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Measuring influenza immunization coverage among health care workers in acute care hospitals and continuing care organizations in Canada

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Key words:

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Background: Immunizing health care workers against influenza is important for preventing and reducing disease transmission in health care environments. We describe the ability of Canadian health care organizations to measure influenza immunization coverage among health care workers and identify factors associated with comprehensive influenza immunization measurement.

Methods: A Web-based survey was distributed to influenza immunization campaign planners responsible for delivering the 2010-2011 influenza vaccine to health care workers working in acute care hospitals or long-term continuing care organizations. The primary outcome was the ability to comprehensively measure influenza immunization coverage.

Results: Of the 1,127 health care organizations approached, 721 (64%) responded. Ninety-one percent had incomplete immunization coverage measurement; 7% could not measure coverage among any personnel. After multivariable adjustment, organizations with a written influenza immunization implementation plan (odds ratio, 2.0; 95% confidence interval, 1.1-3.5) or a policy or procedure describing how to calculate or report immunization rates (odds ratio, 2.1; 95% confidence interval, 1.2-3.9) were more likely to have comprehensive measurement of influenza immunization coverage than organizations without these practices.

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Conclusion: Most organizations demonstrated incomplete measurement of influenza immunization among health care workers. Given the use of influenza immunization coverage as a measure of quality of care, further work is needed to develop a standardized approach to improve its measurement.

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INTRODUCTION

Many health care and public health organizations in Canada and the United States have recently introduced measures to encourage public reporting of influenza immunization coverage of health care workers.¹⁻⁸ The US Healthcare Infection Control Practices Advisory Committee and the Advisory Committee on Immunization Practices released evidence-based recommendations for professionals responsible for influenza immunization and infection control programs.⁹ Two recommendations emphasized the importance of providing feedback on immunization rates and of using immunization coverage as a quality of care measure. However, identifying who has been immunized, who is currently employed within an organization, and which nonemployee groups (eg, volunteers) should be included is challenging. Including different health care workers in numerators (ie, number of health care workers immunized) or denominators (ie, number of health care workers who could be immunized) causes inconsistent coverage estimates.¹⁰ This is further compounded by variability in immunization information accuracy and completeness. Without understanding how immunization coverage is measured, the comprehensiveness of the data, and the limitations associated with these indicators, it is difficult to draw valid conclusions for policies and recommendations and to use coverage as a quality indicator.

The objectives of our study were to describe the ability of Canadian health care organizations to measure influenza immunization coverage of health care workers and to identify factors associated with comprehensive coverage measurement.

METHODS

Sampling strategy

We identified individuals responsible for influenza immunization of health care workers at acute care hospitals (ACH) or continuing care (CC) organizations (eg, assisted living facilities, personal care homes, nursing homes, and long-term care organizations) through consultation with provincial/regional governments and regional infection control networks, postings in bulletins, E-mail lists, Web site advertisements, and calls to organizations identified on provincial Web sites and lists of hospitals accredited by Accreditation Canada. We surveyed the person(s) responsible for coordinating the health care workers immunization campaign, a role undertaken by public health authorities in some jurisdictions. Individuals responsible for campaigns at more than 1 health care facility under the same organization were asked to complete 1 survey for multiple facilities only if the same policies, plans, and procedures applied to all of the facilities for which they were responsible. These organizations were defined as "multiple facilities." Organizations that had both ACH and CC beds were classified as "mixed." We excluded organizations without acute care or continuing care beds (eg, walk-in clinics). In addition, Nunavut, Northwest Territories, and the Yukon were excluded because they did not have health care workers-specific immunization campaigns.

Questionnaire

The questionnaire was developed based on a literature review and research conducted by the Canadian Healthcare Influenza Immunization Network (www.chiin.ca) according to established guidelines¹¹ to identify information gaps in health care worker influenza immunization and immunization program delivery.^{12,13} The questionnaire covered demographics, campaign team/planning/tools, recording and reporting of immunizations, policies and procedures, and evaluation activities. Our analysis focused on factors that we hypothesized to be related to comprehensive measurement of immunization coverage:

- Type of system used for tracking immunizations (paper, electronic, hybrid of both, or none);
- Having immunization reporting practices;
- Having policies or procedures to support immunization data collection and reporting (eg, declination forms and immunization documentation);
- Having a mandatory influenza immunization policy;
- Having an influenza immunization program implementation plan;
- Having an interprofessional team involved in planning the campaign (ie, ≥ 5 different types of personnel, including those involved with occupational health and safety, infection prevention and control, communications, information technology, pharmacy, administration, senior management, and union);
- Evaluating the methods used to count and report immunization; and
- Prioritizing vaccine delivery to certain risk groups.

