold values indicate p-values < 0.05.

	Overall (N = 754)	Unvaccinated (N = 185)	Vaccinated (N = 569)	*p*-value
Other neurodegenerative diseases, n (%)	86 (11.4)	19 (10.3)	67 (11.8)	0.670
Neoplasia, n (%)	275 (36.5)	66 (35.7)	209 (36.7)	0.864
Psychiatric diseases, n (%)	203 (26.9)	50 (27)	153 (26.9)	1.000
Number of chronic diseases, mean (SD)	5.21 (1.82)	5.26 (1.84)	5.20 (1.81)	0.675
Previous COVID-19 infection, n (%)	38 (5.0)	15 (8.2)	23 (4.0)	**0.043**
Chronic medications				
Medications number, mean (SD)	7.09 (2.99)	6.95 (2.9)	7.14 (3.02)	0.438
Polypharmacy (≥ 5 drugs), n (%)	591 (78.5)	147 (79.5)	444 (78.2)	0.789
Corticosteroids, n (%)	94 (12.5)	26 (14.1)	68 (12)	0.538
Immunosuppressor, n (%)	18 (2.4)	8 (4.3)	10 (1.8)	0.089

BADL, Basic activities of Daily Living; IADL, Instrumental Activities of Daily Living; SPMSQ, Short Portable Mental Status Questionnaire; SD, Standard Deviation. Bold values indicate p-values < 0.05.

Compared with unvaccinated individuals, those vaccinated were significantly older (86.4 vs 87.5 years) and more likely to come from residential facilities (21.7% vs 16.3%) and have cerebrovascular diseases (57.3% vs 47.6%) (Table 1). Considering the causes of hospital admission (Supplementary Table 2), we found that anemia, falls and fractures were presented more frequently in unvaccinated patients, and pneumonia was slightly more common in those vaccinated (22.0% vs 14.6%, p = 0.039). No differences between groups emerged for other causes of admission, and when considering the presence of any kind of infection at hospital admission (49.9% vs 49.2%, respectively, p = 0.931). About biochemical parameters (Table 2), unvaccinated patients had significantly lower serum hemoglobin, total protein, and albumin levels and higher C-reactive protein than those vaccinated. No substantial differences were observed concerning the need for oxygen support and the number of antibiotics administrated during the hospitalization.

Table 2
Hospital-related data of the study population according to SARS-CoV-2 vaccination status

	Overall (N = 754)	**Unvaccinated (N = 185)**	**Vaccinated (N = 569)**	**p-value**
Blood tests				
Hemoglobin (g/dL)	11.30 (2.35)	10.89 (2.44)	11.44 (2.31)	**0.006**
White blood cells (x10^3/mm^3)	10.8 (6.9)	10.4 (6.0)	10.9 (7.1)	0.414
Neutrophils (x10^3/mm^3)	8.2 (5.2)	8.1 (4.9)	8.3 (5.4)	0.719
Lymphocytes (x10^3/mm^3)	1.5 (2.1)	1.5 (2.4)	1.5 (1.9)	0.890
Total protein (g/dL)	6.05 (0.79)	5.89 (0.74)	6.1 (0.8)	**0.003**
Albumin (g/dL)	50.41 (7.12)	49.12 (8.77)	50.82 (6.47)	**0.011**
Creatinine (mg/dL)	1.58 (1.43)	1.64 (1.59)	1.57 (1.37)	0.522
CRP (mg/dL)	6.47 (7.61)	7.72 (8.73)	6.06 (7.17)	**0.011**
Procalcitonin (ng/mL)	7.03 (25.95)	3.23 (8.59)	8.28 (29.42)	0.092
In-hospital therapy				
Oxygen therapy, n (%)	276 (36.6)	67 (36.2)	209 (36.7)	0.969
Antibiotics	0.88 (0.93)	0.91 (0.99)	0.87 (0.91)	0.595

Notes: all reported variables except “Oxygen therapy” are expressed as mean (SD)

Abbreviations: CRP, C-Reactive Protein; SD: Standard Deviation. Bold values indicate p-values <0.05.

While there were no differences in the frequency of vaccinated and unvaccinated patients presenting with infections at hospital admission, the incidence of intra-hospital infectious diseases was significantly lower in the former group (33.2% vs 45.4%, p = 0.004). In particular, as shown in Fig. 1, during the hospitalization vaccinated individuals reported less frequently respiratory tract infections and gastroduodenitis (5.1% vs 10.8%, p = 0.010 and 2.5% vs 9.7%. p < 0.001, respectively). Similar results were found considering only patients with acute infections on admission (n = 375). The cumulative incidence of intra-hospital infectious diseases in this subsample was lower in vaccinated than unvaccinated patients (32.3% vs 61.5%, p = 0.002), especially as concerns infectious gastroduodenitis (3.5% vs 13.2%, p = 0.002) and urinary tract infections (19.7% vs 29.7%, p = 0.065).

