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Application of MSD prevention practices by nursing staff working in healthcare settings

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ABSTRACT

Objective: The objective of this article is to examine the application of MSD prevention practices among nursing staff and to identify organizational factors that may or may not support their application.

Methods: We measured the application of prevention practices and its determinants by means of a questionnaire filled out by 399 nurses and nursing staff in Canada. A qualitative component was conducted with two focus groups in order to validate and enrich the interpretation of the survey results.

Results: Results show that most respondents "often" (4) apply MSD prevention practices in their daily professional tasks. Significant differences were observed based on position, mission of the institution, degree, and training.

Conclusions: The characteristics of the nursing staff (position, training, etc.) and the specificities of the setting must be taken into consideration in MSD prevention interventions for nursing staff.

1. Introduction

Work-related musculoskeletal disorders (MSDs) are a major problem among nursing care staff despite the availability of robust research on preventive practices in occupational health and safety (OHS). International literature reports the prevalence of this problem throughout Europe, Canada, the United States, Australia, and other parts of the world (D'Arcy et al., 2012; Kay and Glass, 2011). In the United States, for instance, the nursing profession has consistently been classified sixth among the top ten occupations with the highest occurrence of work-related MSDs (Bureau of Labor Statistics, 2013 cited in Bhimani (2014)). In Quebec (Canada), in 2016, nursing staff¹ in the health and social services sector alone reported 1,040 occupational time-loss injuries compensated by the Quebec health and safety commission (CNESST).² In average, this represents 63.3 compensation days and indemnities of \$7,749 per injury. Moreover, recent data on the prevalence of work-related MSDs in industrialized countries shows that they are recognized as a public health concern.

MSDs among nurses mainly occur due to patient manual handling

and care (Skoglund-Öhman and Kjellberg, 2011; Tullar, Brewer, Amick III, & al., 2010), as well as other handling activities, such as the moving of equipment (Kay, Glass and Evans, 2014). Numerous studies have found a direct link between the tasks performed by nurses, notably patient care, and the occurrence of back pain. In a systematic review of 89 articles published between 1980 and 2012 by Yassi and Lockhart (2013), patient handling appears to be the highest risk factor for the development of MSDs. Patient care activity is characterized by a large number of handling tasks that are physically demanding (Bos et al., 2006; Nelson and Baptiste, 2004; Wardell, 2007) and that present a high risk of injury (Mayeda-Letourneau, 2014). These tasks include lifting, moving, and repositioning patients (turning patients in their beds, helping them to position themselves comfortably in their beds, moving patients up or down on the bed, helping them get out of bed and into a wheelchair, and so on), as well as various tasks required in the course of the patient's everyday life, i.e. bathing, washing, dressing, and feeding, which also place nursing staff in stressful physical positions (D'Arcy et al., 2012; Dawson et al., 2007; Mayeda-Letourneau, 2014; Wardell, 2007).

It should be noted that in OHS, the application of preventive

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¹ For CNESST, nursing staff includes registered nurses (other than supervisors), nursing supervisors, and student nurses. It excludes nursing assistants.

² Data from NAICS 62 on occupational injuries involving nursing staff with CNESST compensated sick days.

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practices is often documented in order to evaluate the effectiveness of interventions or means of prevention (Berthelette et al., 2006; Nichol et al., 2008; Van Gemert-Pijnen, Hendrix, Van der Palen and Schellens, 2006). Furthermore, training and education programs are widely adopted as key injury prevention strategies, despite the fact that several studies identify the need for more comprehensive strategies and multi-dimensional workplace interventions (Clemes et al., 2010; K. Kay et al., 2014; Yassi and Lockhart, 2013). A number of studies have focused on identifying best prevention practices in order to reduce patient handling-related musculoskeletal disorders in nursing staff, along with the associated costs (Hignett, 2003; Thomas and Thomas, 2014). These studies show that the suggested preventive practices have changed considerably over time and are increasingly integrating a range of interventions, such as educational programs, exercise and physical conditioning programs, organizational policy, and use of mechanical handling equipment or other equipment (Dawson et al., 2007; Hignett, 2003; Tullar et al., 2010; Verbeek et al., 2011).

Some authors have pointed out that some risks could be avoided if nurses applied research-recommended preventive practices more effectively, for instance by using safe work methods and appropriate equipment for patient movement and care (Bos et al., 2006; Thomas and Thomas, 2014). In practice, however, the implementation of these preventive practices is much more complex than it appears. The study by Kay et al. (2014) shows that manual handling is more problematic in health care than in other sectors where only inanimate objects are handled. The condition of patients is associated with difficulties related to differences in cognitive abilities, level of cooperation and weight (Nelson and Baptiste, 2004). The limitations resulting from the conceptualization and management of manual handling can also hinder the development of effective interventions to prevent MSDs in nurses (Nelson and Baptiste, 2004).

Other factors relating to the dynamics of work environments are also identified as constituting significant barriers to the implementation of preventive practices (e.g., environmental safety culture, work organization, organizational support) (Garg and Kapellusch, 2012; Schoenfish et al., 2011; Thomas and Thomas, 2014). This highlights the importance of taking the work environment into account so as to solve the problems nurses face in relation to manual handling.

Several OHS researchers agree that the availability of compelling research results on preventive practices does not in itself ensure their application (Faurie et al., 2013). Many of these researchers stress the essential need to better disseminate knowledge resulting from research in this field (Kramer and Cole, 2003), and in particular the importance of properly analyzing the conditions that facilitate the adoption and application of best practices for MSD prevention when implemented in a real-life work environment (Faurie et al., 2013; Lortie et al., 2013; Roy et al., 1995).

