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ABSTRACT

Background Appropriate and consistent facial protective equipment (FPE) use is critical for preventing respiratory illness transmission. Little is known about FPE adherence by home care providers. The purpose of this study is to adapt an existing facial protection questionnaire and use it to develop an initial understanding of factors influencing home care providers' adherence to FPE during the COVID-19 pandemic.

Methods A survey was shared with home care providers during Wave 2 of the COVID-19 pandemic in Ontario. Descriptive statistics and logistic regression by FPE adherence were conducted across individual, organizational, and environmental factors.

Results Of the 199 respondents (140 personal support workers; 59 nurses), 71% reported that they always used FPE as required, with greater adherence to masks (89%) than eye protection (73%). The always-adherent reported greater perceived FPE efficacy, knowledge of recommended use and perceived occupational risk, lower education, and not experiencing personal barriers (including difficulty seeing, discomfort, communication challenges).

Discussion Adherence rates were relatively high. In this context, with participants reporting high levels of organizational support, individual-level factors were the significant predictors of adherence.

Conclusions Initiatives addressing perceived FPE efficacy, knowledge of recommended use, perception of at-work risk, and personal barriers to use may improve FPE adherence.

Keywords: health care workers, respiratory protection, eye protection, adherence, home care, respiratory infection

INTRODUCTION

The COVID-19 pandemic has highlighted the importance of home care within the broader healthcare system and the tremendous value that home care providers offer by enabling clients to live and receive care safely at home, rather than in institutions. This value is directly related to the necessary focus on interrupting or stopping the transmission of infection, as evidenced by the much lower infection rates amongst both workers and care recipients in this sector (West et al., 2022). This sector, like others in global health care systems, faced extreme challenges early in the pandemic related to securing adequate supplies of facial protective equipment (FPE) and other necessary infection prevention and control (IPAC) supplies. These shortages were managed through extraordinary measures including rationing, extended use and limited reuse of these scarce resources (Shang et al., 2020; van den Bulck et al., 2022).

Home-based health care has important differences from institution-based health care (whether in hospitals or long-term care facilities) that impact infection prevention and control including differences in workforce composition, less convenient access to colleagues and supplies, and differences in pre-pandemicIPAC practices. The home care workforce is composed predominantly of unregulated ‘paraprofessional’ workers (known as personal support workers (PSWs), home care aides, home health aides, personal care aides) who provide 70-80% of paid home care (Home Care Sector Study Corporation, 2003). Nurses in home care may hold either a Registered Practical Nurse designation, which requires a 2-year diploma program, or a Registered Nurse designation, which requires a Bachelor’s degree. Home care workers typically work alone in clients’ homes, with relatively limited contact with colleagues (Lang et al., 2008) access only to the personal protective equipment that they carry or have pre-delivered to the client’s home, and little opportunity for just-in-time education on its use. Furthermore, while

hand hygiene and gloves are commonly used in home care and homecare providers are educated and trained in the appropriate use of facial protective equipment, regular use of face masks and eye protection was previously relatively uncommon, as these precautions were necessary in only a small proportion of client visits.

Facial protective equipment is a critical barrier to reduce the transmission of COVID-19 and other respiratory infections (McMichael et al., 2022) but adherence with recommended usage has historically been relatively low, even amongst health care workers. Although little work has focused on the home care setting (Houghton et al., 2020), studies that have examined FPE adherence by nurses in hospital and clinic settings have found that adherence rates are typically relatively low, at 22% - 44% (Nichol et al., 2013; Turnberg et al., 2008); the only study to have reported data separately for nursing assistants (another term for PSWs that is typically used in hospital settings) found adherence rates comparable to those for nurses in the same study (20% adherence to eye protection; 34% adherence to masks) (Turnberg et al., 2008). The sole published study focused on home care was a survey of 353 US nurses in a non-epidemic/pandemic context that found a self-reported rate of eye protection use to be 69%; rates of mask use were not reported (Adams et al., 2021).

Unsurprisingly, higher adherence rates are typically found in facilities and units specialized to care for patients with infectious diseases. Higher adherence rates have been found in Canadian hospitals caring for patients with SARS CoV-1 (77%) (with higher adherence to respiratory protection (94%) than to eye protection (74%)) (Shigayeva et al., 2007). High adherence has also been found to respirators and eye protection in Thai hospitals caring for patients with MERS

(100%) (Wiboonchutikul et al., 2016), and to masks in hospitals caring for patients with pandemic H1N1 in Thailand (74%), China (55%), Hong Kong (70-96%) and Singapore (82-88%) and the United Kingdom (25-62%) (Chokephaibulkit et al., 2013; Chor et al., 2012; Hu et al., 2012). Adherence can also change over time: Canadian health care providers caring for SARS CoV-1 patients had low adherence at the beginning of the epidemic (35% of shifts) in March 2003 but very high adherence (97% of shifts) only three months later (Shigayeva et al., 2007). Studies to date that have focused on the COVID-19 pandemic have reported mixed results. Studies conducted in some hospital and primary care settings have found near-perfect adherence to respiratory and/or eye protection (e.g. in Hong Kong, Oman and Italy) (Al Abri et al., 2021; Ippolito et al., 2021; Wong et al., 2021), while others have reported lower rates (e.g. hospitals in the UAE (78% mask adherence, 51% eye protection), the US (42-86%) and Ethiopia (35% masks adherence, 15% for eye protection) (Atnafie et al., 2021; Bani-Issa et al., 2021; Darwish et al., 2021; Sartori, 2021).

