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Mesures de prévention et contrôle de l'influenza en médecine de famille (Influenza prevention and control measures in primary care)

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Département de Médecine de Famille

Mesures de prévention et contrôle de l'influenza en médecine de famille

(Influenza prevention and control measures in primary care)

THESE

préparée sous la direction du Professeur Nicolas Senn
avec la co-direction de la Docteure Yolanda Müller Chabloz

et présentée à la Faculté de biologie et de médecine de
l'Université de Lausanne pour l'obtention du grade de

DOCTEUR EN MEDECINE

par

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Mesures de prévention et contrôle de l'influenza en médecine de famille
(Influenza prevention and control measures in primary care)

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pour Le Doyen
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Monsieur le Professeur John Prior
Vice-Directeur de l'Ecole doctorale

Mesures de prévention et contrôle de l'influenza en médecine de famille

Contexte : Les médecins des premiers recours en cabinet ambulatoire jouent un rôle central durant l'épidémie saisonnière de grippe. Certains d'entre eux font également partie du système de surveillance national suisse (Sentinella) utilisé par l'Office Fédérale de la Santé Publique (OFSP) pour suivre la saison de la grippe. Il y a cependant peu de données sur la transmission de la grippe dans le milieu des soins ambulatoires, malgré le fait qu'une partie importante de la population consulte son généraliste pour des symptômes grippaux chaque année. Les travailleurs de santé sont a priori également plus à risque d'être infecté par la grippe du fait de leur exposition durant la saison. Cependant, les études actuelles se basent quasi uniquement sur le milieu hospitalier et ne différencient pas les différentes catégories de soignants, ni leur lieu de travail respectif afin de savoir lesquels sont le plus à risque.

Objectifs : Les buts de cette étude étaient d'une part d'estimer le rôle de la transmission nosocomiale (associée au milieu des soins) de la grippe parmi les patients vus dans les cabinets de médecine de premier recours, et d'autre part de décrire l'utilisation de mesures de prévention et de méthodes de protection contre la grippe dans le contexte ambulatoire.

Méthodes : Afin de mener à bien notre recherche nous avons créé deux récoltes de données différentes. Premièrement nous avons envoyé un questionnaire aux 166 médecins Sentinella durant la saison de grippe 2018-19. Les questions portaient sur le type de cabinet, les recommandations pour la prévention et le contrôle des infections, la vaccination contre la grippe par les médecins et leurs employés, et pour finir les mesures d'hygiène des mains et de port du masque. Deuxièmement, pour l'étude cas-contrôles nous avons utilisé les rapports habituels de Sentinella, avec rajout de quelques questions afin de comparer la proportion de patients avec une activité professionnelle dans la santé entre les cas consultants leur médecin de premier recours pour des symptômes grippaux et les contrôles de la même population de ces médecins généralistes. Les cas de grippe étaient confirmés par PCR au centre national de référence à Genève (HUG). L'analyse portant sur l'association entre l'activité professionnelle et le fait de consulter pour un état grippal était faite via un modèle de régression logistique.

Résultats : Concernant le questionnaire, 122 cabinets ont répondu (proportion de 73.5%), et démontrait une vaccination de 90.2% des médecins répondants, mais seuls 46.7% estimaient leurs employés vaccinés à >60%, bien que la vaccination soit offerte. La plupart des cabinets (68, 55.7%) n'avaient pas de recommandations spécifiques pour leurs employés concernant le port du masque. Pour l'étude cas-contrôle, sur les 4287 cas de symptômes grippaux ayant consultés, 235 (5.5%) travaillaient dans la santé, contre 872 (3.1%) sur les 28'561 contrôles. Après ajustement, être actif dans le milieu de la santé augmentaient les risques de consulter pour des symptômes grippaux (OR 1.66, 95% CI 1.40-1.97). L'association était la plus forte pour les médecins et les aides-soignants. Concernant les milieux, le risque de consulter était plus élevé pour tous les lieux de travails de soins, sauf les visites à domicile.

Conclusions : Cette étude a permis de montrer premièrement que les médecins sont relativement bien vaccinés contre la grippe, mais qu'en revanche leurs employés le sont moins. Les mesures de désinfections des mains étaient également insuffisantes. Deuxièmement il a été mis en évidence que les personnes actives dans le milieu de la santé étaient plus à risque de consulter leur généraliste pour des symptômes grippaux comparé avec la population non active dans les soins. Tous ces résultats justifient de futurs efforts pour comprendre la transmission de la grippe plus largement dans le système de soin, et également de développer des mesures de prévention et de contrôle de l'infection dans le milieu ambulatoire.

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WILEY

ORIGINAL ARTICLE

Are healthcare workers more likely than the general population to consult in primary care for an influenza-like illness? Results from a case-control study

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Abstract

Background: Healthcare workers are at increased risk of contracting influenza. However, existing studies do not differentiate professional categories or domains of the healthcare system that are most at risk.

Methods: This case-control study compared proportions of patients with professional activity in the healthcare system between cases consulting their primary care physician for an influenza-like illness (ILI) and controls from the general patient population of the same practices of the Swiss sentinel network. Influenza was confirmed by rRT-PCR in a subset of practices. Analysis used a mixed logistic regression model, including age and sex as potential confounders.

Results: During the 2018/2019 influenza surveillance season, out of 4287 ILI cases and 28 561 controls reported in 168 practices, 235 (5.5%), respectively 872 (3.1%), were active in the healthcare system. After adjustment, being active in health care increased the odds of consulting for an ILI (OR 1.66, 95% CI 1.40-1.97). The association was strongest for physicians and nursing aides. In terms of work setting, odds of consulting for ILI were increased for professionals of almost all healthcare settings except home-based care.

Conclusion: Individuals active in the healthcare system were more likely to consult their primary care physician for an influenza-like illness than for another reason, compared with individuals not active in the healthcare system. These results warrant further efforts to understand influenza transmission in the healthcare system at large.