These results were confirmed in the logistic regression after adjusting for potential confounders (Table 3). A total of 375 (49.7%) of the patients were admitted for acute infectious diseases, and 274 (36.3%) developed an intra-hospital infection during the hospital stay. Indeed, SARS-CoV-2 vaccination resulted

independently associated with a 41% lower risk of developing intra-hospital infections (OR = 0.59, 95%CI: 0.41–0.85, p = 0.005). This association was further confirmed, albeit slightly attenuated, correcting for the main causes (infectious and non-infectious) of hospitalization (OR = 0.67, 95%CI: 0.46–0.98, p = 0.041).

Table 3
Logistic regression for the association between SARS-CoV-2 vaccination and intra-hospital infections

	OR (95%CI) of intra-hospital infections ***p*-value**		
	Model 1	**Model 2**	**Model 3**
SARS-CoV-2 vaccination (vs non-vaccination)	0.59 (0.42–0.84) *p* = 0.003	0.59 (0.41–0.85) *p* = 0.005	0.67 (0.46–0.98) *p* = 0.038

Model 1 is adjusted for age, sex, and pre-admission setting; Model 2 is also adjusted for the number of chronic diseases, polypharmacy, use of corticosteroid or immunosuppressant drugs, and BADL; Model 3 includes the variables in Model 2 and also the presence of acute cerebrovascular diseases, falls/fractures, anemia and infections at hospital admission. *Abbreviations*: BADL, Basic Activities of Daily Living; OR, Odds Ratio; 95% CI, 95% Confidence Intervals.

During the hospital stay, 114 (15.1%) patients died, and higher mortality was observed among the unvaccinated than the vaccinated ones (24.3% vs 12.1%, p < 0.001). At the fully-adjusted Cox regression (Table 4), SARS-CoV-2 vaccination significantly reduced the likelihood of in-hospital death by 40% (HR = 0.60, 95%CI: 0.39–0.94, p = 0.041).

Table 4
Cox regression for the association between SARS-CoV-2 vaccination and in-hospital mortality

	HR (95%CI) of in-hospital mortality ***p*-value**		
	Model 1	**Model 2**	**Model 3**
SARS-CoV-2 vaccination (ref: non-vaccination)	0.64 (0.43–0.96) *p* = 0.029	0.63 (0.41–0.97) *p* = 0.036	0.60 (0.39–0.93) *p* = 0.024

Model 1 is adjusted for age, sex, and pre-admission setting; Model 2 is also adjusted for the number of chronic diseases, polypharmacy, use of corticosteroid or immunosuppressant drugs, and BADL; Model 3 includes the variables in Model 2 and also the presence of acute cerebrovascular diseases, falls/fractures, anemia and infections at hospital admission. *Abbreviations*: BADL, Basic Activities of Daily Living; HR, Hazard Ratio; 95% CI, 95% Confidence Intervals.

Regarding the length of hospital stay, unvaccinated individuals reported an almost 2-day longer hospitalization than the vaccinated ones (12.5 [SD 10.4] vs 10.9 [SD 7.3] days, p = 0.017). Moreover, they

were less likely to return to their pre-admission setting at discharge (41.1% vs 52.9% vs p = 0.007) but tended to be transferred more frequently to LTC or other hospital wards (23.8% vs 19.2%, p = 0.205). In the logistic regression (Supplementary Table 3), SARS-CoV-2 vaccination was associated with a lower probability of being transferred to LTC or other hospital departments (OR = 0.63, 95%CI: 0.40–0.99, p = 0.043), but the results were attenuated after adjustment for the cause of hospitalization (OR = 0.64, 95% CI: 0.41–1.02, p = 0.059). No significant associations emerged on the new transfer to a NH.

Discussion

Our study showed that older inpatients vaccinated against SARS-CoV-2 were less likely to develop infectious diseases and die during the hospital stay than those not vaccinated. Moreover, vaccinated patients had, on average, a shorter hospital stay compared with their unvaccinated counterparts.