To inform interventions to promote adherence, it is necessary to understand the predisposing, reinforcing, and enabling factors that influence health care workers' choices regarding the use of FPE. At the individual level, previous work conducted in hospital and clinic settings has found adherence to be improved by having a longer tenure in a health care role, increased frequency of use, a higher perception of risk, positive attitudes toward FPE (including feeling protected by it), and an absence of personal barriers such as discomfort, visual clarity,interference of the FPE with care, and the impact on client relationships (e.g. communication difficulties or concern about offending clients) (Bani-Issa et al., 2021; Barratt et al., 2020; Nichol et al., 2013; Prakash et al., 2020; Sartori, 2021; Shigayeva et al., 2007). At the organizational and environmental

levels, adherence has been found to be greater when FPE is readily available, workers have clear training and clarity on FPE usage policies, and workers perceive high organizational support – including organizational, supervisory and peer support, positive communication surrounding health and safety, role modeling and instructional feedback from supervisors and managers, and support for changing work practices (Adams et al., 2021; Al Abri et al., 2021; Barratt et al., 2020; Chughtai et al., 2020; Hu et al., 2012; Shigayeva et al., 2007). The environmental and organizational influences on home care workers, who typically work alone in settings that are neither designed for care nor controlled and resourced by the employer, differ greatly from those who work in acute, clinic and congregate settings. Furthermore, the use of FPE was not previously common in this context. The sole study of home care nurses found adherence to IPAC protocols (including FPE use) to be promoted by having a sufficient supply of equipment and lack of in-home barriers; investigation of most of the above-listed individual, organizational, and environmental factors was beyond its scope (Adams et al., 2021).

Sector-specific research is needed to understand how nurses (both registered practical nurses and registered nurses) and PSWs in home care used FPE to limit the spread of respiratory illness during the COVID-19 pandemic. Such findings would provide employers with information on how to increase FPE adherence to safeguard the health of home care providers and their clients. To that end, the objectives of this study were to:

1. Adapt an existing Facial Protection Questionnaire (FPQ) instrument (Nichol et al., 2008; Nichol et al., 2013) for use with nurses and PSWs in home care during the present COVID-19 pandemic.

2. Pilot-test the survey with a moderate sample of home care workers (PSWs and nurses) to develop an initial understanding of the individual, environmental and organizational factors influencing their use of FPE during the COVID-19 pandemic.

METHODS

Study design and study participants

This study was designed as a pilot to inform a larger and more comprehensive multi-organizational project. It employed a cross-sectional survey design, with surveys administered at one large home care organization in the Greater Toronto Area of Ontario, Canada. Ethics approval was obtained from the University of Toronto's Research Ethics Board and the study purpose was shared with participants through the informed consent process.

Nurses and PSWs employed by the organization were invited to participate in the online survey via an email from the research team, forwarded by their supervisors. Participants were offered a $20 gift card as compensation for their time. The survey was available to participants from January 27, 2021 – February 10, 2021, during the second wave of the pandemic in the region studied. A reminder email was sent to nurses only on January 29th, 2021 to support the recruitment of a sufficient sample of respondents from this group.

Survey tool

The questionnaire developed for use in this study is an adaptation of the Facial Protection Questionnaire used by Nichol et al (2008, 2013) with nurses working in the acute care sector,

which follows the PRECEDE model to explore the Predisposing, Reinforcing, and Enabling Factors in Educational Diagnosis and Evaluation as adapted to understanding self-protective behaviour at work (Nichol et al., 2008). For the present study, the FPQ was adapted to reflect: (1) home care-specific language and working conditions; (2) the inclusion of unregulated healthcare providers (PSWs) as well as nurses (RPNs and RNs); (3) the circumstances of the ongoing COVID-19 pandemic, including changes to FPE usage guidelines resulting from supply shortages, and (4) a focus on droplet rather than airborne precautions to reflect contemporaneous local public health on preventing the transmission of COVID-19.

The new home care-focused, COVID-19-specific version of the FPQ (FPQ-HC-C19) was a 5-part, 95-item questionnaire, measuring demographics and work patterns (Part 1), individual factors that may affect adherence (Part 2), adherence to recommended use of FPE (Part 3), environmental factors (Part 4) and organizational factors that may influence adherence (Part 5). The survey is available upon request.

