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Measuring the impact of a mandatory province-wide vaccinate-or-mask policy on healthcare worker absenteeism in British Columbia, Canada

Michelle Murti [a,b,c,*], Michael Otterstatter [d,b], Alison Orth [a], Robert Balshaw [d,e], Khalif Halani [f], Paul D Brown [a], Samar Hejazi [a], Darby Thompson [f], Sandra Allison [g,b], Aamir Bharmal [a,b], Meena Dawar [h,b], Dee Hoyano [i,b], Victoria Lee [a,b], Monika Naus [d,b], Sue Pollock [j,b], John Bevanda [j], Sandy Coughlin [k], John Fitzgerald [i], Dave Keen [a], Melanie Maracle [g], Stacy Sprague [h], Bonnie Henry [l,b]

[a] Fraser Health Authority, 13450 102nd Ave., Suite 400, Surrey, BC V3T0H1, Canada
[b] University of British Columbia, 2206 East Mall, Vancouver, BC V6T1Z3, Canada
[c] Public Health Ontario, 480 University Ave., Suite 300, Toronto, ON M5G1V2, Canada
[d] BC Centre for Disease Control, 655 W 12th Ave, Vancouver, BC V5Z4R4, Canada
[e] University of Manitoba, 753 McDermot Ave., Third Floor, Winnipeg, MB R3E0T6, Canada
[f] Emmes Canada, 4664 Lougheed Hwy., Suite 200, Burnaby, BC V5C3Y2, Canada
[g] Northern Health Authority, 299 Victoria St. Suite 600, Prince George, BC, V2L5B8, Canada
[h] Vancouver Coastal Health Authority, 601 West Broadway, 11th Floor, Vancouver, BC V5Z4C2, Canada
[i] Island Health Authority, 1952 Bay St., Victoria, BC V8R1J8, Canada
[j] Interior Health Authority, 505 Doyle Ave., Kelowna, BC V1Y0C5, Canada
[k] Providence Health Care, 1081 Burrard St., Vancouver, BC V6Z1Y6, Canada
[l] Office of the Provincial Health Officer, PO Box 9648 STN PROV GOVT, Victoria, BC V8W9P4, Canada

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ABSTRACT

Objectives: Vaccinate-or-mask (VOM) policies aim to improve influenza vaccine coverage among healthcare workers (HCW) and reduce influenza-related illness among patients and staff. In 2012, British Columbia (BC) implemented a province-wide VOM influenza prevention policy. This study describes an evaluation of policy impacts on HCW absenteeism rates from before to after policy implementation.
Methods: Using payroll data from regional and provincial Health Authorities (HA), we assessed all-cause sick rates (sick time as a proportion of sick time and productive time) before (2007–2011, excluding 2009–2010) and after (2012–2017) policy implementation, and during influenza season (December 1–March 31) and non-influenza season (April 1–November 30). We used a two-part negative binomial hurdle model to calculate odds ratios (OR) of taking any sick time, relative rates (RR) of sick time taken, and predicted mean sick rates, adjusting for age group, sex, job type, job classification, HA, year and vaccine effectiveness.
Results: During influenza season, HCWs in the post-policy period were less likely to take any sick time (OR 0.989, 95%CI: 0.979–0.999) but had higher rates of sick time (RR 1.038, 95%CI: 1.030–1.045). However, during non-influenza season, HCWs in the post-policy period were more likely to take any sick time (OR 1.015, 95%CI: 1.008–1.022) but had lower rates of sick time (RR 0.971, 95%CI: 0.966–0.976). There was an overall increase in predicted mean sick rate from pre to post-policy in influenza season (4.392% to 4.508%) and non-influenza season (3.815% to 3.901%).
Conclusions: The observed year-round increase in sick rates from pre-to-post policy was likely influenced by other factors; however, opposite trends in how HCWs took sick time in the influenza and non-influenza seasons may reflect policy influences and need further research to explore reasons for these differences.

