



## A cross-sectional survey of reported musculoskeletal pain, disorders, work volume and employment situation among sign language interpreters

Steven L. Fischer<sup>a,\*</sup>, Kathryn Woodcock<sup>b</sup>

<sup>a</sup>School of Kinesiology and Health Studies, Queen's University, 28 Division Street, Kingston, Ontario K7L3N6, Canada

<sup>b</sup>School of Occupational and Public Health, Ryerson University, 350 Victoria Street, Toronto, Ontario M5B 2K3, Canada

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### ABSTRACT

This research sought to determine the prevalence of pain and musculoskeletal disorders (MSDs) among sign language interpreters registered with the Association of Visual Language Interpreters of Canada (AVLIC). Additionally, we sought to measure weekly work volume (durations of exposure to interpreting) and employment situation (salaried or freelance) to understand if work volumes or employment situations impacted reported pain or MSD prevalence.

Over 68% of the AVLIC membership responded to the survey (314 respondents), and 38% of respondents reported being previously medically diagnosed with carpal tunnel syndrome, arthritis, bursitis, thoracic outlet syndrome or tendonitis. At the time of filling out the survey 25% of interpreters reported feeling pain at a level greater than 3 on a 10-point visual-analog scale. Most respondents identified the neck, upper back, and right upper limb as being the location of the pain. In terms of work volume, interpreters working primarily in salaried roles worked significantly more ( $24.7 \pm 9.5$  h per week) than those working primarily in freelance roles ( $21.7 \pm 10.9$ ); however there was no difference in pain or MSD reporting between the two groups. These results support previous research identifying that sign language interpreters are at an elevated risk of musculoskeletal problems. In addition, these findings demonstrate that both freelance and salaried interpreters are equally at risk, although salaried interpreters are exposed to a greater weekly dose of interpreting. Therefore intervention efforts should focus on factors present in both employment situations, such as total weekly exposure time or work–rest relationships.

*Relevance to industry:* Intervention is needed to help curb the pronounced MSD rates among sign language interpreters. Administrative controls to manage weekly exposures and work–rest ratios (similar to little league pitchers) may be beneficial for both salaried and freelance interpreters.

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### 1. Introduction

Sign language interpreters play a key role assisting the participation of Deaf people within a society where most rely on verbal communication. However there is a growing body of literature that shows a high prevalence of pain amongst sign language interpreters (Stedt, 1992; Sweeney et al., 1994; Feuerstein et al., 1997; Cohn et al., 1990; Scheuerle et al., 2000). Although a systematic review of the literature (Fischer et al., in press) revealed that most of the research was of a low to moderate quality, there was consistency in the observation that sign language interpreters are susceptible to work-related musculoskeletal injury.

For example, the National Institute for Occupational Safety and Health (NIOSH) in the USA reported that 92% of surveyed interpreters reported pain within the previous year, where 20% of respondents met their symptom case definition for a work-related upper extremity musculoskeletal disorder (MSD) (Sweeney et al., 1994). Similarly, Feuerstein et al. (1997), found that 32 and 29% of the interpreters surveyed met the NIOSH symptom case definition, for the hand and shoulder respectively. Cohn et al. (1990) reported on the medical diagnoses for fourteen interpreters who sought medical attention for their symptoms. They found that most interpreters suffered from myofasciitis or tendonitis in the right upper limb, at the fingers, wrist, elbow or shoulder, which the authors attributed to repetitive use and fatigue (Cohn et al., 1990). Research has consistently shown that interpreters are at a high risk for pain and MSDs, particularly in the neck, and right upper limb.

Research investigating why interpreters have an increased prevalence of MSD and injury is more limited (Fischer et al., in

\* Corresponding author. Tel.: +1 613 533 6000x75210; fax: +1 613 533 2009.

