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Major Article

Outbreaks of health care–associated influenza-like illness in France: Impact of electronic notification

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Background: Mandatory notification of health care–associated (HA) infections, including influenza-like illness (ILI) outbreaks, has been implemented in France since 2001. In 2012, the system moved to online electronic notification of HA infections (e-SIN). The objectives of this study are to describe ILI outbreak notifications to *Santé publique France* (SPF), the French national public health agency, and to evaluate the impact of notification dematerialization.

Methods: All notifications of HA ILI outbreaks between July 2001 and June 2015 were included. Notifications before and after e-SIN implementation were compared regarding notification delay and information exhaustiveness.

Results: Overall, 506 HA ILI outbreaks were reported, accounting for 7,861 patients and health care professionals. Median delay between occurrence of the first case and notification was, respectively, 32 and 13 days before and after e-SIN utilization ($P < .001$). Information exhaustiveness was improved by electronic notification regarding HA status (8.5% of missing data before and 2.3% after e-SIN, $P = .003$), hypotheses of cause (25.4% of missing data before vs 8.0% after e-SIN, $P < .001$), and level of event control (23.7% of missing data before vs 7.5% after e-SIN, $P < .001$).

Conclusions: HA influenza notifications, including HA ILI or influenza, to health authorities are essential to guide decisional instances and health care practices. Electronic notifications have improved the timeliness and quality of information transmitted.

BACKGROUND

Health care–associated (HA) influenza or HA influenza-like illness (ILI) outbreaks occur frequently in health care facilities, with attack rates ranging from 11%-59%, and associated mortality rates ranging from 2%-66%.[1] The outbreaks increase hospital costs via prolonged hospital stay, inappropriate antibiotic use, additional diagnostic tests, and therapeutic interventions among affected patients, with absenteeism of health care professionals (HCPs).[2,3] HA influenza prevention combines vaccination of at-risk persons and HCP, complemented by appropriate infection control measures, such as isolation of infected patients, hand hygiene, and the use of face masks. Because most outbreaks of HA infections are potentially preventable, early outbreak detection and control should decrease mortality, morbidity, and costs related to HA influenza.[4] HA ILI risk has been linked to community ILI rates, with risk heterogeneity depending on medical specialty and year.[5] In nursing homes, lower respiratory tract infection outbreaks are concomitant with community influenza epidemics.[6]

In 2001, French health authorities introduced mandatory notification of some HA infections for all health care facilities to *Santé*

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publique France (SPF), the French national public health agency (www.santepubliquefrance.fr), through regional health agencies (*Agences Régionales de Santé*) and coordinating centers for HA infection prevention and control (*Centre de Coordination de la lutte contre les Infections Nosocomiales*). The aim is to ensure early detection of serious or recurrent infectious risk situations in health care facilities to implement, as soon as possible, prevention and control measures locally, regionally, nationally, and internationally, if need be.[7] The process enables health care facilities to benefit from *Centre de Coordination de la lutte contre les Infections Nosocomiales* expertise, their regional offices, and SPF, if need be. Based on defined notification criteria, HA influenza or ILI clusters should be notified.[8] Initially, paper forms were sent by fax, but external system for electronic notification of HA infections (e-SIN, Signalement des infections nosocomiales) has been implemented since January 2012. Notification modalities (criteria, form, data, and circuitry) remain the same. Information is hosted in a unique, shared, and secure database.

Correlation between incidence in the community and notification efficiency has been observed with other infectious diseases (eg, measles, pertussis), with a facilitating effect on notification by the presence of large numbers of cases in the community and higher notification rates during epidemic than during nonepidemic years.[9] Therefore, for influenza, a larger number of notifications would be expected during seasons with important outbreaks compared with seasons with modest outbreaks.

The principal objective of this study is to describe the notification of ILI clusters. The secondary objectives are to assess the impact of e-SIN setup on notification reactivity and information exhaustiveness and to correlate notifications with ILI community incidence.