* Corresponding author at: Public Health Ontario, 480 University Ave., Suite 300, Toronto, ON M5G1V2, Canada.
E-mail addresses: michelle.murti@oahpp.ca (M. Murti), Michael.otterstatter@bccdc.ca (M. Otterstatter), alison.orth@fraserhealth.ca (A. Orth), Robert.balshaw@umanitoba.ca (R. Balshaw), khalani@emmes.com (K. Halani), paul.brown@fraserhealth.ca (P.D. Brown), samar.hejazi@fraserhealth.ca (S. Hejazi), dthompson@emmes.com (D. Thompson), Sandra.allison@northernhealth.ca (S. Allison), aamir.bharmal@fraserhealth.ca (A. Bharmal), meena.dawar@vch.ca (M. Dawar), dee.hoyano@viha.ca (D. Hoyano), Victoria.lee@fraserhealth.ca (V. Lee), monika.naus@bccdc.ca (M. Naus), sue.pollock@interiorhealth.ca (S. Pollock), john.bevanda@interiorhealth.ca (J. Bevanda), scoughlin@providence.bc.ca (S. Coughlin), john.fitzgerald@viha.ca (J. Fitzgerald), dave.keen@fraserhealth.ca (D. Keen), melanie.maracle@northernhealth.ca (M. Maracle), stacy.sprague2@vch.ca (S. Sprague), bonnie.henry@gov.bc.ca (B. Henry).

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1. Introduction

Each year, seasonal influenza is associated with a significant burden of illness with the World Health Organization estimating there are 290,000–650,000 deaths associated with seasonal influenza annually [1]. In North America, the United States (US) estimates there are 140,000–710,000 hospitalizations from influenza each year, and Canada estimates there are 12,200 hospitalizations from influenza and 3500 deaths attributable to influenza annually [2,3]. With high rates of hospitalization, health care settings can be sources of transmission and risk for both patients and healthcare workers (HCWs) [3]. In Canada, the National Advisory Committee on Immunizations (NACI) recommends annual influenza vaccination for all HCWs and sets a target rate of 80% coverage [4]. Despite these recommendations, uptake of influenza vaccination remains low. Canadian estimates of influenza vaccine coverage among healthcare personnel from population-based surveys from 2007 to 2014 ranged from 4% to 72% depending on the type of health care occupation [5]. The 2014 Canadian adult National Immunization Coverage survey found 69.2% of all healthcare personnel had received influenza vaccine, while 75.9% of those in close contact with patients or residents had been immunized [6]. In the 2016–17 season, US HCW vaccination coverage by state ranged from 75.2% to 97.2%, largely due to the number of sites where employers require vaccination as a condition of employment [7,8].

Following the example of US organizations achieving sustained rates of >98% through HCW influenza immunization policies, in 2012, British Columbia (BC) became the first province in Canada to mandate a vaccinate-or-mask (VOM) policy for all employees of Health Authorities (HA) [9,10]. The BC Influenza Prevention Policy requires all HCWs to either be vaccinated or to wear a mask in patient care areas throughout the influenza season, and this policy also applies to visitors, volunteers and students who attend a patient care area. Health care delivery in BC, other than outpatient primary care, is a single-payer system and fully unionized environment (with several unions) organized by regional HA. Introduction of the policy was also associated with increased promotion of infection prevention and control in patient care areas with highly visible signage including reminders to mask if not vaccinated. The policy for staff took full effect in the 2013–14 season after implementation without enforcement for staff in the 2012–13 season [11]. While individual HCW vaccination status was not systematically collected prior to the policy, aggregate coverage reporting from acute care and long-term care facilities showed significant increases among HCWs. Influenza vaccine coverage in acute care staff increased from 40% to 75% and from 57% to 79% among long-term care staff from the 2011–12 to 2013–14 seasons [12,13].