After reviewing the literature, it is clear that there is a gap in knowledge about how MSD preventive practices are really applied in healthcare settings. Thus, this article purports to examine the application of MSD prevention practices among nursing staff and to identify organizational factors and socio-demographic variables that may or may not support their application. To this end, descriptive and comparative analyses will be carried out.

The first part of this article will be devoted to reviewing studies on best practices for MSD prevention among nurses. In the second part, we will detail our method and then present our results. Finally, we will discuss the main contributions of the study and their clinical significance.

2. Preventive practices among nursing staff

In their systematic review of 12 systematic reviews and 51 primary studies published before 2011 for all occupational sectors, Kuijer et al. (2014) differentiate between worker-directed and work-directed MSD prevention measures. Worker-directed preventive measures include

training in handling techniques, the use of back belts, and pre-employment medical examinations. Among work-directed preventive measures, some are aimed at eliminating manual handling, such as introducing patient and material handling equipment, and prevention methods. The goal of preventive practices is to improve handling situations, such as reducing the weight of the load, working height optimization, and reducing the horizontal lifting distance and sliding friction. Other preventive practices include organizational factors, such as regulations aimed at banning patient handling.

In their literature review, Nelson and Baptiste (2004) identify three categories of MSD prevention practices, referred to as “ergonomic solutions”: 1- *Technical practices*, such as changes to the workplace environment and layout, and equipment and patient handling device use in order to prevent work-related musculoskeletal injury; 2- *Administrative practices*, such as patient handling procedures (“no manual handling” policy, for instance), patient evaluation protocols, and the creation of patient transfer teams; and 3- *Practices related to behavior and/or work practices*, including education and training of nursing staff in body mechanics and techniques, training in the proper use of patient handling equipment, and the presence of “peer leaders”.

In fact, studies highlight two types of preventive practices: single-component practices focusing on a single aspect, and multi-component practice involving interventions that combine a range of components.

2.1. Single-component practices: training program-centered prevention practices

Historically, education and training about body mechanics and patient handling techniques have been widely used in order to reduce the occurrence of MSD in nursing staff (Garg and Kapellusch, 2012; Kay and Glass, 2011; Krill et al., 2012; Wardell, 2007). Training remains the preferred prevention approach in organizations as regards back pain (Clemes et al., 2010; Kay and Glass, 2011) and is widely implemented in the healthcare sector (Nelson and Baptiste, 2006). However, the literature shows that this method, when used in isolation, has consistently failed to reduce musculoskeletal disorders in nursing staff (Krill et al., 2012).

The content of training programs is often centered around teaching patient handling techniques (Kay et al., 2014). This is true despite the fact that the initiated approaches vary: training may be practical and/or theoretical, it may concern techniques for moving patients, biomechanical and ergonomic principles, or equipment use (Bos et al., 2006; Dawson et al., 2007; Hignett, 2003; Tullar et al., 2010). It can be offered in the workplace or as part of the nursing student curriculum (Dawson et al., 2007). Other training programs focus on physical exercise such as muscle training, stretching, and endurance (Clemes et al., 2010; Dawson et al., 2007; Tullar et al., 2010). These exercises can be done at home or in the workplace (Dawson et al., 2007). In addition, the design of these training programs can vary significantly from one organization to another in terms of frequency, duration, participants, and so on. According to a systematic review by Verbeek et al. (2011) of 18 articles published between 1981 and 2010, of which 12 deal with nursing staff, the duration of training varied from a single briefing on patient handling to a two-year-long training at the rate of 1 h per week. Groups are generally made up of no more than 15 people. The training personnel is either a colleague or, more generally, an ergonomist. In some cases, traditional training is supported by follow-up and feedback (Verbeek et al., 2011).

As for training effectiveness, the literature review carried out by Clemes et al. (2010) reveals that the handling techniques learned by workers in the context of their training are not put into practice at work. In their empirical study, Skoglund-Öhman and Kjellberg (2011) make the same observation, showing that home care services staff is unable to apply the techniques learned during training due to a variety of obstacles related to the physical work environment, the expectations of the individuals receiving care and their families, as well as work

organization. In their empirical study analyzing staff training programs, Kay and Glass (2011) also contend that despite prior training, nursing staff fails to master MSD prevention principles. These authors report that 82% of nursing staff stated that they use safe handling practices, while only 18% provided the right answers in manual handling knowledge assessments. These results concur with literature demonstrating that strategies which are focused on training only neglect essential aspects of successful manual handling management (Kay and Glass, 2011). Education and training alone are therefore not effective: they should be combined with other interventions in order to effectively prevent MSD injuries (Skoglund-Öhman and Kjellberg, 2011).

2.2. Single-component practices: prevention practices focused on technical or organizational intervention

The literature shows that prevention practices which focus on a *single technical intervention* are frequent. In this context, prevention practices are generally limited to implementing the use of MSD prevention equipment. According to a systematic review by Hignett (2003) of 63 articles published between 1960 and 2001, only two studies report equipment supply as a single-component intervention, therefore rare. Back belt use is also mentioned (Dawson et al., 2007; Nelson and Baptiste, 2004; Verbeek et al., 2011). Back belts were widely used in the 1990s to prevent back injuries in the context of care, but there is no evidence that they are effective (Nelson and Baptiste, 2004).