Part 1 included 15 items that measured demographic information, work patterns, and frequency of FPE use (daily, weekly, monthly, rarely, never) before and after the start of the COVID-19 pandemic. Participants responded using checkboxes or by filling in blanks.

Part 2 explored individual factors which may have affected adherence including knowledge of how COVID-19 is transmitted (5 items), knowledge of facial protection use and the effectiveness of preventative actions (7 items), exposure history and personal impacts (6 items), perception of risk (3 items), and personal barriers to the use of FPE (18 items). Most questions used Likert

scales (strongly agree/agree/neutral/disagree/strongly disagree), plus a 'don't know' option for the knowledge questions. The single exception was: "Do you know people who have been exposed to an infectious respiratory illness at work which resulted in a negative physical and/or mental health outcome?", which used a yes/no response supplemented by checkboxes to specify the relationship to these individual(s) (family member/close friend/colleague/someone else I know).

Part 3 examined adherence to recommended use of each surgical masks and eye protection within 2 meters of a client with a suspected or diagnosed droplet spread disease, both before (4 items) and since the start of the COVID-19 pandemic (6 items, including within 2 meters of any client, to reflect newly required IPAC practices). Responses for the time before the COVID-19 pandemic used a 5-point Likert scale (always/mostly/sometimes/rarely/never), while questions which asked about the participant's current practice used the same 5-point Likert scale, supplemented by a 'not applicable' option. For a respondent's current practice to be deemed 'adherent', they had to answer 'always' to all six of the current practice questions, thus reflecting adherence to the FPE use practices required at the time of the survey. This definition is stricter than was used in the original FPQ and reflects the heightened risk and demands for consistency during the COVID-19 pandemic.

Part 4 of the survey asked about environmental factors that could influence adherence: the availability of (4 items) and convenience of access to (2 items) FPE, and media coverage of COVID-19 (2 items). 5-point Likert scales (strongly agree/agree/neutral/disagree/strongly disagree) were used for each item, except a question about training dates.

Part 5 of the survey measured organizational factors, including organizational support for health and safety (6 items), absence of job hinderances (3 items), training (6 Likert-scale items plus a training date) and communication (7 items). All items are very similar to those from the original FPQ (which drew from established scales) and use 5-point Likert scales (strongly agree/agree/neutral/disagree/strongly disagree).

Finally, at the end of the survey, respondents were encouraged to share any additional information regarding FPE.

Pretesting of the survey tool

The revised FPQ was pre-tested by three PSWs and three nurses from the host home care agency. Feedback from these testers was used to simplify the survey flow, remove questions about the organization of the care environment that were deemed non-relevant, and adapt the phrasing of some questions to make their intent easier to understand. It is the final/revised version of the survey tool that is described above. This final tool contained 95 items.

Statistical Analysis

This study used descriptive statistics consisting of frequency distributions (proportions) or means for each variable separated by FPE adherence (‘Always adherent’ versus ‘Not always adherent’). Additionally, tests of significance through chi-square for categorical and t-test for continuous explanatory variables against adherence were performed with a significance threshold of $p \leq 0.05$. Lastly, a logistic regression was utilized to test the relative statistical significance of multiple

explanatory variables on FPE adherence. Adjusted odds ratios (OR) were used for interpretation, with a value of 1.0 signifying equal probability between outcome variable groups of always adherent versus not always adherent. All analyses utilized RStudio software (Version 1.4.1103). Supplementary analyses provided more detail about specific personal barriers to using FPE by providing proportions for each individual survey item as well as assessing combined personal barriers to each mask, face shield, and eye protection use.

RESULTS

Sample

Complete surveys were submitted by 199 participants – 140 PSWs (70.4% of the sample) and 59 nurses. Participants took an average of 19 minutes to complete the survey. The majority of respondents were female (92.5%) and the average age was 44 years (Table 1). Most respondents had full-time employment status (83.9%); respondents had an average of 9.3 years of experience in their roles. Having obtained a Diploma/Certificate as their highest educational attainment was more common (83.4%) than Bachelors/Masters/Doctoral degrees (16.6%).