In addition to the policy goals of increasing immunization rates and preventing transmission of influenza from HCWs, the third goal was "to reduce influenza-related absenteeism in healthcare workers employed by health authorities in BC". An initial evaluation, in one BC HA after the first year of the policy, found 'unvaccinated' staff had significantly higher absenteeism due to all-cause illness compared to vaccinated staff in influenza season [14]. However, other jurisdictions have had more modest results; five years after a mandatory influenza vaccination policy in Virginia Mason clinics in the US, there was a non-significant decrease in HCW absenteeism [15]. Therefore, our aim was to evaluate whether implementation of BC's province-wide mandatory VOM policy applicable to HCWs and anyone in a patient care area changed HCW all-cause absenteeism among HA employees.

2. Methods

2.1. Payroll data on HCW sick time

This study utilized HCW payroll data from employees of the seven regional and provincial HA in BC (Fraser Health, Interior Health, Northern Health, Provincial Health Services, Providence Healthcare, Vancouver Coastal Health, Vancouver Island Health) from December 1, 2007 to March 31, 2017. Available data for each HCW included year of birth and sex, HA, job type (part-time, full-time, or casual status), and descriptions of job classification (job descriptions and codes). Job classification descriptions were grouped into a summary classification of 'clinical' and 'non-clinical', with 'indeterminate' classification where there was insufficient information on the role. Available data for each day employed include: hours of productive time, hours of sick time, and hours of other absences (e.g., vacation, leaves of absences). Daily hours data were aggregated into calendar months. The monthly "sick rate" for each HCW was defined as the amount of sick time divided by the sum of sick time and productive time in a month (i.e., the amount of sick time relative to the amount of time the HCW was supposed to be working in a month).

We excluded months where a HCW had zero productive time and days in which >12 or <0 hours (h) were recorded in a day. In addition, we excluded individuals with 'casual' status because of differences in sick-time policies compared to regular (full-time or part-time) employees. Additional exclusions include HCWs for whom year of birth, sex, or employee identification key was not discernable. Finally, April 1, 2009 to March 31, 2010 was excluded to remove the pandemic influenza year.

2.2. Influenza season sick rates

We defined the "influenza season" (IS) as the period of time between December 1 and March 31, corresponding to the period when the BC influenza prevention policy was in effect; with non-influenza season (NIS) as the period from April 1 to November 30. Monthly sick rate was summarised using mean and standard deviation (SD) in influenza season (IS) and non-influenza season (NIS) by HCW, year of birth, sex, HA, job type and job classification role.

2.3. Modelling sick rates in the pre and post-policy periods

We compared HCW sick time by IS and NIS in the pre-policy (December 1, 2007–November 30, 2012) and post-policy (December 1, 2012–March 31, 2017) periods using a 2-stage negative binomial hurdle model. The first stage of the two-stage hurdle model is a logistic regression of the factors impacting the risk of taking any sick time in a month. The second stage of the model is a negative binomial regression of the factors impacting the rate of sick time taken in a month [16].

Our model included reported policy period (pre, post) and influenza season (IS, NIS) and the interaction between the two terms to isolate the effect of the post-policy period on monthly sick rates by season (IS vs NIS). Total time (the sum of sick time plus productive time) was included as a statistical offset in the model, effectively acting like the denominator of a rate calculation to account for time worked by each employee each month. We adjusted for effects of other important variables by including: year of birth, sex, HA, job type, job classification, annual influenza vaccine effectiveness (VE) estimate, and calendar year to account for varying seasons and trends over time. VE estimates were based on the all-ages and all influenza estimates from the Canadian Sentinel Practitioner Surveillance Network [17].

As a large proportion of HCWs had no sick time in a month, the hurdle model accounts for the likelihood that there are different underlying mechanisms that influence why HCWs take no sick time versus the amount of sick time off when it is taken. The negative binomial model also addresses the overdispersion in the data, precluding use of standard Poisson or over-dispersed Poisson models. Coefficient estimates and associated 95% confidence intervals (CI) from the logistic and negative binomial models were transformed into odds ratios (ORs) and relative rates (RRs) respectively. The ORs and RRs of predictors in the model are based on coefficients from the hurdle model and conditional on all other things being equal, and therefore, represent the predictors' effect on sick rates on average and in a given month. This approach accounts for HCWs having varying characteristics (e.g., job type, job classification) over time. Predicted marginal means of overall monthly sick rate estimates from the two components of the model were calculated by policy period for both IS and NIS.