KEYWORDS

epidemiology, human, influenza, occupations, prevention and control, primary health care

1 | INTRODUCTION

Healthcare workers are at increased risk of influenza infection compared to non-HCW.[1-3] For example, influenza-like illness (ILI) among Italian medical residents peaks earlier compared to the general population.[3] General practitioners (GPs) in particular have been shown to have high levels of basic immunity to influenza, probably resulting from frequent contacts with influenza viruses in the past.[4]

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Already during the 1918 influenza pandemic, social class based on occupation had an impact on mortality.[5] Occupation of influenza cases has been explored in more details during the 2009 H1N1 pandemic. In a study conducted in four American states, the proportion of healthcare workers was three times higher among laboratory-confirmed influenza cases compared to its proportion in the general workforce.[6] In a Spanish matched case-control study, being a healthcare worker was associated with consulting as an outpatient for influenza.[7]

However, existing studies of influenza risk based on occupation do not differentiate between the different settings of the healthcare system, such as hospitals, residential homes, physician practices. Direct transmission from healthcare workers has been documented,[8] but whether patients acquire influenza mostly from other patients or from healthcare workers is still debated.[9,10]

Most of the work on healthcare-associated influenza has been conducted in hospitals[11] or long-term care institutions. In hospitals, a significant proportion of influenza infections is acquired during admission.[12] Patients visiting the emergency department for another reason than influenza during the influenza season have an increased risk of contracting influenza compared with community controls.[13] In an outpatient setting, one retrospective cohort study among children aged two to five years old reported an increased risk of 36% (incidence rate ratio 1.36; 95% CI 1.22-1.52) of presenting for an ILI visit in the 8 days after a non-ILI visit to a pediatric clinic.[14]

Our research question was whether being professionally active in the healthcare system (exposure) increases the risk of influenza infection, assessed by consulting a primary care practitioner for influenza-like illness (outcome). We assumed that healthcare workers would mostly consult their primary care practitioner in case of influenza-like illness. Therefore, we estimated the association between seeking consultation for an influenza-like illness or having confirmed influenza, and being professionally active in the healthcare system, differentiating by type of profession and work setting.

2 | MATERIALS AND METHODS

This unmatched case-control study was conducted within the Swiss national sentinel surveillance system (Sentinella) during the 2018-2019 influenza surveillance season. Sentinella is a network of approximately 165 primary care physicians (general internal medicine specialist or pediatricians), maintained by the Swiss Federal Office of Public Health (SFOPH) since 1986 for the purpose of influenza surveillance. During the influenza surveillance season (epidemiological week 40 to 16), participating physicians declare on a weekly basis every case of influenza-like illness, defined as a history of fever (>38°C), generally of abrupt onset, and presence of either sore throat or cough. Nasopharyngeal swabs are performed in a subset of practices, allowing identification of circulating strains in Switzerland by the National Reference Center of Influenza. Confirmed influenza cases are defined as ILI cases with positive nasopharyngeal swabs by rRT-PCR. In order to obtain a denominator for ILI incidence, physicians report the daily number of patient contacts and, twice a year for a duration of two weeks, detailed patient-contact information with documentation of age and sex. ILI incidence by number of inhabitants is extrapolated by triangulating the proportion of ILI per number of patient contacts with the number of consultation per individual, obtained from national statistics such as the Swiss Health Survey.

We used two different sets of cases in our study. First, cases were defined as all ILI cases, reported to Sentinella during the influenza surveillance period (October 2018 [week 40] to April 2019 [week 16]). In a second analysis, we restricted cases to confirmed influenza cases by rRT-PCR. As controls, we used the patient contacts reported by physicians during week 11 and 12, 2019, minus ILI cases (patients with same sex and year of birth declared both as case and control within same week in same practice). Both for cases and controls, we added to the existing data collection a question about professional activity in the healthcare system, understood as the part of the health system providing health care to patients. Professional activity corresponded to the International Labour Office definition of occupied labor force. If professionally active, we further enquired about type of profession and work setting. Type of profession was categorized based on the International standard classification of occupations (ISCO version 08), simplified in eight categories relevant for the healthcare system, and based on the type of contact with patients: (1) physicians; (2) nurses; (3) nursing aides/personal care workers; (4) medical assistant or paramedics; (5) physical, occupational, or psycho-therapist; (6) laboratory or radiology technician, pharmacy assistant; (7) pharmacist or dentist; (8) administrative personal; (9) other; and (10) unknown. Work setting was categorized as: (1) private practices; (2) hospital; (3) pharmacy; (4) at-home care; (5) nursing home; (6) reeducation center; (7) dentist or therapist practices; (8) radiology or laboratory center; (9) office space; (10) other; and (11) unknown. In case of missing information about professional activity, data of people born before 1954 and after 2003 were recoded as "not active," and the remaining "missing" recoded as unknown.

For both cases and controls, the following variables were obtained from the routinely collected Sentinella: week, age, sex. In addition, for ILI cases we collected whether the swab was sent to the reference laboratory, and rRT-PCR result. At practice level, we obtained the region and total number patient-physician contacts during influenza surveillance season. The project made full use of the quality assurance system of Sentinella. Declaring GPs received instructions about data collection, with main messages reinforced by regular Newsletters. Predefined checks in electronic data entry diminished the risk of data entry errors. The Sentinella program Commission, consisting of regional representatives of declaring physicians, Swiss family medicine institutes, and the SFOPH, reviewed the study protocol and data collection forms.

Analysis of this case-control study was based on a mixed logistic regression model, taking into account the clustering by practice by including a random intercept. We considered age and sex as potential confounders, because age was associated with both types of profession and ILI incidence, and sex was associated with types of profession, as well as possibly associated with ILI incidence and health-seeking behavior in case of ILI. Profession and work setting of

patients active in the healthcare system were compared to those not active, excluding those with unknown or missing activity information (complete case analysis). If active, other professions with <5% of total and unknown profession were regrouped into a single category. If active, but profession, respectively, work setting, was missing, it was recoded as unknown. For confirmed influenza cases, the dataset was restricted to practices where swabs were performed. Separate models were used for activity in the healthcare system in general, categories of professional activity if active in the healthcare system, and categories of work settings, because of collinearity between these variables. In a sensitivity analysis, we repeated the model for activity in the healthcare system, setting all missing data to "inactive," To examine possible over- or underrepresentation of some professions among controls, we compared the proportion of individuals active in each professional category among subjects aged 15-64 years old with national occupational statistics.[15] We used the Stata 15 software for all analyses.

The investigators had access only to anonymized data. Neither additional health-related data nor biological material was collected specifically for the study. As such, the project was not under the scope of the Swiss human research law (LRH) and did not require formal ethical review.

3 | RESULTS

During the 2018/2019 influenza surveillance season, there were 4287 ILI cases reported from 168 practices, out of which 346 were confirmed for influenza from the 79 practices swabbing ILI cases. During weeks 11 and 12, 28 561 controls were recorded, reduced to 15 463 after restricting the dataset to practices doing swabs.