E-mail address: [steve.fischer@queensu.ca](mailto:steve.fischer@queensu.ca) (S.L. Fischer).

press). Few studies were able to identify specific pain and MSD risk factors for sign language interpreters. However, three factors from the literature had at least limited support, including mechanical exposure, stress, and speaker's pace (which directly impacts mechanical exposures). In terms of mechanical exposures, two studies (Delisle et al., 2005; Qin et al., 2008) have demonstrated that sign language interpreters are exposed to wrist motions well in excess of the high-risk thresholds reported by Marras and Schoenmarklin (1993). Although stress has also been identified, research demonstrating how stress influences exposure, pain and MSD is sparse, and interventions focused on stress reducing techniques among interpreters have shown mixed results (Delisle et al., 2007).

The challenge in understanding risk factors for MSD during interpreting is further complicated by the employment situations of interpreters. Sign language interpreters are divided into either salaried (employed by a company or institution) or freelance (self-employed, or short-term contracts) employment. To date, existing research has either treated interpreters as a singular group (Sweeney et al., 1994; Feuerstein et al., 1997), or has focused on salaried interpreters (Cohn et al., 1990; Delisle et al., 2005; Qin et al., 2008). Important insights may be gained by understanding how their exposures differ, and if these differences are reflected in their reporting of pain and injury.

The purpose of this research was three-fold: first, we aimed to quantify the prevalence of pain and MSD among Canadian sign language interpreters. Second, by classifying interpreters based on their employment situation, we aimed to understand if freelance and salaried interpreters were exposed to different work volumes. Third, whether or not work volumes were different, we aimed to determine if pain and MSD experience differed. Based on anecdotal communications with senior members in the Association of Canadian Visual Language Interpreters of Canada (AVLIC), we expected salaried interpreters to have greater work volumes and consequently be more likely to report pain and MSDs than freelance interpreters who have control over their work volume.

## 2. Methods

### 2.1. Participants

Participants were recruited from the AVLIC membership. Members were contacted for participation through an advertisement in their quarterly newsletter. Additional contact was made by having local chapter representatives advertise the study at regional meetings to ensure participation from respondents all across Canada. Interested participants were directed to an internet web-link allowing them to fill in the survey at their own convenience. The questionnaire was administered using a platform provided by SurveyMonkey (SurveyMonkey.com).

### 2.2. The survey

The survey consisted of six categories: general information, work volume, training and mobility, work-related stress, health – lifestyle and personal well-being, and needs as an interpreter. Most questions were posed using a closed-ended method with scaled and ranked options. Open-ended questions were used to solicit additional feedback for AVLIC on possible workshop topics or resources that AVLIC could provide for its members. The questionnaire was developed by incorporating questions from the job content questionnaire (Karasek et al., 1998), the standardized Nordic questionnaire (Kourinka et al., 1987), and the 2005 Statistics Canada – Canadian Community Health Survey (CCHS).

Additional field-specific questions were added by the research team in collaboration with the AVLIC ad-hoc committee on repetitive strain injury, the group responsible for updating current AVLIC guidelines for repetitive strain injury reduction and management. The object of the questionnaire was to solicit feedback on the prevalence of pain and injury and information on work demands and coping strategies in sign language interpreting. This paper focuses specifically on the information gained from the general information, work volume, and work-related stress portions of the survey. The remaining information regarding training and mobility, health – lifestyle and personal well-being, and needs as an interpreter was acquired to aid AVLIC in better understanding their membership. The questionnaire and research protocol was approved by the Ryerson Research Ethics Board.