Sensitivity analyses of the model included removal of the 2012–13 season (when policy was not enforced), removal of the 2016–17 season (unusually high sick rates), and removal of the VE term. As well, the model was re-fit using a 2-stage zero-inflated regression hurdle model.

All analyses were performed using R version 3.4.2 software [18]. This project was assessed by the Fraser Health Authority Research Ethics Board and was determined as evaluation, and therefore exempt from review and approval.

3. Results

3.1. Payroll data of HCWs

There were 190,018 HCWs employed in the HA from December 1, 2007 to March 31, 2017. After application of the inclusion and exclusion criteria, there were 132,927 HCWs, with 103,265 employed in the pre-policy period and 107,268 employed in the post-policy period (Table 1). Exclusions for daily time >12 or <0 h and indiscernible data removed <4% of daily payroll records. The sex distribution of HCWs was similar in the pre and post policy periods with the majority of HCWs being female. The mean year of birth was approximately five years later for HCWs in the post-policy period (equating to similar mean ages of employees in the pre and post policy periods). HCWs may change their HA, job type or job classification over time accounting for varying contributions of these variables to aggregated monthly sick rates. Proportions of payroll records by job type and job classification were similar in the pre and post policy periods, with the majority of HCWS having a clinical role and full-time status (Table 1).

3.2. Summary of unadjusted monthly sick rates December 2007–March 2017

The overall mean monthly sick rate was 5.5% (Standard Deviation (SD) 11.02) in IS and 4.8% (SD 10.51) for NIS (Table 2); this equates to approximately 8.8 and 7.2 sick hours per typical 160 h month for a full-time employee in IS and NIS, respectively. Across all years and all HCW characteristics, sick rates were higher in IS compared to NIS. IS sick rates ranged from 5.3% to a high of 5.9% in the 2016–17 season, while NIS sick rates were more consistently between 4.7% and 4.9%. Female HCWs, part-time HCWs, and those in clinical jobs all had higher sick rates than males, those who are full-time and those in non-clinical roles, respectively.

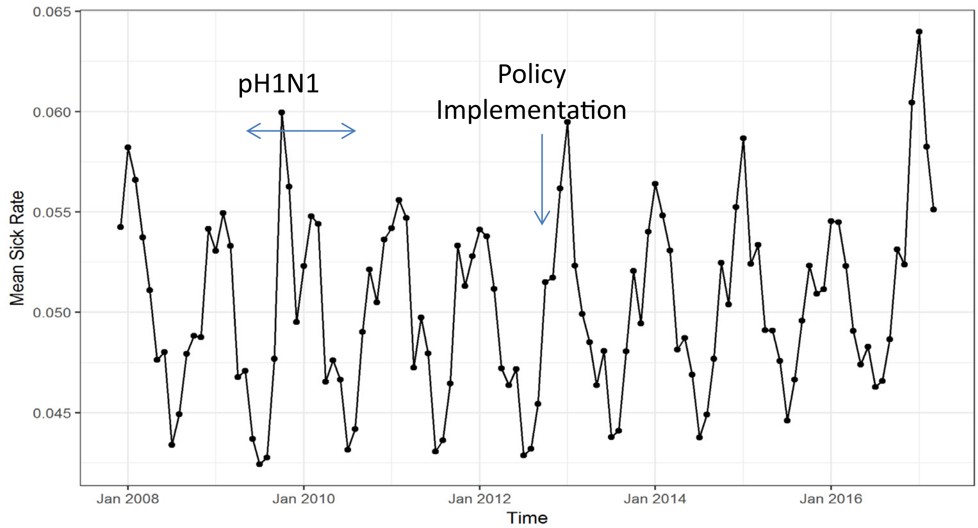
Fig. 1 shows the overall mean monthly sick rate per month from December 2007 to March 2017. Monthly sick rates generally peaked in the IS between December and February and were the lowest in the NIS between June and August. The excluded pandemic year (April 2009–March 2010) had two peaks in November 2009 and March 2010, showing an atypical pattern compared to seasonal influenza but in alignment with pandemic influenza activity. Absenteeism in the 2016–17 IS peak was higher than the other seasons in this time period, with the next highest IS peaks occurring in the 2008–09, 2012–13, and 2014–15 seasons.