The frequency of acute infections at hospital admission and during hospitalization in our sample was noteworthy, affecting 49% and 36% of patients, respectively. These data align with the current literature, which reports that infections caused 48% of hospital admissions in older people[20] and occurred in around 40% of older inpatients during hospitalization.[21]

When looking at the likelihood of developing an infection during the hospital stay, we found that SARS-CoV-2 vaccinated patients had a 33% lower risk than the unvaccinated ones. A possible explanation of this result may be that vaccinated patients had a better health status at hospital admission, making them less vulnerable to intra-hospital infections. Accordingly, comparing clinical data at hospital admission, vaccinated participants had higher hemoglobin, total protein, and albumin levels than unvaccinated. However, no significant differences emerged in other laboratory parameters or the type and number of comorbidities, except for cerebrovascular diseases (more frequent in vaccinated participants). Furthermore, vaccinated patients were older than the unvaccinated ones; therefore, they may have presented a greater impairment in the immune response linked to immunosenescence.[22, 23] In addition to the above considerations, when adjusting the association for the potential confounders, the reduction in the risk of intra-hospital infections among vaccinated patients was only slightly attenuated and consistent with the main analysis. Although residual confounding cannot be ruled out, these findings suggest that SARS-CoV-2 vaccination may protect against other infectious diseases. This effect could be related to the development of a cross-reactive antibody response against different pathogens beyond SARS-CoV-2, or a general stimulation of the immune response. Such an issue has already been demonstrated for other vaccines recommended to the older population. For instance, through these mechanisms, the influenza vaccine can also prevent influenza-related pneumonia,[11–13] and the pneumococcal vaccine protects from pneumonia caused by serotypes of *Streptococcus pneumoniae*[16, 17] that are not the specific targets of the vaccine. As concerns the SARS-CoV-2 vaccines, previous studies suggest that they lead to produce cross-reactive antibodies against other common human coronaviruses.[24–26] Moreover, as previously mentioned, the protective effect of SARS-CoV-2 against a larger spectrum of infectious diseases may involve an immunostimulatory effect both on the innate and acquired responses.[27–29] Indeed, previous research underlined that some components of SARS-CoV-2

mRNA vaccines could act as adjuvants and boost immunity. In particular, recent studies by Alameh et. al and Kobiyama et al, suggest an intrinsic adjuvant activity of the lipid nanoparticle (LNP)-encapsulated nucleoside-modified in mRNA vaccines, that stimulates the immune response.[30, 31] Interestingly, in our sample, we did not find any difference between vaccinated and unvaccinated patients regarding the overall frequency of infectious diseases at hospital admission. When focusing on the specific infections at hospital admission, however, a slightly increased prevalence of pneumonia emerged among the vaccinated patients. This issue is not of clear explanation; one hypothesis is that unvaccinated patients may could be less prone to access hospital in case of respiratory infections of mild or medium severity. Conversely, the lower odds of intra-hospital infections among vaccinated patients supports the hypothesis that SARS-CoV-2 vaccination might be more protective in conditions of greater vulnerability, such as during hospitalization with other ongoing acute illnesses. Another possible explanation is that the cross-reactivity of SARS-CoV-2 vaccines may be mainly directed to pathogens causing intra-hospital rather than community-acquired infections. In this regard, exploring which specific microorganisms may be hit by cross-reactive antibodies induced by SARS-CoV-2 vaccines in future investigations would be interesting.

Likely because of the above-described effects and immunostimulation, older inpatients who got the vaccination against SARS-CoV-2 reported better hospitalization-related outcomes, including shorter hospital stay and lower in-hospital mortality, even when analyses were adjusted for potential confounders. Moreover, in the same way, vaccinated older adults showed a lower probability of being transferred to another ward or LTC rather than returning to their pre-admission setting, supporting the positive influence of vaccination on the patient's prognosis.[32, 33]

Limitations of our study include the lack of available data about the specific microorganisms causing the infections detected at hospital admission or during the hospital stay. Furthermore, the incidence of non-infectious in-hospital complications, which could have influenced the patient's prognosis, was not investigated. However, we believe that having collected extensive data about health, functional and cognitive status, and the need for oxygen supplementation during the hospitalization, allowed us to capture the patients' vulnerability and prognosis. Moreover, the negligible frequency of patients who got a viral vector vaccine did not allow us to perform appropriate subgroup analyses by type of vaccine administered. Finally, as in all observational studies, we may not have completely controlled the confounding effects of other variables in the tested associations. However, the inclusion of several possible confounders in the analyses supports our results.

Conversely, the strengths of our study concern the large sample size and the wide set of information collected for each patient. Furthermore, the real-world setting of our study allows us to generalize the observed results to the general older population. Lastly, we investigated an issue novel and of current interest, contributing to the available scientific literature.