Some single-component prevention practices also focus on *organizational intervention only*. An example in point is creating transfer teams according to Hignett (2003) and Nelson and Baptiste (2004). The members of these teams are skilled in the techniques of patient handling and their role is to help other staff perform high-risk patient transfers. In other words, in order to help other workers perform their tasks, the task of high-risk patient handling is entrusted to care staff that is trained for this purpose (Nelson and Baptiste, 2004). Based on three studies, there is moderate evidence of the effectiveness of the use of patient handling teams as a single-component intervention (Hignett, 2003). According to a systematic review by Tullar et al. (2010) of 19 articles published between 1980 and 2009, only one study relies solely on the establishment of a participatory ergonomics team. This team brings together members of staff who identify, assess, and make recommendations in relation to manual handling. In the authors' view, evidence is lacking as to the effectiveness of these single-component interventions in reducing MSD in nursing staff.

2.3. Multi-component prevention practices: Safe Patient Handling programs

Most interventions are based on training combined with other activities, referred to in the literature as *multi-factor interventions*. Research highlights the development of multi-aspect interventions including a variety of components combined into a program in order to face the problem of manual handling instead of integrating one element in isolation (Kay et al., 2014). These prevention programs related to patient handling are designated in various ways in the literature, such as *Safe Patient Handling Program (SPHP)* (Krill et al., 2012; Wardell, 2007), *Safe Transfers Every Person Succeeds (STEPS)*, *Safe Patient-Transfer Training Program (SPTTP)* (Carta, Parmigiani, Roversi, & al., 2010), *Multidisciplinary Prevention Intervention* (Schoenfisch et al., 2011), *Ergonomic Program* (Garg and Kapellusch, 2012), and *The Quality Improvement Intervention* (Bhimani, 2014).

These programs involve at least two components. In the case of MSD prevention practices characterized by two-component interventions, they generally consist in a combination of training and the use of handling equipment (Bos et al., 2006; Dawson et al., 2007; Verbeek et al., 2011). In their empirical study, D'Arcy et al. (2012) mention prevention measures that include training provided in the workplace and the introduction of handling equipment. Multi-component

interventions commonly include an organizational or management policy to support safe handling practices (such as a zero-handling policy), specific equipment (slide sheets, ceiling-mounted patient lifting hoists, or mobile patient lifts), risk assessments, staff training, and use of specific transfer techniques (Thomas and Thomas, 2014). The prevention program components and design are numerous and may vary.

Review of these studies suggests that, over the last 15 years, use of handling material has become an important part of prevention programs in healthcare facilities (Kay et al., 2014; Thomas and Thomas, 2014; Tullar et al., 2010). A large number of organizations focus on supplying equipment such as ceiling-mounted patient lifting hoists in order to reduce physical stress in nursing staff in the context of patient transfer (Thomas and Thomas, 2014). Some of these facilities have implemented zero-lift policies (Tullar et al., 2010). This body of literature suggests that care facilities adopt a great variety of prevention practices. Consequently, chosen practices are often used in isolation and only address one or two dimensions of prevention (equipment and/or training, for instance). However, a growing volume of research underscores the importance of developing more integrated prevention programs that implement a number of combined interventions.

3. Method

3.1. Participants and procedure

Our study is aimed for nursing staff in the public health and social services network in Quebec (Canada). The population reached is made up of women and men occupying the positions of nurse, nursing assistant, assistant head nurse, nurse clinician or nursing counselor and nurse practitioner working in the various institutions of the public network, either in hospitals (CH), in long-term care residential centers (CHSLD) and geriatric institutes, local community service centers (CLSC), general and specialized care hospitals (CHSGS), university hospitals (CHU), affiliated hospitals (CHA), rehabilitation centers (RC), psychiatric hospitals (CHp) and private licensed centers (residences).

We conducted a survey of nursing staff working within the health and social services network. Given the impossibility of obtaining a list of respondents' emails, the questionnaire was relayed from the project partners' websites, newsletters and Facebook pages. All aspects of the survey announcement procedure, follow-up and reminder messages were discussed and established with a follow-up committee. The sample is considered a convenience sample, given that the respondents are solicited by the trade union centers that represent them. Several validation steps were followed to ensure the validity of our questionnaire, its relevance, intelligibility, and completeness.

A total of 426 questionnaires completed by study respondents were collected. After reviewing the data, 25 questionnaires were excluded due to their ineligibility for the study with respect to the practice area criterion (5 respondents not working in any region of Quebec province), the institution's mission (4 respondents: 3 religious institutions, 1 factory) and the position (16 respondents: 7 beneficiary attendants, 5 respiratory therapists, 2 head nurses, 1 coordinator, 1 coach). Two other questionnaires were withdrawn due to the large number of missing data. Statistical analyses were therefore carried out on 399 respondents.

We then held two focus groups to enrich our analysis and interpretation of the survey results. Managers and nursing staff participating in both focus groups were selected in order to have profiles that are as diverse as possible, based on their experience in the healthcare system, their home unit, the position they held and their knowledge of how to apply preventive practices in their workplace. This selection strategy provided a better understanding of the specific workplace conditions in each instance and how they could influence the implementation of MSD prevention measures in practice.

A certificate of ethics from the institutional research committee was obtained prior to the start of our data collection.

3.2. Collected data

The study questionnaire covers several dimensions of the application of preventive practices. This article will present the results on knowledge application; comparative analyses will be carried out according to socio-demographic variables also included in the questionnaire and reported by the study population.

We measured knowledge application as a series of activities, based on Cohen and Levinthal (1990), Zahra and George (2002) and Todorova and Durisin (2007). In the questionnaire, respondents were asked to assess how frequently they engaged in each of the four preventive practices over the last 12 months, using a 5-point scale ranging from 1 (never) to 5 (very often). The four preventive practices are: 1- the application of SPHM (Safe Patient Handling and Movement) guidelines,³ a multi-component intervention that includes training and handling agent; 2- the application of good practices about the use of mechanical assistance for handling or moving a patient; 3- the application of good practices with respect to the assessment of the level of assistance required by the patient before his or her transfer (e.g., level of mobility, cognitive conditions, etc.); 4- the application of good practices with respect to the inspection of the condition of the handling or moving of equipment.