The median age for the ILI cases was 33 (12-52, 95% CI), compared with 52 (27-71, 95% CI) for controls (Table 1). There were slightly more females among controls than among ILI cases (52.7% vs 50.2%, P = .001). Of the total, ILI cases 235 (5.5%) were working in the healthcare system, compared to 872 (3.1%) for controls. Professional activity was unknown for 546 (12.7%) ILI cases and 2865 (10.0%) of controls.

Being active in the healthcare system was associated with increased odds of consulting for an ILI (crude OR 1.91, 95% CI 1.65-2.21; Table 2). The associations persisted after adjustment for age, sex, and inclusion of a random intercept for practice (Adj OR 1.66, 95% CI 1.40-1.97). The association was strongest for the physicians (Adj OR 2.85, 95% CI 1.47-5.53) and nursing aides (Adj OR 2.01, 95% CI 1.42-2.85). Odds were also increased for administrative staff and for other or unknown profession. After adjustment, we found no increased odds for nurses nor for medical assistant and paramedical staff.

In terms of work setting, we found increased odds of consulting for ILI for professionals of almost all healthcare settings except home-based care. The association was strongest for those working in private practices (Adj OR 2.26, 95% CI 1.43-3.58) and nursing homes (Adj OR 2.06, 1.53-2.78). It was also increased, to a lesser degree, for professionals working in hospitals. It was not significantly increased for workers in home-based care and other healthcare settings.

Results for PCR-confirmed influenza, although based on a limited number of cases, were consistent with results obtained for ILI overall (Table 3). The odds of consulting for a confirmed influenza were particularly high among physicians (Adj OR 6.83, 95% CI 1.78-36.1) and nursing aides (Adj OR 2.32, 95% CI 1.02-5.29), and for staff active in private practices (Adj OR 4.53, 95% CI 1.65-12.41), hospitals (Adj OR 2.56, 95% CI 1.05-6.23), and nursing homes (Adj OR 2.44, 95% CI 1.08-5.53). No significant associations were found between confirmed influenza and being an administrative staff or a staff active in another or unknown profession.

In sensitivity analyses, we considered all individuals with unknown or missing activity in the healthcare system as not active instead of excluding them from the logistic regression models (Table S1). All associations found in the main analysis were confirmed. Associations were also consistent when restricting the data to cases and controls to individuals aged 15-64 years old (Table S2). Finally, to get a sense of the healthy worker bias present in our data, we compared the proportions of individuals working in different categories or work settings among our control population with available national statistics (Table S3). With the exception of nurses, all professional categories were rather underrepresented among controls. Comparing disease severity of ILI between healthcare workers

TABLE 1 Sample characteristics of influenza-like illness (ILI), respectively, rRT-PCR-confirmed influenza cases, and controls representing the general patient population of primary care practices of the Swiss sentinel network Sentinella, 2018-2019 influenza surveillance season

	Cases (ILI)	Controls	Cases (confirmed influenza)	Controls
N observation	N = 4287	N = 28 561	N = 346	N = 15 463
Median age in years (IQR)	33 (12-52)	52 (26-71)	35 (15-55)	54 (25-72)
N female (%)	2147 (50.1)	15 047 (52.7)	173 (50.0)	8174 (52.9)
Active in the healthcare system*				
Yes	235 (5.5)	872 (3.1)	23 (6.7)	434 (2.8)
No	3506 (81.8)	24 824 (86.9)	298 (86.1)	13 478 (87.2)
Unknown	546 (12.7)	2865 (10.0)	25 (7.2)	1 551 (10.0)

Note: *Missing activity and born before 1954 and after 2003 recoded as "not active"; otherwise recoded as unknown.

TABLE 2 Association between being active in the healthcare system and consulting for an influenza-like illness (ILI)

	Cases (ILI) N = 3741	Controls (ILI) N = 25 696	Crude OR (95% CI)	Adjusted OR (95% CI)
	n (%)	n (%)		
Not active in the healthcare system	3506 (93.7)	24 824 (96.6)	1	1
Active in the healthcare system	235 (6.3)	872 (3.4)	1.91 (1.65-2.21)	1.66 (1.40-1.97)
Profession if active in the healthcare system				
Nurse	61 (1.6)	259 (1.0)	1.67 (1.26-2.21)	1.28 (0.95-1.74)
Nursing aide	54 (1.4)	156 (0.6)	2.45 (1.79-3.35)	2.01 (1.42-2.85)
Medical assistants/ paramedics	24 (0.6)	66 (0.3)	2.57 (1.61-4.11)	1.46 (0.88-2.44)
Administrative staff	17 (0.5)	65 (0.3)	1.85 (1.08-3.16)	1.84 (1.02-3.30)
Physician	14 (0.4)	42 (0.2)	2.36 (1.29-4.33)	2.85 (1.47-5.53)
Occupational, physical therapy, dietitian	7 (0.2)	52 (0.2)	0.95 (0.43-2.10)	0.96 (0.41-2.24)
Laboratory and radiology technicians, pharmacy assistants	8 (0.2)	14 (0.1)	1.77 (1.32-2.36)	1.95 (1.40-2.72)
Pharmacist, dentist	2 (0.1)	14 (0.1)		
Other	31 (0.8)	101 (0.4)		
Unknown	17 (0.5)	74 (0.3)		
Work setting if active in the healthcare system				
Nursing home	76 (2.0)	198 (0.8)	2.72 (2.08-3.55)	2.06 (1.53-2.78)
Hospital	51 (1.4)	187 (0.7)	1.93 (1.41-2.64)	1.66 (1.18-2.32)
Private practice	31 (0.8)	80 (0.3)	2.74 (1.81-4.16)	2.26 (1.43-3.58)
Home-based care	13 (0.4)	56 (0.2)	1.64 (0.90-3.01)	1.53 (0.79-2.94)
Administration	7 (0.2)	8 (0.0)	1.29 (0.99-1.69)	1.24 (0.92-1.67)
Pharmacy	5 (0.1)	18 (0.1)		
Dentist, physical, occupational therapy	5 (0.1)	31 (0.1)		
Radiology, laboratory	2 (0.1)	18 (0.1)		
Rehabilitation	1 (0.0)	19 (0.1)		
Other	15 (0.4)	90 (0.4)		
Unknown	29 (0.8)	167 (0.6)		

Note: Missing activity excluded. Model adjusted for age (linear and quadratic), sex and cluster effect by practice. Unknown or missing activity excluded.