### 2.3. Data analysis and statistics

From the accumulated responses, descriptive statistics were calculated to describe the participant demographics, pain and MSD prevalence, and work volume. The employment situation of each interpreter was determined by comparing the number of hours worked per week in a salaried role to the total number of hours worked per week. As many salaried interpreters accept occasional interpreting appointments outside of their primary workplace, often because of a shortage of interpreters in their community, an interpreter was classified as “salaried” if more than half of their working time was in a salaried role, otherwise they were classified as freelance. Once the classifications were made, statistical comparisons were conducted between groups (salaried or freelance) across the survey responses related to work volume, pain and MSD prevalence. All comparisons between dependent measures recorded on an interval scale (work volume and pain intensity) were made using a one-way analysis of variance (ANOVA) where the  $\alpha$ -level was set at 0.05. A Levene's test was used to determine if the data met the homogeneity of variance assumption, and a non-parametric Kruskal–Wallis test was substituted for the one-way ANOVA analysis when this assumption was not met. All group comparisons between dependent measures recorded on a nominal scale (pain location and MSD type) were made using a Chi-squared test. All statistical analyses were performed using SPSS 14.0 software (SPSS, Chicago, Illinois). General feedback and individual opinions of the respondents regarding interpreting issues were qualitatively assessed to provide feedback to the AVLIC board on matters of policy, education, and workshop availability.

## 3. Results

### 3.1. Demographics

The questionnaire received 314 responses, 68% of the 465 members of AVLIC at the time of administering the survey in 2007. Since that time AVLIC's membership has grown to over 600 members across Canada, demonstrating the growth of the profession. Of those responding 287 (92%) were female, with an average age of  $37.2 \pm 9.2$  years and an average body mass index (BMI) of  $26.2 \pm 6.1$  kg/m<sup>2</sup>, while male interpreters had an average age of  $38.4 \pm 7.9$  years and an average BMI of  $31.9 \pm 3.7$  kg/m<sup>2</sup>. More than half of the respondents had more than 10 years (39%) or between 5 and 10 years (29%) of experience working as a paid interpreter.

### 3.2. Employment situation

Half of the interpreters reported working as freelance interpreters for all of their working hours, while 35% reported working

only as salaried interpreters. The remaining 15% split their working time between both employment situations, where they were classified based on the role in which they spent the most time per week. Of those 15% splitting their time between both employment situations,  $82 \pm 11\%$  of their total work time was spent in the employment situation for which they were classified.

### 3.3. Work volume by employment situation

Interpreters described their work volume by answering three questions, and responses were compared between respondents classified as salaried versus freelance.

1. In the last full week available to work as an interpreter, how many hours did you work (either solo or with a teammate)?
2. Of those hours worked, how many hours did you work solo?
3. What was the longest duration of a solo interpreting appointment that you worked in the previous week?

The amount of time spent working with a teammate was derived by subtracting the number of hours per week working in a solo role from the total number of hours worked in the previous week. During teamed interpreting, approximately half of the time is spent producing sign language or interpreting from signs to spoken words, with the other half of the time enables interpreters to physically rest, rest while serving as a backup resource to the teammate.

Salaried interpreters worked significantly more hours per week, worked more hours in a solo capacity and were exposed to longer single durations of solo interpreting than freelance interpreters (Table 1).

### 3.4. Pain and MSD reporting by employment situation

Pain and MSD prevalence were compared between salaried and freelance interpreters based on responses to the following questions:

- 1 On the body chart below please indicate the site where you experience the most pain and indicate the intensity of this pain on the 0–10 scale provided:
  - a After 1 h of continuous solo interpreting?
  - b After one day of team interpreting?
  - c At the present time?
- 2 Has the doctor ever told you that you suffer from any of the following: Arthritis, Tendonitis/Epicondylitis, Bursitis, Carpal Tunnel, or Thoracic Outlet Syndrome? (The survey provided a checkbox for each disorder and respondents could report multiple disorders.)

Interpreters reported pain scores ranging from 5.4 to 5.6 on a 10-point visual-analog scale *after* active interpretation (1 h of solo interpreting or 1 day of team interpreting). At the *time of filling out the survey* (i.e., not performing interpretation), interpreters

reported pain at an intensity of 3.4–3.7. There was no significant difference in pain intensity either after work or at the time of reporting between salaried and freelance interpreters (Table 2).