The review of the literature brought us to measure, in nine questions, the factors that are likely to influence the application of preventive practices in organizations (Thomas and Thomas, 2014). These include training, tools, meetings, policies and places of exchange between work team. Furthermore, we measured the barriers to the application of preventive practices in six questions concerning the lack of time, training or support, the non-availability of a resource person and the unavailability or difficulty of accessing equipment (Garg and Kapel-lusch, 2012; Schoenfisch et al., 2011; Thomas and Thomas, 2014).

The focus groups were led by two researchers and a research assistant. The collected data was analyzed using qualitative data processing software (QSR, NVivo, version 11). The initial categorizations retained were consistent with the main dimensions of the questionnaire since it was a question of recording participants' impressions of the survey results and the meaning they gave to these results. The emerging concepts of the interpretations given by the respondents made it possible to identify sub-categories which were validated after consensus between two coders and a validation with the literature.

3.3. Data analysis

Descriptive analyses of our sample were carried out in order to identify the profile of our respondents based on their socio-professional characteristics. Then, confirmatory analyses of the variables were performed using the partial least squares method and using SmartPLS software. These analyses made it possible to verify the convergent validity (reliability) and the discriminating validity of our constructs.

Comparative analyses of the averages of the application of preventive practices according to socio-professional characteristics were carried out using ANOVA. These analyses identified differences in knowledge application averages based on (1) the position, (2) the mission of the institution of affiliation, (3) the basic training (the last completed degree) and (4) the training provided by the employer.

The data collected in the two discussions were analyzed using qualitative data processing software (QSR, NVivo, version 11). The initially selected categorizations were consistent with the main dimensions of the questionnaire since they were designed to capture the participants' impressions of the survey results and the meaning they gave to these results. The concepts that emerged from the interpretations

³ The SPHM program is recognized by the Ministry of Health and Social Services (MSSS) in the province of Quebec (Canada) and is taught in vocational training centers.

given by the respondents made it possible to identify subcategories that were validated after reaching consensus between the two coders and validation with data from the literature.

4. Results

4.1. Survey respondent characteristics

Analyses of the distribution of respondents by gender show that the majority are women, 89.8%, with men representing only 10.2%. The most represented age group among respondents is 25–34 years of age with about one third of respondents, or 34.7%, followed by 35–44 years of age (27.8%) and, in a smaller proportion, 45–54 years of age (21.4%). The proportion of younger nursing staff (8.3%) and older nursing staff (7.8%) is small. Lastly, the average age of respondents is 38.7 years.

Analyses of the distribution of respondents by position show that 40.1% are nurses (group P1), 25% are nurse clinicians or nursing counselors (group P2), 24.9% are nursing assistants (group P3) and 10% are assistant head nurses (group P4).

Of all respondents surveyed, 43.4% identified hospitals (CH) (group A1) as their main place of affiliation. General and specialized care hospitals (CHSGS), university hospitals (CHU) and affiliated hospitals (CHA) are the second most important affiliation of respondents with a percentage of 21.6% (group A2), followed by CHSLD (public and private) and geriatric institutes (group A3) with a percentage of 15.5%. 10.6% of our sample is affiliated with CLSC (group A4), while other affiliation sites have a lower percentage of 3% (groups A5, A6 and A7).

Regarding the level of education completed by the nursing staff surveyed, the results indicate that approximately one third have completed the college degree level (group D1), or 34%, while another one third (33%) have a bachelor's degree (group D2), followed by 19.3% who have completed secondary school (group D3). The proportion of nursing staff with another degree is relatively lower, with 9% for the university certificate (group D4), 4.6% for the specialized graduate degree and the master's degree (group D5).

For training, 74.8% of respondents indicated that they had not received any hours of training on MSD prevention by their employer in the last 12 months (group T2) and 10.2% mentioned that they do received it (group T1).

The profile of Focus group participants and a table of acronyms are presented in Tables 1 and 2 respectively.

4.2. Application of preventive practices

As for the application of preventive practices, the frequency distribution of statements corresponding to the application of MSD

Table 1
Focus group participant profiles.

Focus group 1	Focus group 2
1-01 Nurse, ambulatory care unit, CLSC	2-01 Nurse, 27 years (exp), delivery room, children's hospital)
1-02 Nursing assistant, CH	2-02 Nurse, 7 years (exp), home care
1-03 Nurse clinician, 6 years (exp), psychiatric hospital	2-03 Head nurse, 11 years (exp), surgery, CHU
1-04 Nurse, 7 years (exp), emergency, triage, children's hospital	2-04 Director of human resources, CHU
1-05 Nurse, 5 years (exp), emergency, triage, children's hospital	2-05 OHS advisor, SPHM trainer
1-06 Nursing assistant, 10 years (exp), neonatology, children's hospital	2-06 Head of care and services, CHU
1-07 Nursing assistant, 5 years (exp), neonatology, children's hospital	
1-08 Nursing assistant, 9 years (exp), neonatology, children's hospital, floating staff	

Table 2
Table of acronyms.

• CH:	Hospital Center
• CHA:	Affiliated hospital center
• CHp:	Psychiatric hospital center
• CHSGS:	General and specialized care hospital
• CHSLD:	Long-term care residential centers
• CHU:	University hospital center
• CLSC:	Local community service center
• CNESST:	Commission des normes, de l'équité, de la santé et de la sécurité du travail (Quebec's occupational health and safety commission)
• MSSS:	Ministry of Health and Social Services
• SPHM:	Safe Patient Handling and Movement guidelines
• RC:	Rehabilitation center

prevention practices on the part of nursing staff shows that they “often” (4) apply MSD prevention practices in their daily professional tasks (median of 4 “often” except for the statement on the inspection of the condition of the patient transfer equipment, which obtains a median of 3 “sometimes”) (Table 3). Moreover, 73% of nursing staff report applying SPHM guidelines often or very often. These results reflect the fact that this program is recognized by the Ministry of Health and Social Services and is even taught in vocational training centers.