(HCW) and non-healthcare workers, there were 1.8% (4/218) clinical pneumonia among HCW, compared with 3.9% among non-HCW (126/3149), a difference that was not significant even after adjustment for risk of complication and age in a logistic regression model (Adj OR for pneumonia among HCW 0.56, 95% CI 0.20-1.54).

4 | DISCUSSION

In this study, individuals active in the healthcare sector were more likely to consult their primary care physician for an influenza-like illness, respectively, confirmed influenza, than for another reason. In terms of professional categories, the association was particularly strong for physicians and nursing aides. Surprisingly, being active either as an administrative staff or as any other or unknown profession in the healthcare system was also associated with an increased risk of consulting for an ILI. This could be due both to a higher risk of infection and to more sensitization in healthcare settings to abstain from work in case of ILI symptoms. In terms of work settings, private practices and nursing home particularly stood out, followed by hospitals.

The main limitation of this work is that health-seeking behavior of health professional in case of ILI may differ from the general patient population. However, we have few reasons to believe that health professionals would consult more frequently for ILI, a rather mild illness in the active population, than for other health issues, which would have led to overestimation of the association. On the contrary, previous studies have shown that health professionals tend to minimize ILI symptoms and continue to work despite recommendations against this.[16-18] There were not significantly less patients presenting with clinical pneumonia among healthcare staff. In addition, we recognize that it would have been preferable to sample controls from the patient population over the same time-period as the cases, but this was not considered feasible within the sentinel set-up, and would have probably resulted in many more missing data. By contrast with other

TABLE 3 Association between being active in the healthcare system and consulting for PCR-confirmed influenza

	Cases (confirmed influenza) N = 321	Controls (confirmed influenza) N = 13 912	Crude OR (95% CI)	Adjusted OR (95% CI)
	n (%)	n (%)		
Not active in the healthcare system	298 (92.8)	13 478 (96.9)	1	1
Active in the healthcare system	23 (7.2)	434 (3.1)	2.40 (1.55-3.70)	1.81 (1.13-2.90)
Profession if active in the healthcare system				
Nurse	4 (1.2)	124 (0.9)	1.46 (0.54-3.97)	1.15 (0.41-3.23)
Nursing aide	7 (2.2)	100 (0.7)	3.17 (1.46-6.87)	2.32 (1.02-5.29)
Medical assistants/paramedics	2 (0.6)	37 (0.3)	2.44 (0.59-10.19)	1.40 (0.32-6.24)
Administrative staff	1 (0.3)	40 (0.3)	1.13 (10.15-8.25)	1.24 (0.16-9.55)
Physician	3 (0.9)	20 (0.1)	6.78 (2.00-23.0)	6.83 (1.78-36.1)
Occupational, physical therapy, dietician	0 (0.0)	29 (0.2)	NA	
Laboratory and radiology technicians, pharmacy assistants	0 (0.0)	22 (0.2)	3.23 (1.40-7.45)	0.93 (0.93-5.46)
Pharmacist, dentist	0 (0.0)	6 (0.0)		
Other	5 (1.6)	39 (0.3)		
Unknown	1 (0.3)	17 (0.1)		
Work setting if active in the healthcare system				
Nursing home	7 (2.2)	114 (0.8)	2.78 (1.28-6.01)	2.44 (1.08-5.53)
Hospital	6 (1.9)	88 (0.6)	3.08 (1.34-7.11)	2.56 (1.05-6.23)
Private practice	5 (1.6)	46 (0.3)	4.92 (1.94-12.5)	4.53 (1.65-12.41)
Home-based care	0 (0.0)	32 (0.2)	NA	
Administration	1 (0.3)	7 (0.1)	1.47 (0.60-3.60)	0.89 (0.35-2.25)
Pharmacy	1 (0.3)	6 (0.0)		
Dentist, physical, occupational therapy	1 (0.3)	17 (0.1)		
Radiology, laboratory	0 (0.0)	7 (0.1)		
Rehabilitation	0 (0.0)	10 (0.1)		
Other	1 (0.3)	41 (0.3)		
Unknown	1 (0.3)	66 (0.5)		

Note: Missing activity excluded. Model adjusted for age (linear and quadratic), sex and cluster effect by practice. Unknown or missing activity excluded.

professional categories, we found no association between being active as a nurse and consulting for ILI. However, nurses were also more represented among controls than other healthcare worker categories, which could have biased the result toward the null.

This is the first study to explore the question of healthcare setting-associated influenza transmission from a primary care standpoint. Individuals active in the healthcare system appear to be overrepresented both among ILI and among confirmed influenza cases. The observed differences between professions and work settings could reflect different contact intensity between professionals and influenza-infected patients, as well as differences in adhesion to infection prevention and control measures.

However, our results suggest that other professionals working in health care, for example administrative staff, may also be at increased risk of influenza. One could argue that individuals not in direct contact with patients do not pose a particular hazard for vulnerable patients. However, they may contribute to the overall burden of circulating viruses. Besides, these professionals may also in contact with patients, for example when working at reception desks. Decreasing circulation of influenza viruses in healthcare settings is likely to be beneficial to patients. Also, for their individual health, staff should be informed of their increased risk of influenza if this finding is confirmed.

Currently, apart from influenza vaccination, most specific influenza control measures such as mask wearing focus on droplet transmission. More attention to standard precautions, including hand hygiene, surface disinfection, and ventilation, may be required to prevent influenza in the healthcare workforce at large. Our results suggest that private practices and nursing homes could constitute weak spots of infection control. While efforts to increase staff vaccination coverage should be sustained, specific infection control recommendations targeting these settings should be developed, taking into account their specificities. To guide such recommendations, further studies on transmission

modes and evidence on effective interventions should be directly generated in the relevant settings, and not extrapolated from hospitals. For example, a prospective cohort study among staff of primary care practices should be conducted to estimate infection rates without being confounded by differences in health-seeking behavior.