The location of pain was also consistent between groups (Fig. 1). Most interpreters felt the highest level of pain in the neck, right shoulder, and upper back regions, after 1 h of solo interpreting, after 1 day of team interpreting, or at the time of filling out the survey. However, when asked to think about their pain at the time they filled out the survey, salaried interpreters reported right forearm pain more frequently than freelance interpreters ( $p = 0.004$ ), although the right forearm was on average the 4th most reported site of pain.

The prevalence of previously diagnosed MSDs was high across all interpreters ranging from 5 to 23% depending on the MSD type (Fig. 2). The Chi-squared test did not detect significant differences in the frequency of MSD reporting for any of the MSD types between salaried and freelance interpreters ( $p$ -values ranged from 0.878 for tendonitis/epicondylitis to 0.096 for carpal tunnel syndrome).

## 4. Discussion

Sign language interpreters collectively reported a high prevalence of pain and MSD, consistent with our hypothesis and the previous literature. In addition, salaried interpreters were exposed to longer single and weekly durations of interpreting, also consistent with the anecdotal evidence. However, contrary to our expectation, the exposure differences between employment categories were not reflected in pain and MSD reporting. Either pain and MSD prevalence among sign language interpreters is unrelated to the exposure dose, or both freelance and salaried interpreters are so overexposed to harmful work volumes that they both exceed thresholds necessary to develop high levels of pain and MSD prevalence, despite the differences observed in the exposure doses.

### 4.1. Pain, MSDs and work volume among sign language interpreters

The prevalence and intensity of pain and MSDs documented from AVLIC interpreters are high, consistent with previous literature. MSD prevalence is reportedly as high as 42% for tendonitis, and range from 7.6 to 11% for carpal tunnel syndrome (DeCaro et al., 1992; Smith et al., 2000; Stedt, 1992). The location of pain in the AVLIC survey is comparable to previous reports identifying the neck, shoulder, and hand and wrist as the most problematic areas for interpreters (Feuerstein et al., 1997; Scheuerle et al., 2000). Demographics reported for this sample of interpreters were also similar to those reported in the literature on sign language interpreters, where the average ages reported here fall between the mean age ranges previously reported (28.2–39.3 years of age) (DeCaro et al., 1992; Feuerstein et al., 1997; Scheuerle et al., 2000; Stedt, 1992). The average mean work volume of  $23.3 \pm 10.1$  h per week observed here is similar to the mean value of 21.8 h per week documented by Feuerstein et al. (1997). The consistency of results

**Table 1**

Work volume comparisons between salaried and freelance interpreters. Significant mean differences are indicated by a grey highlight ( $p < 0.05$ ). Salaried interpreters work more hours per week, more hours in a solo role, and work for longer maximum durations of solo interpreting than their freelance counterparts. Non-parametric Kruskal–Wallis tests were used when the data did not meet the homogeneity of variance assumption.