Table 2
Unadjusted mean monthly sick rate (%) and standard deviation (SD) during influenza season and non-influenza season by year, sex, job type and job classification.

		Influenza Season Mean (SD)	Non-influenza Season Mean (SD)
Overall		5.5 (11.02)	4.8 (10.51)
Year	2007/08	5.6 (11.24)	
	2008/09	5.4 (10.87)	4.8 (10.54)
	2010/11	5.5 (10.99)	4.7 (10.48)
	2011/12	5.3 (10.85)	4.8 (10.55)
	2012/13	5.4 (11.01)	4.7 (10.39)
	2013/14	5.5 (10.94)	4.8 (10.41)
	2014/15	5.5 (10.98)	4.8 (10.56)
	2015/16	5.3 (10.82)	4.9 (10.57)
	2016/17	5.9 (11.45)	4.9 (10.55)
Sex	Male	4.4 (9.57)	3.8 (9.04)
	Female	5.7 (11.27)	5.0 (10.76)
Job Type	Part-time	5.8 (11.51)	5.0 (10.94)
	Full-time	5.4 (10.77)	4.7 (10.28)
Job Category	Non-Clinical	4.7 (10.28)	4.1 (9.81)
	Indeterminate	3.8 (8.60)	3.1 (8.07)
	Clinical	5.9 (11.41)	5.2 (10.87)

Table 1
The number, birth year and sex distribution for included HCWs, and the number and proportion of payroll records associated with HCWs' job classifications and types in the pre and post policy periods.

			Pre-Policy	Post-Policy
Number of HCWs		N	103,065	107,258
Birth Year		Mean (SD)	1965.5 (12.17)	1970.7 (12.11)
		Range	[1932, 1994]	[1932, 1998]
Sex	Male	N (%)	15,519 (15%)	17,633 (16%)
	Female	N (%)	87,546 (85%)	89,625 (84%)
Job Classification	Clinical	N (%)	69,105 (64%)	71,781 (65%)
	Non-clinical	N (%)	34,059 (31%)	35,645 (32%)
	Indeterminate	N (%)	5264 (5%)	3621 (3%)
Job Type	Full-time	N (%)	77,635 (62%)	80,256 (62%)
	Part-time	N (%)	46,806 (38%)	49,186 (38%)



	2007-08	2008-09	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
SPSN overall VE estimate (95%CI) [15]	60% (45-71)	56% (41-67)	37% (17-52)	59% (43-70)	50% (33-63)	68% (58-76)	9% (-14-27)	46% (32-57)	45% (31-56)

Fig. 1. Mean monthly sick rate December 2007 to March 2017, and the Canadian Sentinel Practitioner Surveillance Network's overall vaccine effectiveness estimate and 95% confidence intervals for those seasons (excluding the pandemic 2009–10 season).

3.3. Fully-adjusted hurdle model comparing odds ratios and relative rates of absenteeism in the pre and post policy periods

From the logistic regression first stage of the hurdle model, after adjusting for potential confounders, IS months post-policy were significantly less likely to include any sick time compared to pre-policy, odds ratio 0.989 (95% CI: 0.979–0.999) (Table 3). NIS months in the post-policy period were significantly more likely to have any sick time compared to pre-policy, odds ratio 1.015 (95%CI: 1.008–1.022). Factors of HA and year were significant, as were effects of age, job type and job classification, whereas VE did not have a significant association with the risk of sick time and had a negligible impact on the overall model. Female HCWs, on average and in a given month, were more likely to take any sick time compared to male HCWs (OR 1.345, 95%CI: 1.340–1.351). Similarly, full-time HCWs were more likely to have any sick time compared to part-time HCWs (OR 1.299, 95%CI: 1.295–1.303).

