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Can influenza vaccination coverage among healthcare workers influence the risk of nosocomial influenza-like illness in hospitalized patients?

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SUMMARY

Background: Approximately 20% of healthcare workers are infected with influenza each year, causing nosocomial outbreaks and staff shortages. Despite influenza vaccination of healthcare workers representing the most effective preventive strategy, coverage remains low.

Aim: To analyse the risk of nosocomial influenza-like illness (NILI) among patients admitted to an acute care hospital in relation to influenza vaccination coverage among healthcare workers.

Methods: Data collected over seven consecutive influenza seasons (2005–2012) in an Italian acute care hospital were analysed retrospectively. Three different sources of data were used: hospital discharge records; influenza vaccination coverage among healthcare workers; and incidence of ILI in the general population. Clinical modification codes from the International Classification of Diseases, 9th Revision were used to define NILI.

Findings: Overall, 62,343 hospitalized patients were included in the study, 185 (0.03%) of whom were identified as NILI cases. Over the study period, influenza vaccination coverage among healthcare workers decreased from 13.2% to 3.1% ($P < 0.001$), whereas the frequency of NILI in hospitalized patients increased from 1.1‰ to 5.7‰ ($P < 0.001$). A significant inverse association was observed between influenza vaccination coverage among healthcare workers and rate of NILI among patients (adjusted odds ratio 0.97, 95% confidence interval 0.94–0.99).

Conclusion: Increasing influenza vaccination coverage among healthcare workers could reduce the risk of NILI in patients hospitalized in acute hospitals. This study offers a reliable and cost-saving methodology that could help hospital management to assess and make known the benefits of influenza vaccination among healthcare workers.

Introduction

The control of nosocomial infections in hospitals represents a major objective for healthcare organizations in terms of risk management to ensure patient safety and limit the cost of hospitalization.[1] Several studies have reported that influenza infections in healthcare workers may lead to nosocomial outbreaks[2,3] and staff shortages with associated disruption of

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services.[4] Nosocomial influenza is recognized as an emerging issue, especially among immunocompromised patients and those in intensive care units, in terms of morbidity, mortality and associated costs.[5]

Hospitalized patients may acquire influenza from other patients, visitors or hospital employees. It is estimated that approximately 20% of healthcare workers are infected with influenza each season,[6] and many of them continue working while infected, thus favouring the spread of influenza. In this context, the administration of influenza vaccine to high-risk patients and medical personnel represents the most effective method for preventing nosocomial influenza transmission,[7,8] and it may also help to reduce mortality and influenza-like illness (ILI) among elderly subjects.[9,10]

Given these benefits, influenza vaccination of healthcare workers is strongly recommended by many international public health agencies and governments worldwide.[11,12] In this sense, several strategies, both voluntary and compulsory, have been proposed to increase influenza vaccination uptake among healthcare workers.[13] Despite these public health efforts to increase vaccine uptake among healthcare workers, overall immunization rates remain low and various barriers to influenza vaccination have been identified.[14–16] In particular, several authors have reported that healthcare workers remain sceptical about the potential benefits of vaccination and the effectiveness of vaccine strategies.[17]

More evidence-based knowledge on this topic could play a major role in increasing compliance with influenza vaccination among healthcare workers. The present study was designed to analyse the risk of nosocomial influenza-like illness (NILI) among patients admitted to an acute care hospital in relation to several risk factors, including vaccination coverage rates among healthcare workers.

Methods

This cross-sectional retrospective study analysed data recorded over seven consecutive influenza seasons (2005–2006 to 2011–2012) at the University Hospital 'P. Giaccone' of Palermo, Italy, a large teaching hospital with more than 600 beds and 63 wards (predominantly medical and surgical specialties).

According to the Italian sentinel surveillance system for influenza (INFLUNET), an influenza season was defined as the period from the 42nd week of a given year to the 17th week of the following year.[18] Data from several European surveillance systems confirm that these dates correspond precisely with the intervals between the first and last cases of influenza in the community.[19]

Three different data sources were used in this study: hospital discharge records; influenza vaccination coverage among healthcare workers; and incidence of ILI (*N*/1000/year) in the general Sicilian population aged 15–64 years.

In Italy, hospital discharge records are an integral part of a patient's medical record and contain all relevant patient information from admission to discharge. In this study, sociodemographic and clinical characteristics of each patient were collected from hospital discharge records, including sex, age, duration and cost of hospitalization, and primary and secondary discharge diagnoses coded with the clinical modification codes of the International Classification of Diseases, 9th Revision (ICD-9-CM codes). Figure 1 shows the ICD-9-CM codes used to define NILI.[20]

As this study was designed to evaluate influenza infections acquired as a result of hospital stay during the influenza season, the following inclusion criteria were adopted: ordinary hospital regimen; hospitalization during the influenza season (from Week 42 of a given year to Week 17 of the following year); and hospital stay of more than two days. Moreover, patients with a principal diagnostic code suggestive of community-acquired ILI (see Figure 1) were excluded from the study.

Furthermore, the hospital discharge records were used to evaluate the presence of comorbidities using the primary diagnosis at hospital admission.

Data on influenza vaccination coverage of healthcare workers was obtained from the hospital management. Each year, influenza vaccination is offered, free of charge, to healthcare workers. In this study, healthcare workers were defined as full-time or part-time employees who worked at the University Hospital 'P. Giaccone', Palermo for at least one full influenza season during the study period and who provided direct patient care. According to the inclusion criteria, healthcare workers with minimal patient contact, laboratory personnel, clerical staff, gardening staff, catering workers and other occupational groups that have no greater exposure to infectious diseases than the general public were excluded from the study. Moreover, housekeeping services are outsourced to a private provider at the study hospital; as no information was available about these workers, they were excluded from the analyses.

As such, 1494 healthcare workers were included in the analysis, including physicians ($N = 603$, 40.4%), nurses ($N = 846$, 56.6%) and other health professionals (mainly therapists and dieticians) ($N = 45$, 3.0%). The vaccination status of each healthcare worker, according to influenza season and ward, was included in this study. For the 2009–2010 influenza season, influenza vaccination coverage was calculated as the proportion of healthcare workers who received at least one dose of seasonal or pandemic influenza vaccine.

Data on the incidence of ILI (*N*/1000/year) in the general Sicilian population aged 15–64 years were obtained from INFLUNET, co-ordinated by the National Health Institute (Istituto Superiore di Sanità, Rome)[21] and reported weekly by volunteer physicians who monitor a representative sample of at least 2% of the general population. The community incidence rate was documented to adjust for its potential impact on NILI.

Finally, the spread of nosocomial influenza was evaluated by calculating the frequency of NILI in hospitalized patients from each hospital ward across influenza seasons. A binomial variable (presence of at least one case of ILI vs no cases of ILI) was created arbitrarily and used as a predictor of increased risk of patient-to-patient influenza transmission.

Statistical analysis

All data were analysed using R statistical software. For all analyses, a *P*-value of 0.05 was assumed to indicate significance (two-tailed). Absolute and relative frequencies have been reported for qualitative variables, and medians (interquartile ranges) have been reported for quantitative, non-normally distributed variables. Normal distribution was verified by Shapiro–Wilk's test for normality, and median data were