Table 1 *Demographic characteristics of the sample*

Variable	**Description**	**n or Mean (% or SD)**
Sex	Female	184 (92.5%)
Age (years)	(continuous)	44.1 (10.4)
Highest Education		
	Diploma/Certificate	166 (83.4%)
	Bachelors/Masters/Doctoral	33 (16.6%)
Role		
	PSW	140 (70.4%)
	Nursing	59 (29.6%)
Tenure in role (years)	(continuous)	9.34 (7.72)
Tenure in role within primary employment organization (years)	(continuous)	6.56 (5.85)

Employment status		
	Full-time	167 (83.9%)
	Part-time/Casual	32 (16.1%)
Hours worked	(continuous)	34.2 (10.8)
Leadership Role	Yes	59 (29.6%)
More than one employer	Yes	65 (32.7%)
Employed in retirement or long-term care home	Yes	17 (8.5%)
Client Location		
	Private homes/apartments	167 (83.9%)
	Congregate care	24 (12.1%)
	Other	8 (4.0%)
Mode of travel to work includes driving	Yes	131 (65.8%)
Mode of travel to work includes public transit	Yes	86 (43.2%)
Mode of travel to work includes walking	Yes	40 (20.1%)

Adherence

The majority responded as always adherent with FPE (n=141, 71%), while approximately one-third reported not always adherent with FPE (n=58, 29%: mostly (n=26, 13%), sometimes (n=24, 12%), rarely (n=3, 2%), or never(n=5, 3%)). Adherence rates were 71% for both PSWs and nurses. FPE adherence rates differed by type, with higher adherence to surgical masks (n=177, 89%) than eye protection (n=145, 73%).

Univariate and bivariate analysis

Table 2 reports proportions/means and statistical significance (chi-squared or t-test) for each explanatory variable by the outcome variable for FPE adherence. Multiple factors were significantly correlated with FPE adherence. Education was significantly correlated with overall FPE adherence, with higher proportions of more educated individuals (Bachelors or above) in the not always adherent group (28%) versus the always adherent group (12%). Perceived efficacy was significantly correlated with FPE adherence; low perceived efficacy was more prevalent for those that were not always adherent (19%) versus those that were always adherent (4%).

Knowledge of FPE recommendations was significantly correlated with FPE adherence and the majority of the sub-sample that were not always FPE adherent demonstrated gaps in their knowledge of recommended use (64%). Perception of risk was significantly correlated with FPE adherence and perceived risk tended to be lower for those that were non-adherent (48%) versus those that were always adherent (32%). Use of surgical masks or eye protection prior to the COVID-19 pandemic was significantly correlated with FPE adherence during the pandemic.

Table 2 *Relationship between adherence with the use of facial protection and each demographic, individual, environmental, and organization factor*

			Always Adherent		**Not Always Adherent**		**p-value**
Variable	**Description**	**Level**	***n or Mean (% or SD)***		***n or Mean (% or SD)***		***Chi-square or t-test***
Demographic	Gender	Female	130 (92.2%)		54 (93.1%)		1.00
		Male	11 (7.80%)		4 (6.90%)		
	Age	(continuous)	45.0 (10.1)		41.9 (11.0)		0.07
	Highest Education**						**0.01**
		Diploma/Certificate	124 (87.9%)		42 (72.4%)		
		Bachelors/Masters/Doctoral	17 (12.1%)		16 (27.6%)		
Employment	Role						1.00
		PSW	99 (70.2%)		41 (70.7%)		
		Nursing	42 (29.8%)		17 (29.3%)		
	Tenure in role (years)	(continuous)	9.82 (7.75)		8.18 (7.58)		0.17
	Host organization as Primary Employer	Yes	118 (83.7%)		49 (84.5%)		1.00
	Tenure in role within primary employment organization (years)	(continuous)	6.84 (6.04)		5.90 (5.35)		0.28
	Employment status	Full-time	117 (83.0%)		50 (86.2%)		0.73
		Part-time and Casual	24 (17.0%)		8 (13.8%)		
	Hours worked	(continuous)	33.9 (11.1)		34.9 (10.0)		0.53
	Leadership Role	Yes	43 (30.5%)		16 (27.6%)		0.81
	More than one employer	Yes	46 (32.6%)		19 (32.8%)		1.00
	Employed in retirement or long-term care home	Yes	13 (9.22%)		4 (6.90%)		0.78
	Client Location						1.00
		Private homes/apartments	118 (83.7%)		49 (84.5%)		
		Congregate care	17 (12.1%)		7 (12.1%)		
		Other	6 (4.26%)		2 (3.45%)		