From the second stage (negative binomial regression) of the hurdle model, IS months had 4% higher sick rates post-policy compared to pre-policy (RR 1.04, 95%CI: 1.03–1.05), after adjusting for potential confounders. Conversely, sick rates were 3% lower in NIS months in the post-policy vs pre-policy periods (RR 0.97, 95%CI: 0.97–0.98). The highest RR was for months associated with clinical versus non-clinical job classifications (RR 1.164, 95%CI: 1.161–1.167), followed by ages 60 years and older versus ages 19 to 29 years old (RR 1.137, 95%CI: 1.132–1.143). Full-time HCWs were more likely to have any sick time compared to part-time HCWs, but their sick rates were 13% lower compared to part-time HCWs (RR 0.868, 95%CI: 0.866–0.870) when it was taken. HCW with an indeterminate job classification were less likely to have any sick time and 11% lower sick rates compared to HCWs with a clinical job classifications (RR 0.889, 95%CI: 0.882–0.895).

The overall predicted monthly sick rates combining the OR and RR from the fully-adjusted 2-stage model in IS and NIS, pre and post-policy are shown in Table 4. Based on an expected 160 h month of productive time for a full-time employee, there was an increase in IS monthly sick time of 0.186 h post-policy and an increase of 0.138 h in NIS months. This is equivalent to an increase

Table 3
Fully-adjusted[*] odds ratios for months with any sick time and relative rates of monthly sick time taken, and their 95% confidence intervals (CI).

Sick time predictors	Odds Ratio	95% CI	Relative Rate	95%CI
Age 30–39 vs age 19–29	1.097	(1.091–1.103)	1.022	(1.018–1.026)
Age 40–49 vs age 19–29	0.96	(0.954–0.965)	1.001	(1.005–1.013)
Age 50–59 vs age 19–29	0.863	(0.859–0.868)	1.056	(1.052–1.060)
Age 60+ vs age 19–29	0.879	(0.873–0.885)	1.137	(1.132–1.143)
Female vs male	1.345	(1.340–1.351)	1.065	(1.062–1.068)
Full time vs part time	1.299	(1.295–1.303)	0.868	(0.866–0.870)
Clinical vs non-clinical	1.086	(1.082–1.090)	1.164	(1.161–1.167)
Indeterminate vs non-clinical	0.884	(0.875–0.893)	0.889	(0.882–0.895)
Post-policy vs pre-policy (influenza season)	0.989	(0.979–0.999)	1.038	(1.030–1.045)
Post-policy vs pre-policy (non-influenza season)	1.015	(1.008–1.022)	0.971	(0.966–0.976)

[*] Adjusted for year, health authority, age group, sex, VE, job type, job classification.

Table 4
Overall predicted estimate of monthly sick rate in influenza season and non-influenza season in the pre-policy and post-policy periods from the fully-adjusted two-stage model combining OR and RR estimates.

	Predicted mean sick rate (%)		Predicted monthly sick hours*		Increase in sick time hours per month post-policy
	Pre-policy	Post-policy	Pre-policy	Post-policy	
Influenza Season	4.392	4.508	7.027	7.213	0.186
Non-influenza Season	3.815	3.901	6.104	6.242	0.138

* Based on an expected value of 160 h of productive time in a month.

in sick time of 0.744 h/HCW in IS (December 1–March 31) compared to 1.104 h/HCW increase in NIS (April 1–November 30), post-policy versus pre-policy.

Results from all sensitivity analyses were consistent with the results from the primary hurdle model analyses.