While sentinel practices do not constitute a representative sample of all primary care practices, we have no reason to believe that Sentinella practices would be more or less likely to have health professionals among their patients than other private practices. Also, the Swiss sentinel network covers all six regions of the country, and the demographic structure of the adult patient population is overall similar to the one of Swiss practices.[19] While these results cannot be used to extrapolate the proportions of professionals working in the healthcare system, we believe that the reported associations are valid. Still, we cannot exclude the possibility that health professionals were more likely to consult their physician for ILI, knowing that their physician was part of Sentinella. Overall, these findings certainly justify further attention to prevention of influenza transmission in the health system, particularly outside hospitals.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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Infection prevention and control measures in practices of the Swiss sentinel network during seasonal influenza epidemics

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SUMMARY

Background: There are limited data on the transmission of influenza in the context of primary care practices, despite the fact that a significant proportion of the population consult their primary care physician for an influenza-like illness every year.

Aim: To describe the use of influenza prevention and control methods in private practices of the Swiss sentinel network.

Methods: This online cross-sectional survey collected data about infection prevention and control measures in the 166 private practices of the Swiss sentinel surveillance network during the 2018–2019 influenza season. Questions pertained to the practice setting, infection prevention and control recommendations, influenza vaccination status of the physicians and their staff, adhesion to hand hygiene, and mask wearing.

Findings: Among the 122 practices that answered (response rate 73.5%), 90.2% of the responding physicians had been vaccinated themselves, and 46.7% (56/120) estimated that their staff vaccination coverage was >60%, although it was offered to employees in all practices. Most practices (*N*=68, 55.7%) had no specific recommendations for their staff concerning mask wearing. Most physicians reported washing or disinfecting their hands before examining a patient (*N*=91, 74.6%), after examination (*N*=110, 90.2%) and before a medical procedure (*N*=112, 91.8%). However, this rate was lower for arrival at the practice (*N*=78, 63.9%) and leaving the practice (*N*=83, 68.0%).

Conclusion: Most physicians in the Swiss sentinel surveillance network have been vaccinated themselves. However, the vaccination rates among their staff are low, despite vaccine availability. Hand hygiene measures were also suboptimal. These results warrant further efforts to implement infection prevention and control measures in the ambulatory setting.

Introduction

Influenza is a very common disease affecting a significant proportion of the population every year. While mild in most

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cases, it can be fatal for vulnerable groups. The roles of different transmission settings are largely unknown [1]. Schools and day care centres likely play an important role, as do hospitals for vulnerable groups [2]. However, the role of the primary care sector in the transmission chain is unclear, as most data on healthcare-associated infections are based on inpatient studies rather than the ambulatory sector.

Primary care physicians (PCPs) play key roles during the seasonal influenza epidemics, by vaccinating the population in particular vulnerable groups and managing the vast majority of influenza cases. For example, in Switzerland, it was estimated that during the 2018–2019 season, 2.5% of the Swiss population consulted a PCP for an influenza-like illness (ILI), defined as a history of fever (>38°C) and presence of either sore throat or cough [3]. Some primary care practices participate in the Swiss influenza surveillance system (Sentinella), on which the Federal Office of Public Health (FOPH) relies to officially declare each influenza epidemic season (defined as incidence of influenza above 68/100,000 population for the past season) [3]. This system is composed of primary care practices from all over Switzerland who take part voluntarily in epidemiological disease surveillance by sending ILI case data to FOPH, and collecting swabs and sending them to the National Reference Centre for Influenza for analysis [4]. These practices do not receive any additional training or extra material (apart from swabs) for infection prevention and control, as they are meant to be representative of Swiss primary care practices. Many countries have such a sentinel approach to monitor influenza epidemics, which is complementary to newer approaches based on voluntary self-reporting by the population via connected tools [5].

The main challenge with influenza infectivity is that people begin to be infectious 24 h prior to the appearance of symptoms. Therefore, infection control that solely targets symptomatic individuals (e.g. wearing a mask in the case of symptoms) is unable to prevent the transmission of influenza. In addition, transmission occurs via different routes, mainly by direct contact or droplets, but also via aerosols [6]. Furthermore, the clinical diagnosis of influenza is not reliable [7]. Concerning healthcare-associated infections, a study in Canada showed that 17.3% of patients admitted to hospital with a positive influenza test had acquired their infection in a healthcare facility [8].

Due to their daily interaction with sick people in general, and especially those with influenza, healthcare workers (HCWs) are at higher risk of infection [1], and also are more likely to transmit influenza virus, especially as they can be asymptomatic carriers [9–13]. For example, 23% of HCWs in four Scottish hospitals had likely acquired asymptomatic influenza infection during the season, defined as an increase of at least 50% in antibody titre, during the 1993–1994 epidemic [14]. A systematic review published in 2019 showed that there was very little data about interventions to reduce the transmission of influenza in primary care practices; most recommendations made in primary care are extrapolated from studies undertaken in inpatient settings [15]. A recent survey in The Netherlands showed that there were no proper data for healthcare-acquired infections treated by PCPs, and that some PCPs believed they were mainly related to hospital settings and not outpatient settings [16,17].

Even if the effectiveness of vaccination is difficult to assess, vaccination remains one of the only proven methods for prevention of influenza [18,19], leading to a lower rate of influenza infection in vaccinated HCWs [9]. A study in 2016 showed that the vaccination rate among HCWs was highly variable, and as low as approximately 40% in Europe compared with 77% in the USA [20]. A recent Italian study found a vaccination rate of 30% among PCPs [21]. In Switzerland, that rate was estimated to be approximately 16% for 2012 and 2017 [22].

General infection control measures, such as basic hand hygiene with soap and water or alcohol-based solution, are other recognized ways to reduce transmission [23,24]. The impact of air humidity is more controversial, as some degree of air humidity has been shown to reduce the infectivity of influenza [25], but in some tropical countries, the opposite seems to be true, with the rainy season increasing the risk [26]. Social distancing has been demonstrated as a safe measure to lower the transmission of influenza [27], as well as encouraging working from home for people symptomatic of ILI [28]. It should be noted that the role of transmission via contaminated surfaces remains controversial, as it is difficult to estimate the recontamination time of surfaces [24]. Despite the scarcity of direct evidence, there are guidelines concerning healthcare-related infection protection measures, such as those from the Centers for Disease Control and Prevention [29,30]. In Switzerland, no guidelines exist for ambulatory settings at national level, although some recommendations have been developed at regional level [31]. A national strategy has been developed specifically for influenza, but is general and is not specifically targeted at private practices, and the emphasis is placed on vaccination rather than other measures [32].

The aim of this survey was to describe the use of influenza prevention and control methods in practices of the Swiss Sentinella network, in order to inform whether further action is needed in terms of prevention of healthcare-associated influenza infection in primary care in Switzerland.