ANOVA tests were conducted to determine whether there were differences in the application of knowledge on preventive practices depending on the position, the mission of the institution of affiliation, the degree, and whether MSD prevention training is provided by the employer.

4.2.1. Differences by position

The results of the ANOVA tests with respect to the application of knowledge on MSD prevention practices by nurse position reveal statistically significant differences. Indeed, after verifying the null hypothesis of equal variances by the Levene test ($p > 0.05$), the ANOVA results indicate differences between the groups [$F_{(3, 343)} = 7.93$; $p < 0.001$] (Table 4). The results of the post-hoc test with the Bonferroni comparison show that the application of knowledge on preventive practices is on average higher among nurses (group P1) than among nurse clinicians or care counselors (group P2), nursing assistants (group P3) and assistant head nurses (group P4).

4.2.2. Differences by mission of the institution of affiliation

Following unsuccessful attempts to test the null hypothesis of equality of variances by means of the Levene test ($p < 0.05$), the results of the ANOVA (Welch test) also reveal significant differences in the application of knowledge [$p < 0.01$] on preventive practices between groups based on the mission of the institution of affiliation (Table 5). In addition, the results of the Tamhane test show that nursing staff affiliated with the CH (group A1) apply on average more acquired knowledge on preventive MSD practices than those working in CHSGS, CHU, CHA, and CH (group A2). In addition, the results of the Tamhane test show that nursing staff affiliated with the CH (group A1) apply on average

Table 3
Application of MSD prevention practices.

Indicate how often, in the last 12 months, you have performed one of the following actions as part of your daily professional activities:							
(n: 399)	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Very often (5)	DNK/ DNA ^a	Median on a scale of 1 to 5
	(%)	(%)	(%)	(%)	(%)	(%)	
a. I have implemented the SPHM (Safe Patient Handling and Movement) guidelines;	2	5	13	30	43	7	4
b. I have implemented the recommendations regarding the use of a mechanical assistance device for the transfer or movement of a patient (e.g., patient lift);	13	15	17	16	23	16	4
c. I have assessed the level of assistance required by the patient prior to transfer or movement (e.g., level of mobility, cognitive condition, etc.);	2	4	16	26	43	9	4
d. I have inspected the condition of the patient transfer or movement equipment.	16	19	18	14	16	17	3

^a DNA: Do not answer; DNK: Do not know/Not applicable.

more acquired knowledge on preventive MSD practices than those working in CHSLD (public and private) and geriatric institutes (group A3).

4.2.3. Differences by completed degree

The results of the ANOVAs for the application of knowledge on MSD prevention practices according to the last completed degree by nursing staff reveal statistically significant differences.

For the variable application of MSD prevention practices, after testing the null hypothesis of equal variances by the Levene test ($p > 0.05$), the ANOVA results revealed significant differences between the groups [$F_{(4, 243)} = 5.40$; $p < 0.001$] (Table 6). The results of the Bonferroni test indicate that nursing staff who have completed a college degree (group D1) apply prevention practices on average more than those who have completed a secondary school degree (group D3) or a university certificate (group D4).

4.2.4. Differences by employer-provided MSD prevention training

After testing the null hypothesis of equality of variances by the Levene test ($p > 0.05$), the ANOVA results reveal statistically significant differences in the application of knowledge on MSD prevention practices between nursing staff trained in MSD prevention by their employer and those who received no training [$F_{(1, 246)} = 24.12$; $p < 0.001$] (Table 7). For these variables, the results of these tests reveal that nursing staff who have received MSD prevention training from their employer (group T1) apply more knowledge of MSD prevention practices in their daily tasks than those who have not received this type of training (group T2).

4.3. Organizational factors favoring the application of knowledge and barriers to the application of preventive practices

As for the factors that influence the application of MSD prevention practices, nursing staff reported that several factors influence the application of preventive practices in their workplace. As a result, they reported that the availability of equipment in good condition for the transfer of patients (86%), the training on MSD prevention practices (85%) and the support to nursing staff (85%) influence their application of preventive practices. To a lesser extent (59%), nursing staff reported that access to electronic resources on good MSD prevention practices influences their application of preventive practices. Thus, many contextual factors influence whether nursing staff apply preventive practices (Table 8).

As regards barriers to the application of MSD prevention practices in the daily activities of nursing staff, interviewed nurses mainly mentioned the lack of time to apply prevention measures, the lack of training in this regard, and the unavailability of a resource person. The resulting median is rather high, i.e. a median of 4 («agree») for these three statements (Table 9), with respectively 40%, 41% and 38% of nursing staff saying that these states are barriers to the application of musculoskeletal disorder (MSD) prevention practices in their daily work activities.

Table 4
Comparison of the Application of preventive practices by Position (Averages Test - F Test).

	Position												F	p	η^2
	Nurse (Group P1)			Nurse clinician or nursing counselor (Group P2)			Nursing assistant (Group P3)			Assistant head nurse (Group P4)					
	M	SD	n	M	SD	n	M	SD	n	M	SD	n			
Application of preventive practices	.32 ^a	.90	115	-.26 ^a	.96	73	-.24 ^a	1.01	27	-.33 ^b	1.09	32	7.93	0.000***	0.09

Note: *: $p < 0.05$, **: $p < 0.01$; ***: $p < 0.001$.