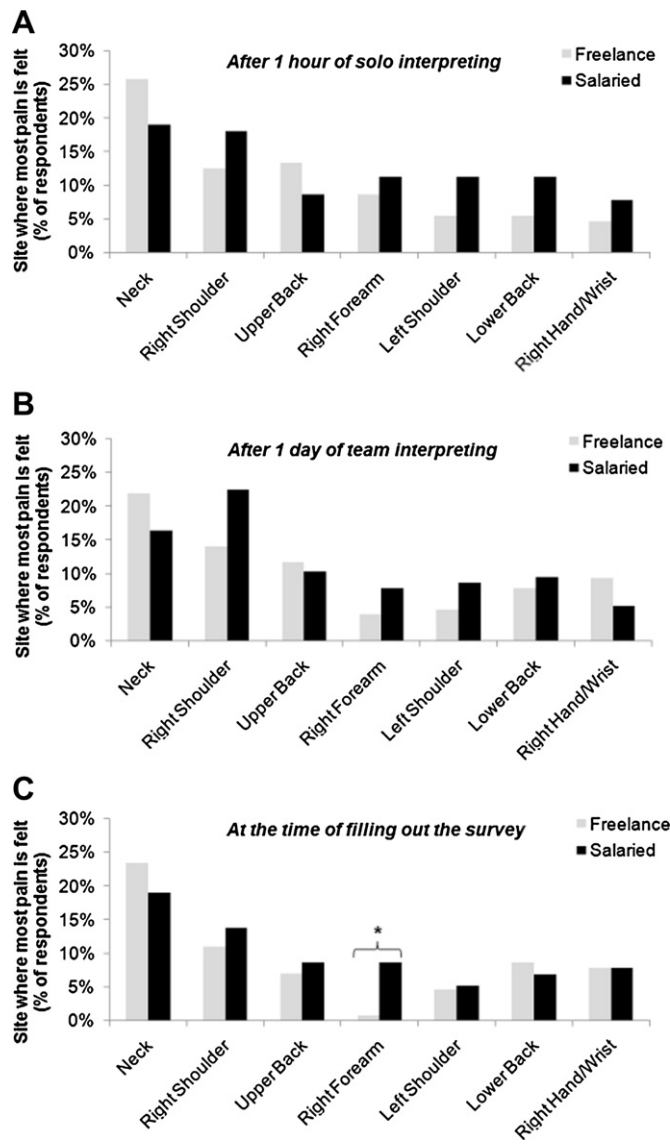
Dependent measure	Salaried interpreter	Freelance interpreter	Mean difference (salaried – freelance)	Statistical test and result
Total hours worked per week	24.7 (9.5)	21.7 (10.9)	3.0	ANOVA [ $F(1,211) = 4.359, p = 0.038$ ]
Hours worked in a solo role	16.3 (11.4)	9.3 (9.4)	7.0	Kruskal–Wallis [ $p < 0.001$ ]
Hours worked in a team role	8.3 (10.2)	12.4 (11.0)	–4.1	ANOVA [ $F(1,211) = 8.030, p = 0.005$ ]
Maximum duration of solo session (hrs)	2.7 (2.1)	1.9 (1.7)	0.8	Kruskal–Wallis [ $p = 0.003$ ]

**Table 2**  
Pain intensity comparisons between salaried and freelance interpreters. Salaried and freelance interpreters reported a similar pain intensity following 1 h of solo interpreting, 1 day of team interpreting, or at the time when they filled out the survey.

Dependent measure	Salaried interpreter	Freelance interpreter	Mean difference (salaried – freelance)	Statistical test and result
Pain intensity following 1 h of solo interpreting	5.4 (2.1)	5.4 (2.4)	0.0	ANOVA [ $F(1,160) = 0.004, p = 0.948$ ]
Pain intensity following 1 day of team interpreting	5.6 (2.4)	5.5 (2.3)	0.1	ANOVA [ $F(1,155) = 0.153, p = 0.696$ ]
Pain intensity at the time of filling out the survey	3.4 (2.3)	3.7 (2.4)	-0.3	ANOVA [ $F(1,140) = 0.363, p = 0.548$ ]

between this study and previous literature reiterates the high risk of pain and MSD problems in sign language interpreting.

The lack of a discernable difference in pain and MSD reporting between salaried and freelance interpreters, despite a difference of more than 10% in their work exposure, is a new finding not previously documented. Contrary to the AVLIC survey results, three



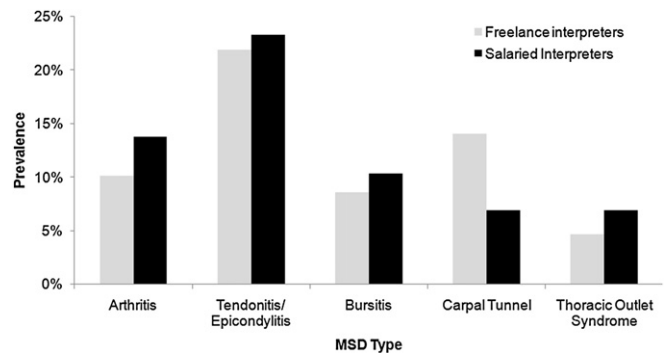
**Fig. 1.** The body locations where freelance (grey bars) and salaried (black bars) interpreters reported feeling the greatest amount of pain. The figure shows the percentage of respondents that selected each location as the site of most pain following: 1 h of solo interpreting (A – top panel), 1 day of team interpreting (B – middle panel), and at the time when they filled out the survey (C – bottom panel). Significant differences between employment situation are indicated with an asterisk \*  $p < 0.05$ .