Methods

A cross-sectional survey was conducted among the 166 primary care practices of the Swiss sentinel network (Sentinella) between 12th March and 25th April 2019. The Sentinella network includes general practitioners and paediatricians from all over Switzerland, put in place by FOPH to monitor transmissible diseases in the country, mainly influenza. These private practices take part voluntarily in the collection of data.

In each Sentinella practice, a single physician is identified as the responder for the sentinel network. The number of practices can vary depending on how many practices choose to participate, but at the time of this study, it was 166. In 2019, 37.5% of Sentinella physicians were female, which is comparable to the proportion reported by the Swiss Physicians Federation [33].

The topics addressed by the questionnaire were as follows:

- number of physicians and their specialty; opening date of practice; number of staff per practice and their professions; staff vaccination coverage (previous season and plans for coming season);
- existence of practice recommendations and measures about prevention and protection methods (estimated percentage of staff vaccinated, mask availability and use, hand hygiene timing, type of room ventilation);

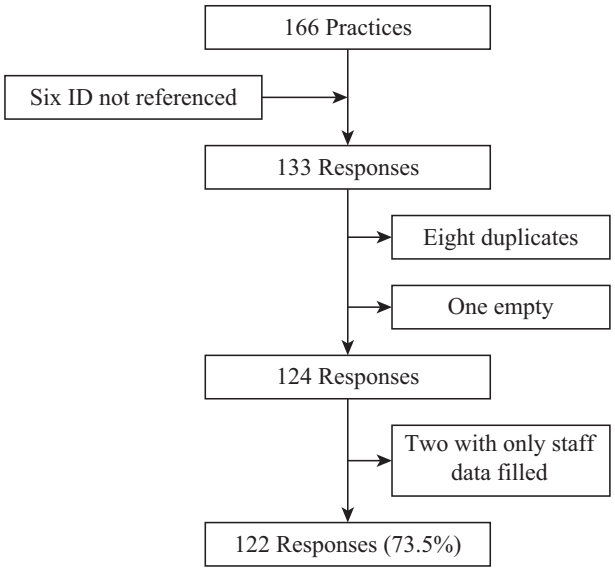

Figure 1. Flowchart showing the response rate of practices invited to participate in the survey on infection prevention and control measures. ID, identification.

- responding physician: self-reported frequency of hand hygiene (handwashing, alcohol-based disinfection);
- physical characteristics of practices: number of rooms, ventilation, availability of handwashing facilities, hydro-alcoholic solutions, frequency of room cleaning and furniture disinfection; and
- possibilities for isolation of patients with respiratory symptoms, and availability of masks and hydro-alcoholic solutions for patients.

The questionnaire, designed using REDCap (Research Electronic Data Capture, Vanderbilt University, Nashville, TN, USA), was piloted in French among three family physicians who were not Sentinella members, and reviewed by members of the Hospital Prevention and Control of Infection Committee of the Vaud district [34]. It was translated into German by a bilingual investigator, and a German-speaking staff member of FOPH reviewed the translation. French and German are the two main languages in Switzerland and the usual working languages in the Sentinella network. Finally, the questionnaire was approved by the Sentinella programme commission, which includes regional representatives of responding physicians, Swiss university institutes of family medicine, and FOPH. FOPH sent the link to the online questionnaire to all Sentinella members during epidemiological week 11 of 2019 (see online supplementary material). The link remained active until week 16, with one e-mail reminder. Participants who preferred paper-based data collection could print out a pdf version of the questionnaire, fill it in, and post it back to FOPH, who forwarded it to the investigators after removing personal information. A data entry clerk entered paper-collected data in the database. A descriptive analysis was conducted using Stata 15 (StataCorp, College Station, TX, USA).

Physician participation in the survey was voluntary and no specific written consent was required. FOPH manages the Sentinella system and guarantees participants' anonymity by using a unique code for each practice. The investigators had no access to identifying data. As the data contained no patient-specific information, it was not under the scope of the Human Health Research Law and did not require ethical review.

Table I
Practice characteristics from the Sentinella network during influenza season 2018–2019

	(*N*=122)	
Main practice specialty (with at least one specialist) (*N*, %)	*N*	%
General practice	108	88.5
Paediatrics	16	13.1
Number of staff (median, IQR)	Median	IQR
Number of physicians	2	1–3
Number of half-days of consultation per week per physician	7.5	5.7–9.0
Number of other staff	4	2–7
Number of full-time equivalent, other staff (30 missing)	2.6	1.6–4.0
Physical characteristics (median, IQR)	Median	IQR
Practice opening year	1999	1990–2011
Total number of rooms	7	6–10
Number of consultation rooms	3	2–4
Number of waiting rooms	1	1–1
Possibility of isolation of patients presenting with respiratory symptoms (*N*, %)	*N*	%
Separation within the same waiting area	8	6.6%
Isolation in a separate room	80	65.6%
Neither separation nor isolation	34	27.9%
Continuous ventilation (*N*, %)	26	21.3%

IQR, interquartile range.

Results

One hundred and thirty-three questionnaires were received from the 166 member practices of the Sentinella network (80.12%), of which 15 were paper-based. After removing duplicates and incomplete forms, and including non-referenced identifiers that were considered to be data entry errors and accepted as valid, there were 122 valid responses (73.5%, Figure 1).

Practice characteristics

Most practices included a general physician (88.5%) and/or a paediatrician (13.1%). Only a small number of physicians were from other specialties. The median number of physicians per practice was two, and they were consulting for a median of 7.5 half-days per week. There were four additional staff on average, mainly medical assistants, administrative secretaries or

Table II
Infection prevention and control practices in 122 private practices of the Sentinella network, 2018–2019