M: Mean of factor scores SD: Standard Deviation n: number.

^a Compared group for which there is a significant difference.

4.4. Focus group results

First, it is important to note that a consensus emerged from both focus groups on the survey results. Focus group participants agreed that these results paint an accurate picture of the application of MSD prevention practices in their workplace. Furthermore, participants suggested several interpretations of these results, as well as improvements they felt were needed so as to promote the application of work-related MSD prevention practices. The following observations arose during the discussions with the participants.

4.4.1. Limited basic training on MSD prevention

According to focus group participants, the basic training provided in colleges and universities seems to be limited and does not appear to meet the workplace requirements. The basic SPHM training taken at the college and university levels appears insufficient and inadequate according to our results.

“If I remember, in my [college degree], I think we covered it over 3 hours of SPHM time” (Nurse, 7 years, emergency, children’s hospital triage).

“[...] where people have the most difficulty, even though they come out of educational institutions, is with the SPHM guidelines. Yes. People have done evaluations with schools to evaluate them for hiring and, the techniques, they perform them well, they are good at approaching patients, but in terms of SPHM guidelines it is incredible how much difficulty people have with it. I think that out of 10, maybe 1 in 10 reached 60-70%. The others have all ignored it, at 50% or less. It’s incredible, though, they just finished” (Head of Care and Services, University Hospital Center).

4.4.2. Discrepancy between training and the reality of work

Basic training appears to be incongruous with the reality of work experienced by nursing staff. Indeed, nursing staff arriving in the workplace face more demanding conditions than those experienced in institutions.

“[...] it is necessary to improve the concordance of reality in the field and to research [...]. There are a lot of problems in connecting the two. We tried many ways to do this. And there’s definitely a problem. All the new staff that comes here ... I don’t envy them” (Director of Human Resources, University Hospital Center).

Indeed, in the workplace, staff are exposed to specific working hours, a high patient ratio and often reduced staffing, involving a demanding pace of work, which is not the case in training institutions.

“[...] When you study, you come for your internships, you take care of a ratio of 1 to X patients, but when you arrive in the institution, the ratio increases enormously! And now you have a lot of students getting distraught in there. [...] And then they find themselves students, graduates, they are helpless in there and they find themselves no longer able to keep up with the pace of work. And then we put them in a high-risk

condition that is quite acute” (Director of Human Resources, University Hospital Center).

“It’s easy to say I’m going to respect the guidelines, well I’m going in, I’m getting ready, I’m positioning myself, I have the right method to move the patient, but sometimes, maybe you don’t have the right equipment, it’s true, sometimes you don’t have a slide sheet, or [the patient] is heavier than you thought, so you should be two on the same side, and then, you know, you can know the guidelines, the concepts, there’s a capacity to analyze that” (OHS Personnel Support Advisor, SPHM Trainer)“

4.4.3. Insufficient training sessions and reminders in the workplace

On-the-job training appears to be insufficient, since the survey data shows that 40.7% of respondents reported that they had not received any training on MSD prevention as staff members of the health and social services network, and 34.8% reported having received only between 1 and 5 h of training. Focus group participants confirmed this data, stating that MSD prevention training is not a “concern” and is rather rare in the workplace. With limited training and almost no reminders, this is particularly difficult for experienced staff whose apprenticeship in training institutions go back several years.

“[...] the thing is, I graduated from college 25-27 years ago ... We had a few hours, less than 5 hours on that aspect, then after that, never again. Nothing, nothing, nothing at all [...]” (Nurse, 27 years, delivery room, children’s hospital).

“I think there are some important basic principles, like bending your knees, for instance, and that’s fine. But let’s say I go to work in a CH or in a CHSLD tomorrow morning, and I’m asked to mobilize patients, it’s certain that I’m not functional, no doubt about that whatsoever” (Nurse, 7 years, emergency, children’s hospital triage).

Another participant pointed out that training on MSD prevention is not mandatory and that these are the budgets that often get cut first.

“Due to budget cuts, it is certainly the training that takes the hit first” (Nurse clinician, 6 years, psychiatric hospital).

4.4.4. Limited training on equipment use

Participants felt that information sessions on the use of equipment for patient transfer and movement influence the application of MSD prevention practices in the workplace. There is a consensus on the matter. The equipment used in the workplace often differs from the equipment used in training. In addition, training in the use of equipment seems very rare. It is therefore likely that nursing staff are not familiar with the use of available equipment. In addition, nursing staff are not necessarily informed of the existing equipment at their disposal, which confirms that they are not trained to use it.

“[...] I’ve been in the delivery room for two years and I just realized that we have equipment to hold the legs of women who give birth, instead of holding them. [...] It’s in every room but it’s not used. No one uses them” (Nurse, 27 years, delivery room, children’s hospital).

Table 5
Comparison of the Application of preventive practices by Mission of the Institution of Affiliation (Averages Test - Welch Test).

Mission of the Institution of Affiliation		CH (Group A1)		CHSGS, CHU, CHA (Group A2)		CHSLD and geriatric institutes (Group A3)		CLSC (Group A4)		RC (Group A5)		CHp (Group A6)		Residence (Group A7)		Welch					
		M	SD	n	M	SD	n	M	SD	n	M	SD	n	M	SD	n	p				
Application of preventive practices		-.20 ^a	.99	114	.44 ^a	.86	62	-.60 ^a	.97	18	.21	.95	30	-.22	1.22	7	.16	.78	5	4.594	0.003**

Note: *, p < 0.05, **, p < 0.01; ***, p < 0.001.

M: Mean of factor scores SD: Standard Deviation n: number.