Individual	Mode of travel to work includes						0.82
		Driving	94 (66.7%)		37 (63.8%)		
		Public Transit	57 (40.4%)		29 (50.0%)		
		Walking	27 (19.1%)		13 (22.4%)		
	PPE use prior to COVID-19 (March 2020)	Frequent	17 (12.1%)		9 (15.5%)		0.67
	PPE use since COVID-19 (March 2020)	Frequent	141 (100%)		56 (96.6%)		0.08
	Knowledge of transmission	High	137 (97.2%)		55 (94.8%)		0.42
	Perceived efficacy**	**High**	**135 (95.7%)**		**47 (81.0%)**		**0.00**
	Knowledge of recommended FPE use*	**High**	**78 (55.3%)**		**21 (36.2%)**		**0.02**
	Exposure at work (self)	Yes	63 (44.7%)		29 (50.0%)		0.60
	Exposure at work (others)	Yes	43 (30.5%)		18 (31.0%)		1.00
	Relationship to known exposed individual						
		Exposure of family	12 (8.51%)		6 (10.3%)		0.89
		Exposure of friend	15 (10.6%)		5 (8.62%)		0.86
		Exposure of colleague	23 (16.3%)		5 (8.62%)		0.23
		Exposure of other (not family, friend, or colleague)	22 (15.6%)		9 (15.5%)		1.00
	Perceived occupational risk*	**High**	**96 (68.1%)**		**30 (51.7%)**		**0.04**
	Personal barriers to using any FPE	High	128 (90.8%)		53 (91.5%)		1.00
	Personal barriers to using a mask	High	120 (85.1%)		52 (89.7%)		0.53
	Personal barriers to using eye protection	High	85 (60.3%)		39 (67.2%)		0.45
	Personal barriers to using a face shield	High	110 (78.0%)		51 (87.9%)		0.16
	Pre-COVID mask use with suspected or diagnosed client**	**Not always**	**22 (15.6%)**		**21 (36.2%)**		**0.00**
	Pre-COVID eye protection use (face shield, goggles, fitted eye protection) with suspected or diagnosed client**	**Not always**	**30 (21.3%)**		**25 (43.1%)**		**0.00**
Environmental							
	Media influence	Yes	124 (87.9%)		47 (81.0%)		0.29
Organizational	Received training	Yes	119 (84.4%)		46 (79.3%)		0.51
	Organizational support for health and safety	High	102 (72.3%)		40 (69.0%)		0.76
	Absence of job hindrance due to FPE	High	29 (20.6%)		14 (24.1%)		0.71
	Access to FPE at work	High	129 (91.5%)		52 (89.7%)		0.89
	Convenience of FPE at work	High	123 (87.2%)		48 (82.8%)		0.55
	Communication + Support (peer, sup & org)	High	91 (64.5%)		35 (60.3%)		0.69

*p<0.05, **p<0.01

Multivariate analysis

After accounting for other factors within a single model via logistic regression analysis, our findings showed that most variables that were significant when considered independently (through chi-square or t-test) remained significant to FPE adherence (Table 3). Compared to participants who were always adherent to FPE (the reference group used for the outcome variable in the regression), those who were not always adherent were significantly more likely to have higher education, low perceived efficacy of FPE, low knowledge of recommended use of FPE, and low perceived risk. Although pre-COVID FPE use was significant in bivariate analyses, it was non-significant in the regression model. Additionally, once considering other factors in the full regression model, an absence of personal barriers to using a face shield was positively and significantly associated with high adherence.

Table 3 *Regression output for odds of not always adhering to FPE*

Variable	**Description**	**est.**	**SE**	**p**	**adjusted Odds Ratio (95%CI)**
Gender	male vs. female	0.29	0.77	0.71	1.09 (0.24, 4.92)
Age	continuous years	-0.02	0.02	0.34	0.98 (0.94, 1.02)
Highest Education**	Bachelors/Masters/Doctorate vs. Diploma/Certificate	1.41	0.54	0.01	4.37 (1.49, 12.82)
Role	Nursing vs. PSW	-0.35	0.48	0.46	0.65 (0.24, 1.71)
Hours Worked	continuous hours	0.00	0.02	0.79	1.01 (0.97, 1.05)
Travel to work includes driving	Yes vs. no	0.46	0.62	0.46	1.78 (0.5, 6.32)
Travel to work includes public transit	Yes vs. no	0.39	0.30	0.19	1.53 (0.83, 2.8)
PPE Use Prior to COVID-19	Frequent (Daily/Weekly/Monthly) vs. Infrequent (Rarely/Never)	0.76	0.60	0.21	1.91 (0.59, 6.19)
Knowledge of transmission	Low (SA/A to less than 4/5 questions) vs. High (SA/A to at least 4/5 questions)	0.56	1.01	0.58	1.66 (0.24, 11.54)
Perceived FPE efficacy***	Low (N/D/SD/DK to ANY variables) vs. High (SA/A to all variables)	2.11	0.66	0.00	9.15 (2.39, 35.08)
Knowledge of recommended FPE use**	Low (N/A/SA/DK to ANY variables) vs. High (D/SD to all variables)	1.01	0.41	0.01	2.7 (1.2, 6.11)