	N	% (missing excluded)
Vaccination		
Offered to staff	122	100.0%
Physicians aware of staff vaccination coverage (seven missing)	105	91.3%
Vaccination coverage		
Influenza vaccination of answering physician (one missing)	110	90.9%
Estimated vaccine coverage of staff (two missing)		
0–20%	18	15.0%
21–40%	22	18.3%
41–60%	24	20.0%
61–80%	21	17.5%
81–100%	35	29.2%
Availability of alcohol-based disinfection solution for staff (one missing)		
All year round	121	100.0%
During influenza epidemic season alone	0	0.0%
Not available	0	0.0%
Availability of alcohol-based disinfection solution for patients in the waiting room (one missing)		
All year round	63	52.1%
During influenza epidemic season alone	13	10.7%
Not available	45	37.2%
Availability of protective masks for patients (two missing)		
All year round	23	19.2%
During influenza epidemic season alone	34	28.3%
Not available	63	52.5%
Conditions of access to protective mask for patients		
In case of respiratory symptoms	52	42.6%
Freely accessible	24	19.7%
Other	46	37.7%
Recommendations regarding protective mask wearing for staff (multiple answers possible)		
During care to patients	14	11.5%
In case of respiratory symptoms	50	41.0%
If not vaccinated against influenza	15	12.3%
No specific recommendation	68	55.7%
Use of air humidifier in the consultation room (three missing)		
Yes	9	7.6%
No	110	92.4%

cleaners. The median number of consultation rooms was three, with one waiting room (Table I). In most practices, patients with influenza symptoms were asked to wait in a separate room (*N*=80, 65.6%); in other practices, there was no separation from other patients (*N*=8, 6.6%) or the question was not answered (*N*=34, 27.9%) (Table II).

Vaccination

Regarding vaccination against influenza, out of 122 responses, 110 (90.2%) physicians reported that they had been vaccinated themselves against influenza. Reasons given by those who had not been vaccinated were: having allergic reactions or an immunologic contraindication (*N*=2); having no interest in vaccination (*N*=2); getting influenza every year regardless of vaccination (*N*=1); never getting sick during the past decade (*N*=1); or forgetting (*N*=1). Vaccination was offered free of charge to employees in all practices, and most physicians reported that they knew (*N*=105, 86.1%) which staff members had been vaccinated. Staff vaccination coverage rates were estimated to be >60% and >80% in 46.7% (56/120) and 29.2% (35/120) of practices, respectively (Table II).

Hand hygiene

Most physicians reported that they washed or disinfected their hands before examining a patient (*N*=91, 74.6%), after examination (*N*=110, 90.2%) and before a medical procedure (*N*=112, 91.8%). However, this rate was lower on arrival at the practice (*N*=78, 63.9%) or when leaving the practice (*N*=83, 68.0%) (Figure 2).

Almost all practices provided access to hand sanitizer for their staff (*N*=121, 99.2%). Nevertheless, when it came to providing disinfectant to patients, this rate decreased, with some providing it only during the influenza season (*N*=13, 10.7%) or not at all (*N*=45, 37.2%) (Table II).

Mask wearing

Masks for self-protection were rarely made available to patients (*N*=63, 52.5%), with 28.3% (*N*=34) of practices providing them only during the influenza season and only 19.2% (*N*=23) providing access all year long. These masks were distributed either at the reception (*N*=52, 42.6%) or on free access (*N*=24, 19.7%). Some masks were also distributed by other means (46, 37.7%), but no further details were supplied. Regarding mask wearing by practice workers, the questionnaire asked which recommendations were given by the physicians to their staff; in the majority of cases, no recommendations were made (*N*=68, 55.7%). Some practices recommended that masks should be worn during patient care (*N*=14, 11.5%), or only with respiratory symptoms (*N*=50, 41%), or even if the staff member was not vaccinated (*N*=15, 12.3%).

Ventilation and cleaning

Natural ventilation with fresh air renewal by opening the windows in the waiting rooms was performed once daily in 36 (29.5%) practices, but the majority of practices did so more often (*N*=64, 52.5%). Fresh air renewal in consultation rooms occurred once daily in 30 (24.6%) practices, and multiple times per day in 76 (62.3%) practices. Continuous mechanical

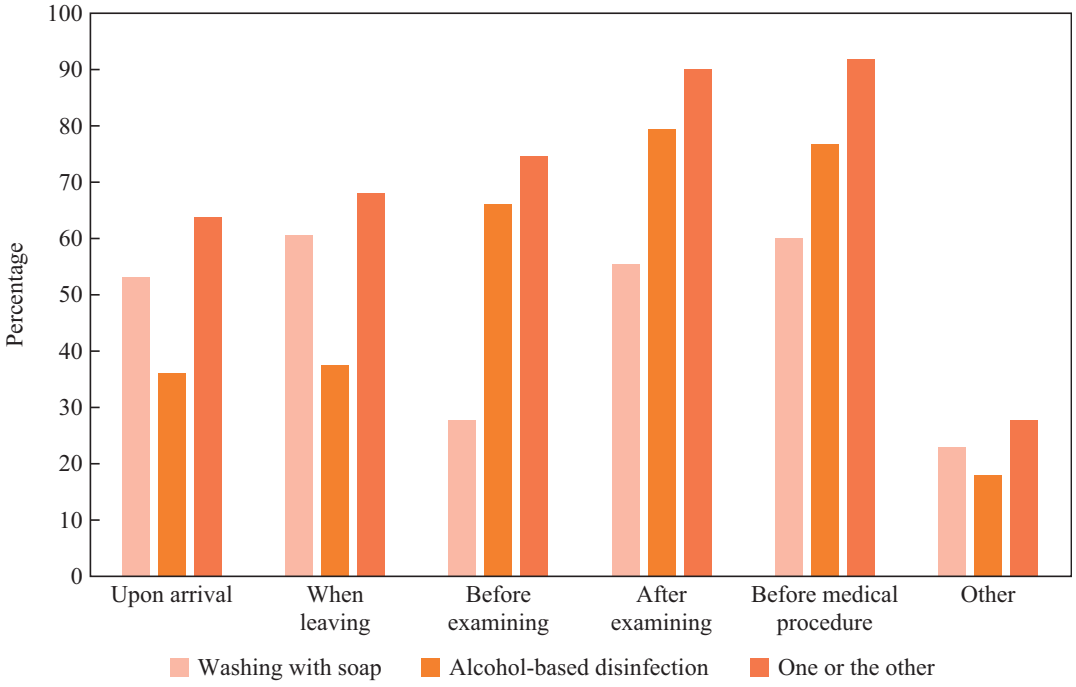

Figure 2. Hand hygiene measures and timing of physicians in the 122 responding practices of the Sentinella network, 2018–2019. Note that 'other' refers to an open question, which allowed participants to list additional handwashing moments, such as going to or returning from a break or from the toilet.

ventilation was present in 26 practices (21.3%), and nine (7.4%) practices used air humidifiers (Figure 3).