^a Compared group for which there is a significant difference.

In addition, prevention equipment is not checked before being used by nursing staff, who consider that available equipment is functional equipment. This confirms a certain lack of training in the use of the equipment, since it should be checked before each use.

“[...] As far as the equipment is concerned, I too tend to assume that everything is functional. I never look at equipment before performing a procedure, that’s for sure” (Nurse, 7 years, emergency, children’s hospital triage).

As a result, it was found that staff is often unaware of the equipment and that it is never checked before use, which confirms the inadequacy of training on the use of equipment available in the workplace.

4.4.5. Lack of support from colleagues

The survey results show that the lack of support from colleagues is a significant barrier to the implementation of MSD prevention practices. According to focus group participants, support on the part of colleague often depends on the working conditions in each setting. For instance, in home care, staff must perform their work alone or seek the help of a family member of the patient. Some services have systems in place to call on colleagues for help, such as “bell” systems. In some services, such as emergency, the low support of team members is often due to time constraints, which are high, making it difficult for colleagues to free themselves to help others.

“You have to run after the help” (Nursing assistant, 10 years, neonatology, children’s hospital).

“The nurse is busy with other care. And you’ve got to keep things going, you know” (Nursing assistant, 10 years, neonatology, children’s hospital).

5. Discussion and conclusion

In this study, we examined the application of MSD prevention practices among Quebec nursing staff and sought to identify organizational factors that may or may not support their application.

Overall, the results show that the application of MSD prevention practices can vary considerably depending on individual factors (such as basic training), and organizational factors (such as the mission of the institution of affiliation). It is therefore important to consider the influence of the characteristics of nursing staff (position, training, etc.) as well as the specific mission of their institution of affiliation when examining the conditions for applying work-related MSD prevention practices.

The results of the study also highlight the limitations of both basic and on-the-job training, and especially their incongruence with the reality of nursing work. On the one hand, training on preventive practices in training centers seems insufficient and inadequate. Indeed, little time is devoted to training and the learning situations do not correspond to the work context. Moreover, workplace training is characterized by the scarcity of regular training sessions and reminders related to MSD prevention as well as by the limited availability of sources of information regarding MSD prevention in the workplace. Furthermore, staff members do not seem to be sufficiently trained in the use of the equipment. Such results are consistent with the work of [Clemes et al. \(2010\)](#) who found considerable evidence that the principles learned during caregiver training are not applied in the workplace. In fact, their study revealed that the barriers to the application of MSD prevention practices are mainly due to workplace constraints. For focus group participants, these barriers are mainly due to organizational work constraints such as patient conditions, urgent situations, physical environment, etc., as confirmed by the work of [Lévis et al. \(2012\)](#).

Furthermore, participants in this study are proposing more training and reminders in the workplace to support the implementation of work-related MSD prevention measures, with some advocating a course of

Table 6
Comparison of the Application of preventive practices by Degree (Averages Test - F Test).

	Degree																	
	College degree (Group D1)			Bachelor's degree (Group D2)			Secondary school (Group D3)			University certificate (Group D4)			Specialized graduate diploma and master's degree (Group D5)			F	p	η ²
	M	SD	n	M	SD	n	M	SD	n	M	SD	n	M	SD	n			
Application of preventive practices	.33 ^a	.91	92	-.03	.98	77	-.46 ^a	.97	22	-.33 ^a	.99	51	-.21	1.36	6	5.40	0.000***	.08

Note: *: p < 0.05, **: p < 0.01; ***: p < 0.001.

M: Mean of factor scores SD: Standard Deviation n: number.

^a Compared group for which there is a significant difference.

Table 7
– Comparison of the Application of preventive practices by MSD Prevention Training Provided by the Employer (Averages Test - F Test).

	MSD prevention training									F	p	η ²
	Training provided by the employer = Yes (Group T1)			Training provided by the employer = No (Group T2)								
	M	SD	n	M	SD	n	M	SD	n			
Application of preventive practices	0.74 ^a	0.85	35	-.012 ^a	0.97	213				24.12	0.000***	0.09

Note: *: p < 0.05, **: p < 0.01; ***: p < 0.001.

M: Mean of factor scores SD: Standard Deviation n: number.

^a Compared group for which there is a significant difference.

Table 8
Factors influencing the application of MSD prevention practices.

Do you believe that the following factors influence the application of MSD prevention practices in your workplace?		
(n: 399)	Yes (%)	No (%)
a. Holding briefings on MSD prevention measures;	75	25
b. Providing training sessions on MSD prevention measures;	85	15
c. Reminders, checklists, written materials on MSD prevention practices made available to nurses;	75	25
d. Access to electronic resources on best practices for MSD prevention;	59	41
e. Availability of equipment in good condition for transferring and moving patients;	86	14
f. Holding information sessions on the use of patient transfer and movement equipment;	81	19
g. Support to nursing staff to facilitate the application of musculoskeletal disorder (MSD) prevention practices;	85	15
h. The existence of policies and procedures on the prevention of musculoskeletal disorders (MSDs);	62	38
i. The existence of mechanisms for the exchange and sharing of information among members of the work team.	69	31

action or even the imposition of preventive measures through more formal rules and mandatory training. The recommendations of many authors are along the same lines since they consider that appropriate training for caregivers is a key element of a prevention program related to handling (D’Arcy et al., 2012; Thomas and Thomas, 2014), such as demonstrating transfer techniques using the equipment, the possibility of practicing the techniques for the staff, and also providing feedback on the skills of trained staff (Carta et al., 2010; Thomas and Thomas, 2014). In addition, the study by D’Arcy et al. (2012) points out that on-the-job training would have greater impact than training which is not directly related to the work context, as evidenced by the research results. The nature of training (theory, video, practice, etc.) must also be considered to optimize the knowledge application and favorize the opportunity of applying knowledge in real scenario, before of applying it with patients.