previous studies found significant relationships between exposure duration (daily, weekly or over a career) and pain or pain reporting (Feuerstein et al., 1997; Podhorodecki and Spielholz, 1993; Sweeney et al., 1994). They concluded that injury risk is greater with increased exposure times. One study also estimated odds ratios for developing symptoms, reporting that interpreters working more than 20 h per week were 6.81 (1.61–28.9) times more likely to develop shoulder pain than those working 10–20 h per week (Sweeney et al., 1994), providing an initial threshold limit value for weekly exposure. Reconciling the AVLIC findings with this literature, we believe that the most likely explanation is that all interpreters remain overexposed, regardless of their current employment situation, considering that the average weekly exposure observed here was greater than 20 h per week, for both salaried and freelance interpreters, and both groups report similar pain and MSDs with similar frequencies.

Past research has shown that sign language interpreters are exposed to repetitive wrist motions, and sustained muscle contractions in the trapezius, in excess of reported thresholds and in excess of other known high-risk occupations (Delisle et al., 2005; Qin et al., 2008). Further, the types of MSDs reported by interpreters are consistent with commonly diagnosed MSDs for females working in other highly repetitive jobs (Ranney et al., 1995). In addition, preliminary support has emerged discussing the potential for a causal link between the wrist postures observed during interpreting (Abdoli-Eramaki et al., 2011), and those required to create elevated pressure in the carpal tunnel, consistent with carpal tunnel syndrome (Keir et al., 2007).

4.2. Possible pathways to intervention

Work volume persists as a key variable to consider when addressing the risk of developing pain and MSDs among sign language interpreters. Unlike many other types of work where engineering controls can be used to reduce or eliminate high-risk exposures, it is the physical act of producing American Sign Language (or other signed languages) that imposes the mechanical demands on the body during interpretation. Therefore the most



**Fig. 2.** The prevalence of previously medically diagnosed MSDs among freelance (grey bars) and salaried (black bars) interpreters. No significant differences were found in the frequency of reporting MSDs between groups.



probable pathway for intervention is through administrative controls over exposure durations and rest. However, current health and safety exposure limits for sign language interpreting remain primarily conventional and negotiated rather than evidence based, allowing interpreters to potentially and unknowingly remain overexposed. However, in the absence of more research aimed at understanding the links between interpreting duration and rest, these conventions are resistant to change.

Sign language interpreters are not unique in their need for and pursuit of evidence-based exposure guidelines. Many athletes and specifically baseball pitchers also face increased injury risks with increased exposures (Olsen et al., 2006) to tasks that cannot be improved by engineering out the risks. Therefore, the literature on work volume guidelines and risk prevention strategies for baseball pitchers (Olsen et al., 2006; Fleisig et al., 2009; Valovich McLeod et al., 2011) may provide an analogous example for how to approach prevention, intervention and guideline development efforts amongst sign language interpreters. For example, a recent position statement released by the National Athletic Trainers' Association in the USA recommends improving injury surveillance, increasing participation in physical examinations, implementing training and conditioning programs and negotiating sport alterations (work to rest policies) (Valovich McLeod et al., 2011) as evidence-based approaches to prevent and reduce overuse injuries in athletes.