Discussion

This survey found that some infection prevention and control measures are already implemented in private practices of the Swiss sentinel network, but there is room for improvement. For example, reported vaccination coverage among physicians was excellent, but coverage in other staff was lower. Adherence to hand hygiene rules was good after examining a patient and before medical procedures, but suboptimal at other time points. Most practices were cleaning and ventilating their consultation and waiting rooms frequently, which may contribute to a reduction in the transmission of influenza. Patient isolation was rarely feasible when there is only one waiting room. There were often no clear recommendations about mask wearing, whether for staff or for patients. In general, Swiss PCPs are aware of the rules for hand hygiene provided by the World Health Organization (Clean your hands campaign), and also the national recommendations about vaccination [32].

This study has some limitations. First, the survey was based on self-declaration, which leads to inevitable desirability bias.

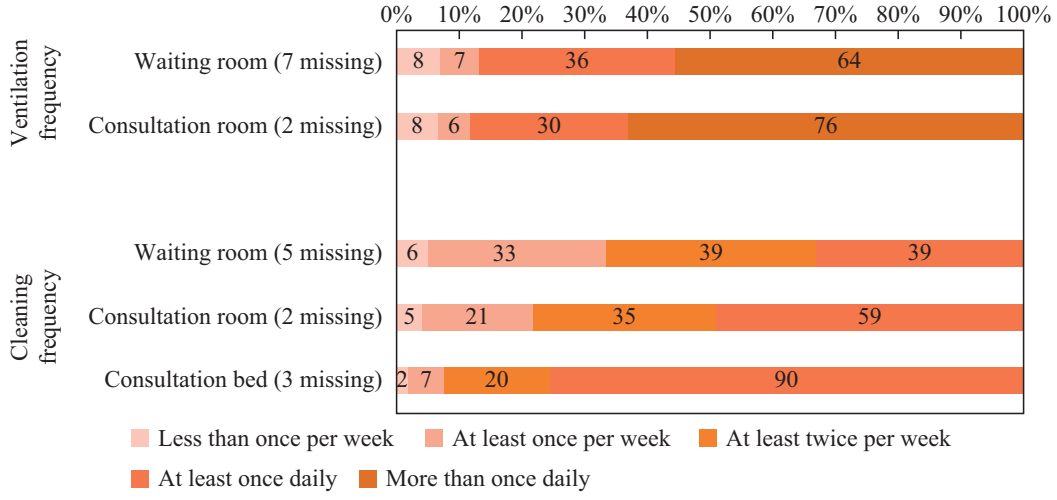

Figure 3. Ventilation and cleaning frequency of different places in the 122 responding practices of the Sentinella network, 2018–2019.

Second, the exact rate of vaccination coverage amongst the staff was not requested, instead asking for the rate estimated by the physician. However, assuming that the reporting physician follows the health of his/her staff, the given approximation is probably close to the reality. Third, regarding hand hygiene, despite good reported availability of hand disinfectants, the authors were not able to observe direct use by the staff or physicians, and data are only available for physicians and not their staff.

The influenza vaccination coverage among primary care staff was lower than the usual 75% coverage recommended by the World Health Organization [20,21]. Nevertheless, it was still higher than most rates found in the health sector around the world [20]. In comparison, an Italian study showed a vaccination rate of 22% among medical residents [11], but a French survey showed a rate of 78% for influenza vaccination among general practitioners [35]. This year in Switzerland, the estimated vaccination rate for HCWs was 23% [3]. A positive point is that the vaccination was offered in every participating practice, and that physicians themselves are vaccinated. They could act as role models to improve vaccination uptake among their staff, as this has been shown to be effective [20]. A systematic review demonstrated that vaccination of HCWs was associated with a lower risk of ILI for themselves [36] and that it drastically reduces the risk of infection for patients [19].

The hand hygiene questions revealed substantial variation; in certain conditions, proper hand hygiene was respected 90% of the time, whereas in the absence of direct contact with patients, this percentage was much lower. This is unsurprising as little attention has been given to hand hygiene in the primary care sector. The 'Five Moments for Hand Hygiene' advocated by the World Health Organization were developed for the hospital setting and may require some adaptation before implementation in the primary care context [23], considering that hand hygiene, if done properly, can reduce the transmission of influenza [24]. Many physicians use soap-based cleaning almost as frequently as alcohol-based hand rub, which was similar to the results of a Dutch study [16]. Hand hygiene could be optimized by a campaign from FOPH or specific training for private practices.

In addition, according to the results of this survey, there were often no clear recommendations given by the physicians in the participating practices about the use of protective masks for patients or staff. Despite the fact that mask wearing is recommended by most health authorities [7], some reviews showed that the protective effect of using masks was not proven against influenza [1,37], and a study in 2019 proved that there was no difference between high-filtration or normal medical masks [38]. The present study did not collect data on the utilization rate of masks by HCWs. Nevertheless, data were obtained on the availability of masks for staff for their personal use. It is hoped that this study will increase physician awareness of their role to implement the wearing of protective masks during seasonal respiratory epidemics.

In terms of generalizability, Sentinella practices may not be fully representative of Swiss family practices as they voluntarily participate in influenza surveillance, and may therefore be more concerned about infection prevention and control. However, the practices in this survey are comparable with Swiss primary care practices in terms of practice size and activity [33,39]. In addition, all Swiss regions are represented in the network. Although adhesion to prevention and control measures is likely to be better in Sentinella practices compared with the average Swiss practice, the weaknesses in prevention and control habits identified in this survey can still be used to develop better targeted recommendations.

The recent outbreak of coronavirus disease 2019 has revealed the general lack of awareness of infection prevention and control measures in primary care practices. Detailed guidelines should be developed for such settings, reinforced by targeted training and an audit system as performed in hospitals. While efforts have been made in the area of vaccination, domains of personal protective equipment and hand hygiene should also be reinforced. More evidence is needed regarding ventilation and room humidification.

More data are definitely needed in the field of infection prevention and control in primary care practices, as well as more evidence regarding the impact of specific measures and interventions to increase their implementation. In particular, hand hygiene and room ventilation should be recommended clearly and promoted intensely at practice level. In addition, specific studies assessing the effectiveness of staff vaccination and mask wearing on influenza transmission in primary care practices are required. As the first study of its kind, the data collected here are very valuable as they will pave the way for future, more comprehensive studies. In particular, it would be very interesting to repeat the survey during the COVID-19 pandemic to capture changes that took place in primary care practices.

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Conflict of interest statement
None declared.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jhin.2020.08.026.

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