Exposure at work (self)	Yes (SA/A to all variables) vs. No (N/D/SD/DK to ANY variables)	0.26	0.41	0.53	1.2 (0.53, 2.75)
Exposure at work (others)	Yes vs. no	0.00	0.47	0.99	0.96 (0.37, 2.44)
Perceived occupational risk**	Low (N/D/SD/DK to ANY variables) vs. High (SA/A to all variables)	1.43	0.47	0.00	4.12 (1.57, 10.77)
Personal barriers to using a face shield*	Low (SA/A to zero barriers) vs. High (SA/A to at least one variable)	1.12	0.57	0.05	0.71 (0.27, 1.84)
Pre-COVID mask use with suspected or diagnosed client	Mostly/Sometimes/Rarely/Never (for either suspected and/or diagnosed client) vs. Always (with both suspected and diagnosed client)	0.03	0.84	0.97	3.18 (1.08, 9.39)
Pre-COVID eye protection use (face shield, goggles, fitted eye protection) with suspected or diagnosed client	Mostly/Sometimes/Rarely/Never vs. Always	-0.38	0.70	0.59	1.94 (0.7, 5.39)
Access to FPE at work	Low (N/D/SD/DK for ANY variables) vs. High (SA/A to ALL variables)	0.55	0.58	0.35	1.21 (0.23, 6.32)
Convenience of FPE at work	Low (N/D/SD/DK for ANY variables) vs. High (SA/A to ALL variables)	0.50	0.56	0.37	0.65 (0.17, 2.54)
Received training: KN thesis definition	No (N/D/SD/DK to 2+ variables) vs. Yes (SA/A to at least 5/6 variables)	0.21	0.53	0.69	1.72 (0.55, 5.41)
Media influence	Reported media influenced risk perception and work practices: No (N/D/SD/DK to ALL items) vs. Yes (SA/A to ANY variables)	-0.50	0.55	0.36	1.79 (0.6, 5.36)
Perceived organizational support	Low (N/D/SD/DK to ANY variables) vs. High (SA/A to all variables)	-0.08	0.46	0.87	1.17 (0.4, 3.45)
Job hindrances to working safely due to FPE	High (N/D/SD/DK to ANY variables) vs. Low (SA/A to ALL variables)	-0.40	0.55	0.46	0.67 (0.23, 1.96)
Organizational support/Communication	Low (N/D/SD/DK to ANY variables) vs. High (SA/A to ALL variables)	-0.16	0.47	0.74	0.85 (0.34, 2.14)

*p<0.05, **p<0.01, ***p<0.001. N/D/SD/DK represents neutral/disagree/strongly disagree/don't know. SA/A represents strongly agree/agree.

Footnote: Any survey variables excluded from the regression model were non-significant when included in the model and did not influence the significance of other variables when included. An exception was personal barrier variables for mask and eye use; when added to the model, personal barriers for face shields became non-significant. These three variables for personal barriers were highly correlated and personal barriers for face shields was most significant and therefore was retained in the model. In addition to meeting the criterion of non-significant when included and no impact on the trend in significance of other variables, reasons for exclusion were based on small sample size within a given category for that variable (N<10), high correlation with a similar variable wherein the other variable was more significant and therefore was retained in the model, and/or small proportional differences between outcome variable groups for that variable. More details are available upon request.

Barriers to PPE Use

Given the very high rates at which personal barriers to FPE use were reported, we further examined the specific barriers reported for each type of FPE. The most commonly-reported barriers to wearing FPE were visual ("glasses fogging", "difficulty seeing", and "face shield fogging"; 87% of respondents),

difficulty communicating (65%), and physical discomfort (57%). The majority of participants reported that wearing a surgical mask made it harder to do their job due to their glasses/eye protection fogging up (74%) and difficulty communicating with clients, families, or colleagues (59%). Difficulty seeing was commonly reported as a personal barrier making it harder to do their job when wearing eye protection (56%). The majority of participants reported that wearing a face shield made it harder to do their job due to their face shield fogging up (71%) and difficulty seeing (57%). Participants who reported that wearing a surgical mask made it harder to do their job due to difficulty breathing were significantly more likely to not always be FPE adherent (X^2 (1, n = *141*) = 4.06, *p = 0.043)*.