4. Discussion

Implementation of a province-wide mandatory influenza prevention policy that significantly increased influenza vaccine coverage among HA employees provided a unique opportunity to assess VOM policy impacts on HCW absenteeism. We found a small but significant lower likelihood of any sick time during IS months in the post-policy period compared to the pre-policy period. However, there was a 4% increase in the rate of sick time taken during IS months in the post-policy period. Whereas, sick rates during NIS months showed the opposite pattern with a significantly higher likelihood of any sick time and a 3% lower rate of sick time taken post-policy. After combining these fully-adjusted OR and RR effects estimates for IS and NIS, months in both IS and NIS had an overall increase in their predicted sick rates in the post-policy compared to pre-policy period. This year-round increase in sick rates suggests factors other than the influenza prevention policy had an impact on HCW all-cause sick time over this time period. However, the different pattern of sick rates in IS versus NIS months suggests potential policy-related effects during influenza season where HCWs are less likely to take sick time, but take more sick time when they do.

Around the same time period as when the policy was implemented, HAs in BC were implementing automated reporting methods to capture HCW absenteeism. Known as the 'employee absence reporting line' in most HA, sick-time absences that were previously reported to the manager and may or may not be captured by employees on their time sheets, sick absences were now directly reported via telephone entry and captured by the payroll database. These systems likely improved the accuracy and completeness of sick time data; therefore, the observation of an overall increase in year-round sick rates in the post-policy period may be expected given the coincident timing of the absence reporting line implementation. And as expected, these administrative changes in the capture and management of sick time likely had similar effects of increasing sick rates in both IS and NIS months. There were no policy changes in this time period impacting how employees earn or use sick time.

In an attempt to disentangle the administrative payroll data changes likely affecting overall sick rates, our analysis used a 2-stage hurdle model approach used in another absenteeism study to consider the potentially different mechanisms driving why HCWs may take no sick time (structural zeroes) versus the amount of sick time taken (non-structural zeroes) [19]. The increased likelihood of having any sick time in the NIS months makes the decreased likelihood of any sick time in IS months post-policy more relevant, as it would be expected to be similar to NIS months if driven by non-policy factors. This increased likelihood of 'structural zeroes' may reflect an actual decrease in illness events among HCWs. It may also represent an increase in HCW 'presenteeism', where HCWs work despite being symptomatic [20,21]. Presenteeism is a well-described phenomenon, and can be increased by feeling "protected" by vaccination or not linking respiratory symptoms to influenza due to vaccination [22–24]. It is possible that the increased proportion of HCWs vaccinated after implementation of the policy increased presenteeism amongst those who were vaccinated. Conversely, when sick time was taken post-policy, HCWs took more sick time in IS and less sick time in NIS compared to pre-policy, again suggesting potential policy impacts in how sick time was used. The increase in post-policy IS sick rates may be related to an increased awareness of staying home when sick (decreased presenteeism) and potentially work avoidance among HCWs required to mask while in patient care areas. However, HAs noted that monitoring and enforcement of mask wearing was variable, and that HCWs who did not report vaccination were more likely to not wear a mask or wear a mask improperly (e.g., around their neck), making it less likely that work avoidance contributed to increased absenteeism. Further research is needed to explore these hypotheses on the observed shifts in sick time behaviours and reasons for changes in how sick time was taken in IS vs NIS post-policy.

In recent years, the HA absence reporting lines began collecting information on the nature of illness (e.g., respiratory symptoms or gastrointestinal symptoms) when sick time is reported, but this data was not collected over the study period and sick time potentially related to influenza was not available for this analysis. We were also unable to differentiate sick time that was taken due to personal illness versus caring for an ill dependent, or other reasons for using sick time, such as medical appointments. Alternative reasons for taking sick time appear to be influential, as the sick rate peak in January 2017 (Fig. 1) coincided with a large winter snowstorm in the lower mainland of BC, when very high sick rates were noted in the two largest HA [25].