MATERIALS AND METHODS

All notifications of HA influenza or ILI clusters reported between July 2001 and June 2015 to SPF by French health care facilities were included. Notifications with influenza virus identified by microorganism code, and notifications with influenza or flu in text data were selected. Clusters of influenza or ILI were defined as episodes with at least 2 cases declared at notification time. The characteristics of declaring health care facilities, the reason(s) for notification, and the episode description (eg, number of cases and deaths at notification time, time period, type of infection or colonization, microorganism in cause, anatomic site infected or colonized, units involved, population involved [patient or HCP], HA nature of the infection [certain, probable, or possible HA], investigations, implemented and planned control measures, at notification time and to plan, the need for external expertise) were gathered during notification. Influenza season was defined as the period between October 1 and April 30, except for the 2009-2010, season which was delineated as May 1, 2009-April 30, 2010.

Episodes with at least 1 confirmed influenza case were analyzed separately from those of ILI without confirmed influenza. Confirmed influenza cases were defined as cases with information on influenza type (A or B). Notifications made 4 years before (2007-2008 to 2010-2011 influenza seasons) and 4 years after (2011-2012 to 2014-2015 influenza seasons) the implementation of e-SIN were compared for reactivity (delay between the first case and notification) and information exhaustiveness, defined by the percentage of missing data. Data on ILI community incidence were based on the French Sentinel Network of voluntary general practitioners, who collect epidemiologic and virologic data online[10,11] (www.sentiweb.fr). No individual data were recorded.

Continuous variables were described as median and interquartile range (IQR) and compared by the Mann-Whitney *U* test. Categorical variables were described as number and percentage, and compared by Fisher exact test or the χ^2 test. $P < .05$ was considered significant. All tests were bilateral.

RESULTS

Between 2001 and 2015, 506 episodes of HA influenza or ILI clusters had been notified (Table 1). Notifications were mostly generated by general hospitals (50%), university or regional hospitals (19%), and local hospitals (10%). Notifications were mostly generated by general hospitals (50%), university or regional hospitals (19%), and local hospitals (10%); regarding type of unit they came mostly from nursing homes (24%), medical units (20%), rehabilitation (18%), and long term care units (18%). Eight episodes occurred outside an influenza season, with 1 episode of confirmed influenza in pediatric rehabilitation. At least 1 virologically confirmed case of influenza was identified in 297 episodes (59%). Another respiratory virus was detected in 4 episodes (1%), and no virus was identified in 205 epi-

Table 1
Characteristics of influenza and influenza-like illness clusters in health care facilities notified to *Santé publique France*, France, 2001-2015

Characteristic	Total (N = 506)	Episodes with at least 1 confirmed influenza case (n = 297)	Episodes without confirmed influenza case (n = 209)
No. of cases at notification time	7,861	4,313	3,547
Median no. of cases per episode (IQR)	11 (6-19)	10 (5-18)	13 (8-23)
No. of presumed related deaths	158	93	65
Mortality rate (per 100 cases)	2.0	2.2	1.8
Median time between first and last case, d (IQR)	6 (4-11)	6 (3-10)	7 (4-11)
Median time between first case and notification, d (IQR)	15 (7-34)	14 (7-32)	17 (9-35)
Median time between last case and notification, d (IQR)	7 (1-23)	6 (1-23)	8 (1-24)
Population affected*			
Patients	98 (379/388)	98 (216/220)	97 (163/168)
Health care professionals	61 (237/388)	61 (138/220)	61 (102/168)
Measures taken at notification time	96 (441/457)	98 (264/270)	95 (177/187)
Barrier measures	91 (223/245)	89 (136/153)	95 (87/92)
Vaccination (awareness)	14 (34/245)	15 (23/153)	12 (11/92)
Antiviral treatment	31 (77/245)	39 (59/153)	20 (18/92)
Hypotheses of cause	82 (364/445)	84 (221/264)	79 (143/181)
Need for external expertise	3 (15/462)	5 (13/271)	1 (2/191)
Event controlled or in the process of being controlled	95 (427/449)	93 (248/266)	98 (179/183)

NOTE. Values are % (number of patients/total respondents) or as otherwise indicated.
IQR, interquartile range.
*Data available since 2012.