In conclusion, our study suggests that SARS-CoV-2 vaccination in older hospitalized patients reduces the risk of intra-hospital infections, even caused by non-SARS-CoV-2 microorganisms, and in-hospital

mortality. These findings highlight the importance of guaranteeing appropriate vaccination coverage in older population, which could limit not only the incidence and severity of COVID-19 but also the onset of other infectious diseases.

Declarations

Conflict of Interest. The authors declare no conflict of interest.

Ethical approval. The study protocol was approved by the local ethical committee (Independent Ethics Committee of the Area Vasta Emilia Centro, protocol number: 881/2022/Oss/AOUFe).

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Author Contributions: Study conceptualization and design: MB, EL, MGB, EF, SS, GB, FS, IM, FR, SM, SV, and CT; acquisition of subjects and/or data: MB, EL, MGB, EF, SS, GB, IM; analysis and interpretation of data: FR, and CT; writing - original draft preparation: MB, EL, MGB, EF, SS, GB, FS, IM, FR, and CT; writing - review and editing: FS, FR, SM, SV, and CT.

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Figures

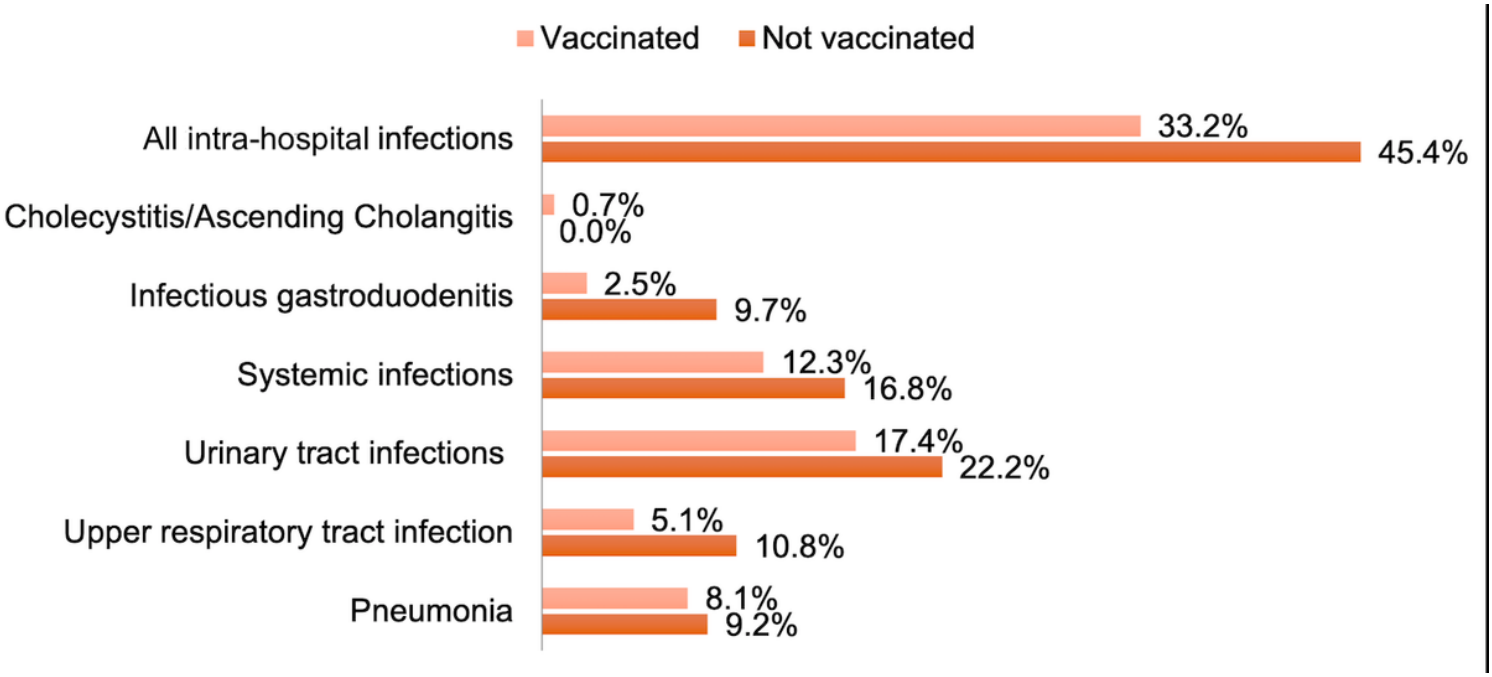

Figure 1

Cumulative incidence of intra-hospital infections in vaccinated and unvaccinated patients.

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