We pilot-tested the questionnaire in 3 rounds with 12 respondents (directors of care, occupational and infection control managers, and public health immunization planners).

Survey implementation

To optimize response and minimize recall bias, we mailed pre-notice letters with \$5 coffee gift cards to respondents in April and May 2011, following completion of the 2010-2011 influenza immunization campaign. One week after mailing pre-notice letters, we sent an online survey to respondents, followed by 3 e-mail reminders at intervals of 1 to 3 weeks, and a final telephone reminder to participants who had not responded after the third email.

Outcome measure

The primary outcome was the ability to measure influenza immunization coverage in all health care workers within an organization. Health care workers referred to individuals working in the organization, regardless of patient contact or employment status (eg, paid staff, volunteers, students, trainees, physicians, and contractors). Contractors were workers paid by an external organization. Respondents were asked if they measured the number of

personnel who were immunized (numerator) during the 2010–2011 campaign, and if they knew the total number of health care workers (denominator) in their organization during the campaign from the following groups: payroll personnel (eg, nurses), casual personnel (ie, employed on a temporary basis), nonpayroll physicians, nonpayroll personnel, students or trainees, personnel on extended leave, and volunteers. These groups were not mutually exclusive. Organizations were considered to have comprehensive measurement of coverage if they measured the numerator and denominator across all applicable groups.

Potential confounders included organization size (large or small), number of facilities under the same organization (single facility or multiple facilities) and type of organization ACH [ie, had no continuing care beds], CC [ie, had no acute care beds], or mixed [ie, had both continuing care and acute care beds]. Large organizations were defined as having ≥ 100 beds in a single facility. Organizations representing more than one facility were also classified as “large.” All acute care hospitals in Canada are private not-for-profit organizations that are publicly funded. CC organizations could be public, private not-for-profit, or private for-profit organizations, and public funding of these organizations varied across provinces. Due to these complexities, ownership was excluded from the analysis.

ANALYSIS

We calculated the proportion of organizations that could measure coverage for all applicable health care worker groups, stratified by organization type. Logistic regression models were fitted to identify variables associated with comprehensive coverage measurement. We examined univariate models for each factor to identify those that were statistically significantly associated with the outcome. Only variables that had a P value $< .25$ were included in the multivariable model, which controlled for organization size, type, and number of facilities. Variables were excluded from the model if they led to complete separation of data, had $> 10\%$ missing data, or had no observations in a group. We measured the variance inflation factor for each factor in the multivariable model. We plotted the deviance, Pearson residuals, and Pregibon leverage against the predicted probabilities to assess whether the results were affected by influential observations. Data analysis was performed using STATA version 10.0. (2007, StataCorp, LP, College Station, TX).

ETHICS

This study received ethics approval from the Research Ethics Boards of the University of Toronto, Capital Health in Halifax, and Bruyère Continuing Care in Ottawa.

RESULTS

Of the 1,127 immunization planners approached, 721 (64%) responded. Fifty-two (4.6%) were excluded because their questionnaires were missing data on immunization coverage measurements, number of beds, and type of organization (ACH vs CC), or they did not meet our inclusion criterion.

The final sample of 669 respondents represented 462 single facilities (52 ACHs, 391 CC organizations, and 19 mixed), and 207 multiple facilities (16 ACH, 55 CC, and 136 mixed). Most respondents (589 [88%]) were occupational safety personnel, infection control representatives, or senior administrators. For single facilities, the median number of beds was 152 for ACHs, 100 for CC organizations, and 77 for mixed organizations.

Table 1

Percentage of respondents who reported an ability to measure coverage for each health care worker group by type of organization

Type of health care worker	No. of respondents (%)			
	ACH (n = 68)	CC (n = 446)	Mixed (n = 155)	Overall (n = 669)
Payroll personnel	64 (94)	410 (92)	140 (90)	614 (92)
Casual personnel	49 (72)	342 (77)	108 (70)	499 (75)
Volunteers	38 (56)	183 (41)	58 (37)	279 (42)
Students or trainees	23 (34)	132 (30)	36 (23)	191 (29)
Nonpayroll physicians	38 (56)	69 (15)	65 (42)	172 (26)
Nonpayroll personnel	19 (28)	116 (26)	22 (14)	157 (23)
Personnel on extended leave	14 (21)	87 (20)	38 (25)	139 (21)

ACH, respondents from acute care hospitals; CC, respondents from continuing care organizations.