Using the sporting example as a guideline it is likely that the overuse injury problems being experienced by sign language interpreters could be reduced using a similar approach. For example, surveillance could be improved by providing interpreters access to simple tools such as the Disability of the Arm, Shoulder and Hand (DASH) survey (Hudak et al., 1996) to help monitor symptoms weekly or monthly, providing an early indication of potential harm if symptoms worsen over time. Improved accessibility to physical examinations could be achieved by having provincial chapters of AVLIC organize annual or bi-annual health forums where medical professionals are on hand to provide annual or bi-annual physical examinations. Raising self-awareness of physical fatigue and emerging pain may be an important step, as preliminary findings are suggesting that interpreters are so focused on their cognitive fatigue that they are unconscious of physical fatigue, even when primed with pain-rating questions (Johnson et al., 2011).

AVLIC health forum events could also provide an avenue for health and fitness professionals to teach and promote targeted training and conditioning programs to help improve the health and physical capacity of interpreters.

In addition, improved policies could be negotiated to promote more effective work to rest scenarios. For example, the National Athletic Trainers' Association position paper reports on the maximum recommended pitch counts for each of the first four practice days following a game performance (Valovich McLeod et al., 2011). Similarly, with necessary research support, sign language interpreting associations and employers could aim to develop guidelines to recommend maximum interpreting durations; with corresponding rest allowances depending on the nature of the interpreting appointment (solo or teamed for example). However, considering the limited available research connecting sign language interpreting exposures and pain (Fischer et al., *in press*) and in the context of employment of both salaried and freelance interpreters, the negotiation of work-exposure limits is likely to require further research evidence.

#### 4.3. Limitations

The data presented here is representative of over 2/3rds of the membership of AVLIC. In a similar questionnaire-based study,

Feuerstein et al. (1997) found that non-responding interpreters shared equal levels of pain and discomfort; however they worked significantly less than the present sample, by approximately 5 h per week. Based on similarity in the findings between this study and Feuerstein et al. (1997) on various demographic and work volume responses, it is assumed that the non-responder findings previously reported may be similar to those AVLIC members choosing not to respond to this survey. If this were the case, it would not likely alter the interpretation that suggests overexposure as a considerable problem for interpreters independent of their employment situation.

Additionally, it is important to note that not all interpreters working in Canada are required to be AVLIC members. However, AVLIC board representatives have suggested that freelance interpreters are often more likely to join AVLIC to receive the added support and community that they do not otherwise have through an employer, as a salaried interpreter may have. Since AVLIC is the only interpreting certifying body in Canada, all certified interpreters must also be AVLIC members. Since previous research has traditionally focused on salaried and specifically institutional interpreters, and found similar results, the findings from this study would likely be consistent across those institutional salaried interpreters not registered as members of AVLIC.

Lastly, of the 314 total survey respondents 69 respondents did not fill in the section of the survey pertaining to their weekly work volume. Since they could not be classified based on employment situation, their data was excluded from the statistical analyses reported here. However, to ensure that they did not report MSD with a frequency that was different from the included participants, a follow-up Chi-squared test was conducted. Included participants reported MSDs with a frequency of 36%, while excluded participants reported MSDs with a frequency of 40%, not statistically different ( $p = 0.574$ ). Therefore we concluded that it was unlikely that these excluded data points would alter the results or the interpretation of the results.

## 5. Conclusion

Interpreters registered with the Association of Visual Language Interpreters of Canada have a high prevalence of MSDs and report pain predominantly in their neck, upper back and right upper limb. Although salaried interpreters worked 12% more hours per week, 43% more time in solo interpreting situations and 30% longer maximum bouts of solo interpreting than freelance interpreters, MSD prevalence and pain intensity remained consistent between the groups. In the context of previous literature, these results suggest that interpreters working in either salaried or freelance positions are overexposed to the high-risk activity of interpreting. However, due to a lack of evidence it remains difficult to discern how much exposure is too much and how much rest is enough. Drawing on intervention approaches developed to reduce repetitive strain injuries for young athletes, the authors recommend that interpreters and employers of interpreters develop approaches to improve injury surveillance, increase participation in physical examinations, implement targeted training and conditioning programs and ongoing research on which to base well-justified work/rest guidelines.

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