Previous descriptions of changes in HCW absenteeism with the implementation of influenza vaccination policies have also shown mixed results [26]. In the 2012 analysis by Kidd et al of New York City as the first state to mandate influenza vaccination, there was a mention of a decrease in 8000 h of influenza season 'call-off' hours compared to the previous season [27]. In the description of the five years of policy implementation at Virginia Mason hospitals in Seattle (from 2006 to 2010), they observed a non-significant decrease in sick leave hours from 7.1 h/HCW in the five years pre-policy to 6.6 h/HCW in influenza season post-policy, and the authors noted that there was considerable variability from year to year [15]. Both of these jurisdictions implemented mandatory vaccination policies, versus VOM policies, and achieved much higher coverage levels among HCWs (>95%) than obtained in BC (<80%) [28]. In a 2017 study of four long-term care homes with varying non-mandatory interventions to increase HCW influenza vaccine uptake, there was a trend towards lower rates of self-reported absenteeism due to respiratory illness in the influenza season; however, no statistical analysis was included [29]. As well, pre-intervention vaccination coverage ranged from 5% to 75% and post-intervention coverage ranged from 71% to 96% in this study

[29]. Achieving higher vaccination coverage (>95% vs <80%) from a mandatory policy would be expected to have greater impacts on 'herd immunity' and contributions to lowering HCW absenteeism. However, in addition to type of vaccination policy implemented and coverage level achieved, there may also be differences in sick time usage policies between Canada and the US that influence the observed absenteeism changes in these policy evaluations. We have not identified any other published evaluations assessing the pre to post-implementation impact of a large-scale VOM policy on HCW absenteeism.

Seasonally, we observed much higher rates of absenteeism during the winter months compared to lower rates in the rest of year, across all years of the study period (5.5% vs 4.8%). This represents a relative increase of 15%, or 1.12 h per employee per month based on a 160 h working month. This finding is somewhat lower than the range of results from previous studies. Two Canadian studies, from 1991 and 1984, measured IS increases in absenteeism in the range of 35% to nearly a two-fold increase compared to the rest of the year, respectively [30,31]. A 2017 study from Italy showed an increase of 2.07 days/person (from 2.99 to 5.06 days/person, 69% relative increase) in influenza periods (defined as week 42 to week 17 of the following year) [32]. Influenza and non-influenza season sick rates were also much lower (approximately 3.7% and 2.4%, respectively) than what was observed in our study, potentially reflecting differences in accrual and usage of sick time in the Italian context. Conversely, a 1999 study from the United Kingdom found limited change in IS vs NIS absenteeism [33].

The use of administrative data on all-cause sick time is subject to limitations. Firstly, without information on the reason for sick time in the available payroll data, we cannot isolate sick time due to influenza-related illness or isolate sick time taken for personal illness versus caring for others. An assessment of sick time from personal influenza-related illness may show a different trend; however, these data are not available. Secondly, as described above, changes in sick time data capture at the same time as the policy implementation may impact overall changes in absenteeism rates. Thirdly, vaccination status of individual HCWs was not available in the pre-policy period to assess changes in absenteeism over time among HCWs who were not vaccinated pre-policy, but were vaccinated post-policy. Finally, our findings reflect a unionized and Canadian health care system context and may not be generalizable to jurisdictions in other countries.

However, use of province-wide payroll data for HCW absenteeism is the most accurate source of information available on sick rates for HA employees in the province. These data also enabled consistent categorization of HCWs through its harmonization of provincial job types and classifications, and transfer of employee identification numbers from one HA to another. We were also able to address seasonal differences impacting HCW absenteeism by including several seasons both pre and post policy.

5. Conclusions

We found opposite trends for pre-policy to post-policy changes in HCW sick time usage during IS vs NIS months. These differences suggest potential influence of the policy on use of sick time in IS where HCWs were less likely to take any sick time, but took more sick time when they did after the policy was implemented. However, there was an overall increase in both IS and NIS sick rates in the post-policy period that was likely influenced by changes in sick time reporting that occurred over a similar time period and other non-policy factors. Further research is needed to explore hypotheses around HCW sick time usage and presenteeism/absenteeism related to the policy that may be contributing to the observed trends, as well as future evaluations from other jurisdictions with VOM policies. Finally, other jurisdictions considering evaluating the impacts of HCW influenza vaccination policies should consider collecting pre-policy data on HCW vaccination status and personal influenza-related sick time to increase the robustness of their evaluation.

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Conflict of Interest

All authors report no conflicts of interest relevant to this article.

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