Coverage measurement

Most respondents measured coverage among personnel on payroll (n = 614 [92%]) and casual personnel (n = 499 [75%]) (Table 1). Fewer than 50% measured coverage among volunteers, students and trainees, nonpayroll physicians, nonpayroll personnel, and personnel on extended leave. Across most health care workers (except casual and nonpayroll personnel), respondents from ACHs measured coverage more comprehensively than those from CC organizations. For example, 38 (56%) respondents from ACHs, but only 69 (15%) respondents from CC organizations measured coverage in nonpayroll physicians. A higher proportion of ACHs than CC organizations were able to measure coverage for their volunteers (ACH = 38 [56%], CC = 183 [41%]).

Sixty-three organizations (ACH = 7 [11%], CC = 47 [11%], mixed = 9 [6%]) reported that they could measure coverage across their entire health care worker population. Of these organizations, only 18 (29%) organizations had all seven health care worker groups in their setting. Forty-five organizations (ACH = 4 [6%], CC = 27 [6%], mixed = 14 [9%]) could not measure coverage in any groups.

Influenza immunization program practices and policies

During the 2010–2011 influenza season, 45% of respondents reported having a written implementation plan for their immunization campaign, and 279 of 669 (42%) worked with an inter-professional team to implement the campaign (Table 2). Four hundred seventy-eight of 669 (71%) respondents reported payroll personnel coverage to senior management, whereas 334 of 669 (50%) reported this for nonpayroll personnel. Most organizations collected data on payroll personnel who declined immunization (n = 447 [67%]), although few collected the same information for nonpayroll personnel (n = 131 [20%]).

Only 20% of organizations (134/669) reported having mandatory immunization policies; of these, most were used in continuing care organizations (ACH = 1 [1%], CC = 117 [26%], mixed = 16 [10%]). Approximately 32% of organizations (212/669) had a documented policy or procedure for personnel who declined immunization (declination process) (ACH = 13 [19%], CC = 168 [38%], mixed = 31 [20%]). Organizations that could comprehensively measure coverage were significantly more likely to have an immunization implementation plan, prioritize vaccine delivery to certain groups, collect information on declinations, and describe the method used to calculate or report immunization rates in their policies or procedures (Table 2).

In the multivariable model (Table 3), organizations that reported having an implementation plan for their immunization campaign or a policy or procedure describing how to calculate and/or report immunization rates were more likely to comprehensively measure rates than organizations without these characteristics (odds ratio,

Table 2

Program practices and policies among influenza immunization programs directed at health care workers (HCWs)

Practice or policy	Proportion of respondents (%) (n = 669)	No. able to measure coverage in all HCW groups (%) (n = 63)	No. unable to measure coverage in all HCW groups (%) (n = 606)	P value
Program had a written implementation plan	302 (45)	37 (59)	265 (44)	.02
Program used a multidisciplinary team (5 or more representatives from different disciplines*)	279 (42)	26 (41)	253 (42)	.12
Reported immunization rates to senior management for:				
Payroll personnel	478 (71)	41 (65)	437 (72)	.23
Nonpayroll personnel	334 (50)	37 (59)	297 (49)	.15
Program was able to prioritize vaccine delivery for:				
Personnel who have contact with patients who are at high risk of developing influenza complications (eg, neonatal, oncology)	279 (42)	31 (49)	248 (41)	.17
Personnel who are at risk of acquiring influenza in their work setting (eg, emergency department personnel)	239 (36)	30 (48)	209 (34)	.04
Personnel's level of direct patient care	313 (47)	38 (60)	275 (45)	.02
Program collects influenza declination information for:				
Payroll personnel who declined immunization	447 (67)	49 (78)	398 (66)	.05
Nonpayroll personnel who declined immunization	131 (20)	21 (33)	110 (18)	< .01
Program tracked influenza immunizations using: [†]				
Paper only	309 (46)	33 (52)	276 (46)	.35
Electronic only	138 (21)	10 (16)	128 (21)	.32
Electronic and paper	192 (29)	20 (32)	172 (28)	.52
Immunizations were not tracked	30 (4)	0	30 (5)	— [‡]
Immunization program had policies or procedures for the following:				
Mandatory immunization of HCWs	134 (20)	10 (16)	124 (20)	.38
Tracking personnel who declined influenza immunization	212 (32)	20 (32)	192 (32)	.99
Calculating immunization rates for HCW immunized outside of the organization	142 (21)	20 (32)	122 (20)	.03
Reporting and/or calculating immunization rates	191 (29)	29 (46)	162 (27)	<.01
Conducted an evaluation after immunization program ended on how immunization rates were counted and reported	351 (52)	38 (60)	313 (52)	.16