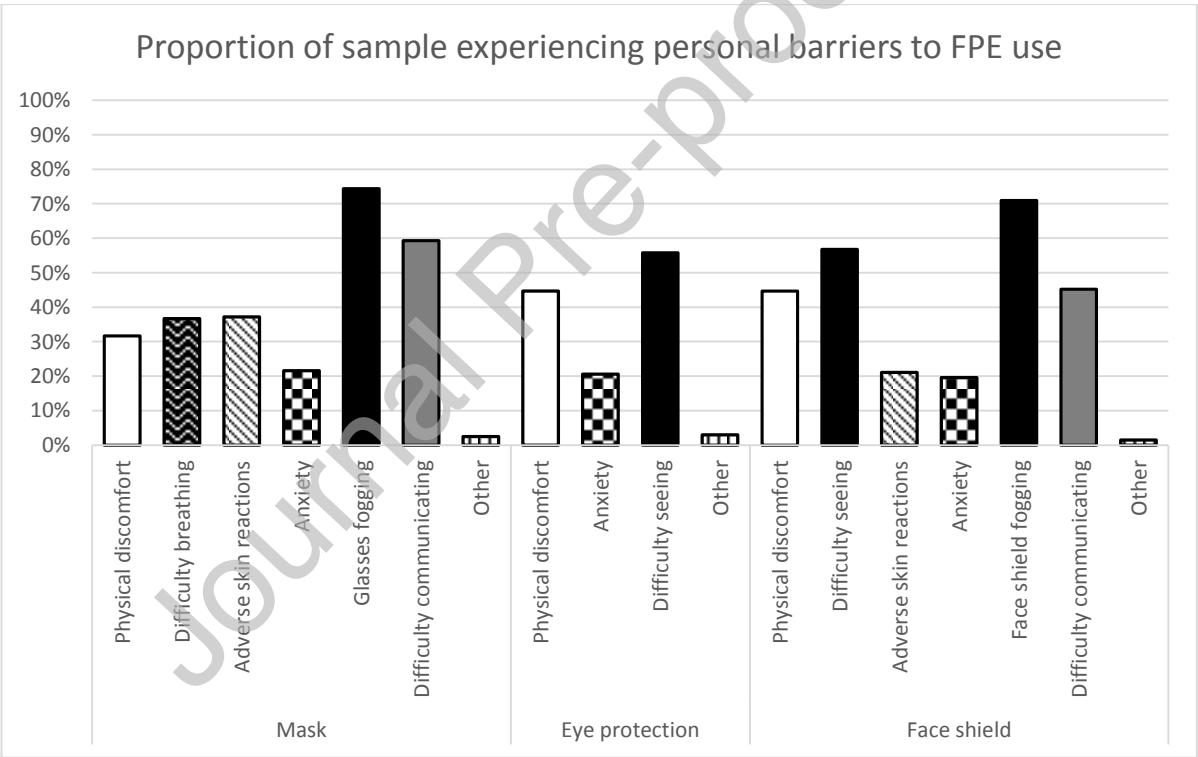

Figure 1: *Proportion of sample experiencing personal barriers to FPE use. Note that Visual barriers (black bars) were most prevalent for all types of FPE, followed by difficulty communicating when wearing masks or face shields (grey bars). Physical discomfort was also commonly reported with each type of FPE (white bars)*

DISCUSSION

Demographics

PSWs represented the majority of the sample (70%), consistent with the workforce composition at the participating care agency and proportions reported in the Canadian home care sector (Ontario Home Care Association, 2011). Demographic characteristics of gender, age, and education are comparable with previous findings for home/community-based PSWs (Sayin et al., 2019; Zagrodney et al., 2019) and nurses (Canadian Institute for Health Information, 2021; College of Nurses of Ontario, 2021). Compared to most samples, both PSWs and nurses in this study were more likely to be employed full-time, reflecting the unionized environment of the host agency.

Adherence

Self-reported adherence in this study was relatively high (71%), despite the strict definition used (always adherent to all elements of FPE). As in previous studies, adherence to surgical masks (89%) was higher than adherence to eye protection (73%) (Atnafie et al., 2021; Bani-Issa et al., 2021; Shigayeva et al., 2007). Note that using a similar definition to previous work by Nichol et al (2013) would have yielded a higher self-reported adherence rate (95%), which drastically exceeds the 44% found in hospital nurses in their study (Nichol et al., 2013) and is comparable to the very high rate (97%) seen in Canadian hospitals during care for SARS CoV-1 patients by the end of the SARS CoV-1 epidemic (Shigayeva et al., 2007). Previous work by Nichol et al found that FPE adherence was significantly higher for nurses who used PPE routinely (Nichol et al., 2013). With the COVID-19 universal masking and eye protection guidelines requiring use with every client at the host organization since May 11, 2020, routine use by providers was normalized by the time this survey was conducted (January and February of 2021); as frequency of FPE use has been found to promote adherence, this likely contributed to the high rate of adherence reported in the present study (Nichol et al., 2013). Baseline (pre-pandemic) data are not available in a Canadian home care setting or for personal support workers, but a study of US home care nurses found a pre-pandemic adherence rate for eye protection of 69% (Adams et al., 2021).

Organizational factors influencing adherence

In previous literature, organizational factors have been identified as substantially driving adherence to infection prevention and control measures (Adams et al., 2021; Barratt et al., 2020; Chughtai et al., 2020; Nichol et al., 2013; Shigayeva et al., 2007); however, they were not found to be significant predictors of FPE adherence in this study. Despite challenges related to global FPE shortages experienced throughout the health care sector (Shang et al., 2020; van den Bulck et al., 2022), the proportion of respondents who reported that their needs were well met at an organizational level was very high – FPE was available and conveniently accessible, the vast majority of staff reported receiving adequate training, and media attention regarding COVID-19 was high. While there was some diversity in perceptions of organizational support and communication related to health and safety, approximately two thirds of respondents in both the adherent and non-adherent groups reported high levels of support and communication. Although this study was carried out solely in the home care setting so direct comparison cannot be made, it is also possible that organizational factors play a lesser role in this sector, where providers typically work alone, compared to congregate settings such as hospitals, clinics and long-term care facilities. Another possibility is that under pandemic conditions with high levels of organizational support and FPE adherence, remaining barriers to adherence are found primarily at the individual level.