The study also identified workplace constraints that can hinder the implementation of preventive practices. For instance, participants mentioned that the difficulty of accessing equipment, as well as overcrowded workspaces, particularly in home care, make it difficult to apply the preventive practices they have learned. These results are consistent with the literature, which confirms that the work environment can influence the application of preventive measures, as authors Thomas and Thomas (2014) have shown. The empirical study by Skoglund-Öhman and Kjellberg (2011) and the literature review by Nelson

Table 9
Barriers to the application of MSD prevention practices.

In your opinion, the barriers to the application of musculoskeletal disorder (MSD) prevention practices in your daily work activities are:							
(n: 399)	Strongly disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)	DNA/ DNK ^a	Median on a scale of 1–5
	(%)	(%)	(%)	(%)	(%)	(%)	
a. Lack of time to implement MSD prevention measures;	7	8	14	40	29	2	4
b. Lack of training on best practices to prevent work-related MSDs;	4	11	12	41	30	2	4
c. Lack of support from other caregivers;	8	27	21	26	14	4	3
d. The unavailability of a resource person (an SPHM trainer or a person specialized in MSD prevention (e.g., an ergonomist);	4	12	14	38	29	3	4
e. The unavailability of efficient and sufficient patient transfer and movement equipment;	6	17	19	30	19	9	3
f. Difficulty in accessing patient transfer and movement equipment when needed.	6	20	14	30	19	11	3

^a DNA: Do not answer; DNK: Do not know/Not applicable.

and Baptiste (2004) also indicate that the physical work environment, such as a reduced workspace on the care units or the layout of the unit and rooms, hinders the use of safe work techniques, particularly in home care (Skoglund-Öhman and Kjellberg, 2011), which is consistent with our results. All these elements highlight the importance of anchoring prevention practices in the reality of the organizational context, which is specific to each workplace.

Accordingly, the equipment needed to implement preventive measures is not always available and easily accessible to nursing staff. The caregiver therefore adapts MSD prevention practices to the availability of prevention equipment. These conditions must be taken into account in the training materials.

With respect to colleague support, participants confirmed limited mutual assistance due to a sustained workload and the desire to conform to colleagues' pace, which sometimes leads them to perform tasks in an unsafe manner. In this regard, the literature discusses the influence of work dynamics on the application of MSD prevention practices, such as the desire to work at the same pace as peers or the effect of social pressure to perform tasks immediately (Schoenfisch et al., 2011). Scant social support within the organization is also a psychosocial risk factor according to the literature (Bernal et al., 2015; Long et al., 2012; Qin et al., 2014; Sherehiy et al., 2004).

In addition, the results of our study highlight the importance for the interviewed nursing staff to have the support of a resource person (also called a peer leader, coach, etc.) in MSD prevention. This finding is also supported by focus group participants, according to whom it is essential to receive direct feedback on their handling practices. Moreover, participants prefer that the contact person be a colleague, who would be able to better understand the difficulties they face. These results are consistent with those of many authors, who highlight the key role of resource persons in implementing a prevention program (Stevens et al., 2013; Thomas and Thomas, 2014), since it improves support for safe handling practices (Alamgir et al., 2011).

Although this study identified many factors associated with the implementation of MSD prevention practices among nurses, it does have limitations that should be mentioned. First, the number of study participants ($n = 399$) as well as the number of variables retained in our measurement considerably limited our quantitative analyzes. Also, it is important to underline another limitation which is linked to the profile of the participants in the focus groups, which is not representative of the conditions of practice of all nursing staff. This could have introduced interpretation bias. In addition, focus group participants indicated that the staff/patient ratio can also influence the application of prevention practices by nurses. This variable was not taken into account in our measurement model since we had chosen to consider, first of all, the variables described in the theoretical models on knowledge transfer. It would be desirable for future research to take this dimension into account. Finally, it is important to mention that in this study, only the physical risk factors were retained. It would be important for future research to integrate psychosocial risk factors and analyze their combined effects in order to better adapt intervention and prevention measures.

In conclusion, the study highlighted that the application of MSD prevention practices had to be adapted according to the individual, the organization and the context. A recent systematic review argues for a number of prevention interventions, with training combined with other components probably being more effective than training alone in preventing MSDs, whether in training institutions or in the workplace (Thomas and Thomas, 2014). The results of our study further add the importance of adjusting MSD prevention measures to each workplace, as well as offering training which is adapted to the different institutions, services and units. Indeed, according to the participants' remarks, it appears that institutional training as well as on-the-job training are for the time being general in nature, and therefore unsuited to the specific constraints of each work environment. In this regard, Nelson and Baptiste (2004) note in their systematic review that no single solution can be

effective, not even across all units in the same institution. Schoenfisch et al. (2011) also highlight the need to consider differences between sites, services and units in the same facility. To this end, the type of patients, the involvement of the unit head, variations in the layout of patient units and rooms, as well as storage spaces, which are factors that vary according to context, should be included in future research.

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CRediT authorship contribution statement

Saliha Ziam: Conceptualization, Methodology, Investigation, Writing - original draft, Supervision, Project administration, Funding acquisition. **Elena Laroche:** Conceptualization, Methodology, Resources, Writing - review & editing, Funding acquisition. **Sawsen Lakhal:** Investigation, Formal analysis, Validation, Writing - original draft. **Marie Alderson:** Validation, Writing - review & editing. **Charles Gagné:** Validation, Writing - review & editing.

Appendix A. Supplementary data

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