*Representatives include occupational health and safety, infection prevention and control, pharmacy, administrative support, information technology personnel, communications, senior administrators, and union representatives.

[†]Categories were mutually exclusive.

[‡]Complete separation of data.

Table 3

Multivariate model

Characteristic	Adjusted odds ratio	95% Confidence interval
No. of facilities		
Single facility (reference)	1.00	
Multiple facility	0.74	(0.29, 1.88)
Type of organization		
Continuing care organization (reference)	1.00	
Acute care hospital	1.50	(0.60, 3.74)
Mixed	0.93	(0.32, 2.74)
Large organizations (≥100 beds)	0.63	(0.36, 1.12)
Program had a written implementation plan	1.99	(1.11, 3.55)
Prioritized vaccine delivery to certain groups*	1.43	(0.80, 2.55)
Program collected influenza declination information for payroll	1.27	(0.60, 2.70)
Program had policies or procedures describing how rates were calculated or reported	2.13	(1.19, 3.86)
Conducted postimmunization program evaluation on how immunization rates were documented and reported	1.30	(0.72, 2.34)

*Groups included personnel who have contact with patients who are at high risk of developing influenza complications (eg, neonatology and oncology), personnel at risk of acquiring influenza in their work setting (eg, emergency department personnel), or personnel's level of direct patient care.

2.0; 95% confidence interval, 1.1-3.5 and odds ratio, 2.1; 95% confidence interval, 1.2-3.9, respectively).

DISCUSSION

This is the first large-scale study to examine the ability of Canadian organizations to measure influenza immunization coverage of health care workers. It is also the first pan-Canadian

study to explore immunization campaign implementation and the policies or procedures that exist to support coverage measurement. Unlike previous research in this area that focused on immunization rates as the primary outcome, our study enquired about the numerator and denominator separately for each health care worker group to better distinguish organizations that measure coverage comprehensively. We revealed significant variation in the ability to measure health care worker immunization coverage, with most organizations able to do so for only a subset of personnel.

A US study found that nearly all hospitals (98%) measuring coverage included payroll employees in their rates,¹² but <60% included other types of employees in their coverage estimates. Compared with health care workers on payroll, it may be challenging to measure the denominators for other groups because they are generally excluded from the organizations' payroll databases, and their lists may be managed externally (eg, colleges and contracting firms). Our results demonstrate that some organizations employ strategies to help support the collection and tracking of immunization data, such as requiring documentation from personnel vaccinated off-site and requiring declination forms when immunization was refused.

As a starting point for reporting and comparing coverage across organizations, it would be valuable for organizations to report subsets of their health care worker population using a standardized definition rather than a combined rate consisting of heterogeneous employee groups. This will allow organizations to identify which groups are underimmunized while facilitating interorganizational comparisons.

This study had some limitations. Although we attempted to identify influenza immunization campaign planners at organizations across Canada, this list was not comprehensive. The moderate response rate among those who were identified may introduce response bias. Because some respondents answered once on behalf of

multiple facilities within the same organization, variations in implementation of campaigns among facilities may be substantial. Six percent of responding organizations did not answer the coverage-related questions. These organizations may not measure coverage at all or those responding may not have been knowledgeable about their organization's practices. Finally, our definition of comprehensive coverage included 7 personnel groups; however, because some groups are likely to be small relative to others, they may be less important to capture in immunization coverage measures.

Until organizations uniformly measure coverage, comparisons of coverage across organizations will be misleading. To achieve accurate and complete measurement, agreement on standard definitions for health care worker groups and who should be included in immunization coverage measurements is required. Further, organizations need standard methods that can be incorporated into their procedures for collecting immunization information. Once these have been achieved, organizations can use health care workers' immunization coverage to support the prevention and control of influenza transmission in health care settings.

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