Individual-level factors influencing adherence

This study did find several individual-level factors which significantly influenced FPE adherence. Significant variables between bivariate and multivariate results remained consistent, suggesting a strong relationship between each of these variables and FPE adherence. In the full regression model, FPE adherence was significantly and positively related to lower education, higher perceived efficacy of FPE, higher knowledge of recommended use of FPE, and higher perceived risk of occupational illness. Although it is in some ways surprising that those with higher levels of education were significantly less likely to always adhere to recommended FPE use, there is a lack of clarity in the literature on the relationship between education and adherence, with some studies finding that professional staff demonstrate better adherence than those with less clinical training (Shigayeva et al., 2007) and others

finding that nurses demonstrate greater FPE adherence than physicians (Chor et al., 2012). A larger sample is required to understand whether level of education has the same impact on adherence for PSWs and nurses, and further research is warranted to understand why higher levels of education might correlate with lower levels of FPE adherence.

Consistent with previous literature on FPE use, perceiving the efficacy of FPE as being low, having a lower level of knowledge about FPE, and low perceived risk of occupational transmission were correlated with lower adherence to FPE use (Chughtai et al., 2020; Hu et al., 2012; Sartori, 2021; Shigayeva et al., 2007). For each of these factors, this suggests an opportunity to improve usage rates by engaging with staff to increase awareness of the risk of occupational transmission of respiratory infection as well as knowledge about and confidence in the use of FPE as an effective means of preventing this transmission.

Participants who experienced high personal barriers to using a face shield were significantly more likely to report non-adherence to FPE guidelines. Personal barriers to mask use were excluded from the regression model due to high correlation with personal barriers to face shield use, but full regression models incorporating either variable yielded similar outcomes. The most commonly-reported barriers to wearing masks, eye protection and face shields were visual (87% of respondents), difficulty communicating (65%), and physical discomfort (57%). These findings are consistent with previous literature which has reported personal barriers including visual clarity, interference with care, and comfort (e.g., fit, heat) as factors influencing non-adherence to FPE (Barratt et al., 2020; Chughtai et al., 2020; Prakash et al., 2020). These findings clearly indicate a need for improvements in fit and comfort to promote increased usage of FPE. As poor mask fit can also influence the degree to which glasses, goggles and face shields fog, fit may also impact this most common complaint. There is clearly a need for improvements in masks, goggles and shields to improve comfort and visual clarity and for these critical human factors to be taken into consideration in the design and selection of FPE.

Study Limitations

The study design used was cross-sectional, capturing behaviours and factors that influence them at only a single point in time. As participation was voluntary, those with strong views about FPE may have been more likely to respond. As with any survey study, bias due to recall and social desirability may be present. In the context of adherence, self-reported adherence rates may be higher than those observed in practice, making it likely that our data over-estimated true adherence rates to some extent.

This study represented a pilot implementation of a newly-adapted survey. As such, it employed a relatively small sample size meaning that only large effects could be detected. In particular, the relatively low number of participating nurses meant that the study was not sufficiently powered to allow comparison of how given factors may have different influences on personal support workers versus nurses. Further study, with a larger sample size, will allow such factors to be explored and may allow for testing with a more diverse sample. The present sample was drawn from a single home care agency serving primarily urban and suburban environments; future work should incorporate perspectives from other home care agencies, including those serving rural and small-town settings.

CONCLUSIONS

The home care nurses and PSW participants in this survey reported very high levels of adherence to FPE, with 71% reporting that they always wear both masks and eye protection or a face shield with all clients as required by the universal masking and eye protection requirements in effect at the time of the study (Wave 2 of the COVID-19 pandemic in Ontario, Canada). In contrast to previous findings, organizational and environmental barriers did not emerge as significant predictors of FPE adherence in this study. Results suggested that when these organizational and environmental standards were largely met, as was the case with this sample, individual factors became the significant predictors of FPE compliance. Higher adherence was significantly related to greater perceived efficacy of FPE, greater knowledge of recommended use of FPE, higher perceived risk of occupational illness, and a lower level of education.

Lower adherence was significantly correlated with reported personal barriers to face shield use (which was highly correlated with reporting of personal barriers to mask use). Very high levels of personal barriers to use were reported – most commonly visual barriers, difficulty communicating and physical discomfort. Policies, initiatives and education addressing perceived FPE efficacy, knowledge of recommended FPE use and perception of occupational risk would be expected to significantly effect FPE compliance in the home care sector. There may also be opportunities to improve adherence through reducing personal barriers through innovations to improve visual clarity, ease communication, and improve comfort.

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