Musculoskeletal pain in health professionals at the end of their studies and 1 year after entry into the profession: A multi-center longitudinal study

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Research Article

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Abstract

Background: Musculoskeletal pain, especially back pain, is common among health professionals (HPs). They reduce work productivity and cause high costs. This follow up study investigates the prevalence and individual course of Musculoskeletal pain among HP students at the end of their studies and one year after entering the health care workforce. Participants were asked whether their Musculoskeletal pain was related to study or work conditions.

Method: Self reported one year prevalence for lower back pain, neck and shoulder pain, pain in arms or hands, and pain in legs or feet was collected by an online questionnaire at two timepoints from 1046 participating HPs. Generalized estimating equation (GEE) models of the binomial family with log link were employed to estimate adjusted prevalence and corresponding normal based 95% confidence intervals were derived using the bootstrap method with 1,000 replications.

Results: Prevalence of lower back pain as well as neck and shoulder pain was very high at baseline and follow up in all students and later HPs. Prevalence for pain in arms or hands, legs or feet was lower and there were significant differences between the professions. HP associated their lower back pain and neck and shoulder pain clearly with study and work conditions; HPs linked pain in arms or hands, legs or feet strongly with work conditions only.

Conclusion: The prevention of lower back pain and neck and shoulder pain must be included in the curricula of all health professions at universities. As best practice example, they should incorporate ergonomic measures and exercises as a daily routine of the formation of health professionals. The impact of physically demanding professional tasks on upper and lower extremities needs to be investigated in further studies in order to take preventive measures.

Background

Musculoskeletal health is a key factor for human functioning as it enables mobility, dexterity, and the ability to work (1). Low back pain (LBP), neck pain (NP), and other musculoskeletal disorders (MSDs) show high prevalence, and they are the main causes for years lived with disability, with LBP having the most severe impact worldwide (2). Compared to other noncommunicable diseases, MSDs are the most relevant cause for the loss of productive life years in the workforce (1). To instigate and promote preventive and mitigating public health measures, it is important to identify populations at risk and to understand the causes and the development of MSD in these populations.

In this article, we present a follow up, observational study investigating the prevalence and individual course of low back pain (LBP), neck/shoulder pain (NP), pain in arms or hands (AHP), and pain in legs or feet (LFP) in health professionals (HPs) at the end of their university studies (HP students) and 1 year later, after having practiced as HPs in the health care system.

There are good reasons to investigate MSD in young health professionals in the transition from study to work.

1. Given the shortage of qualified HPs, it is important to integrate and retain young HPs in the health care workforce by taking care of their health. MSD, especially work-related and chronic MSD,

- may be a reason for HP students to discontinue their studies (3, 4).
- reduce the ability to perform job tasks and roles (time management, interpersonal relationship, output (5, 6), presentism (7))
- predicts burnout (8)
- causes sick leave absence and often result in the long-term absence (absenteeism) (9);
- and causes HP to change their specialty or role at work or to leave the profession (5, 10, 11)

2. Young HP in the transition from study to career entry are predominantly female and between 20 and 30 years old. LBP occurs mainly in this age range (12); women are more prone to NP than men (13). The first onset of work-related upper limb symptoms is common among HP within the first 5 years of working as a therapist (14).

3. HP students seem to be more prone to MSP than their peers of the same age. Swiss HP students showed a higher prevalence for NP (61%) and LBP (60%) than their peers in the general population (15). Physiotherapy students reported a higher prevalence of several MSP compared to social science students: NP (51.9% vs. 39.1%), LBP (60.6% vs. 48.3%), and pain in the knees (36.1% vs. 26.1%) (16). Nursing students reported 1-year prevalence rates for LBP ranging from 24% to 71% (17), with indications for growing LBP rates from 50% in the first study year to 67% in the third study year (18).

4. Many studies and reviews have reported high prevalence rates for MSP among HPs: For physiotherapists, a 1-year prevalence of 40–91% for work-related MSP was found (19). For nurses, the following mean 1-year prevalence rates were reported: 55% for LBP, 44% for shoulder, 42% for NP, 36% for lower-extremity pain, and 26% for upper-extremities pain (20). Another review investigating midwives, nurses, and physicians found 1-year prevalence rates ranging from 36% to 96% for NP, 13% to 93% for shoulder pain, and 17% to 91% for upper back pain (21). For midwives, a cross-sectional survey in the United Kingdom revealed a 1-year prevalence of 92% for MSP, 71% for LBP, 45% for NP, and 45% for pain in the shoulders (22). Chinese health care professionals in tertiary hospitals reported the following MSP: NP (47.6%), upper back (18.7%), lower back (72.8), shoulders (52.1%), elbows (8.7%), wrists/hands (31.1%), knees (65.7%), and ankle/feet (23.6%) (23). One in four Swiss HPs reported severe or very severe musculoskeletal disorders in a cross-sectional study, with nurses showing the highest prevalence rates (24). Due to difficulties in measuring pain and a lack of simple biomarkers for MSD, the prevalence and impact of these conditions on morbidity and mortality may even be underestimated (25).

Causes of work-related MSP

Physical and psychosocial factors contribute to the development of work-related MSD (26, 27). Low level of work satisfaction and support, high level of distress, negative affectivity, low level of job control, fear avoidance and high psychological demands are psychosocial risk factors (27). When high psychological demands and low job control were present, the odds of prevalent LBP, shoulder pain, knee pain, and pain at any anatomical site were 1.56, 1.89, 2.21, and 1.38, respectively (28). In addition, there is evidence for a causal relationship between MSP and ergonomic factors of the tasks HPs have to perform, like bending the trunk frequently, heavy or awkward lifting, bending or twisting the neck, maintaining shoulder abduction for long periods, and walking or standing for long periods (23, 29). In HP students, MSD was associated with increased clinical training load, mental stress symptoms, smartphone average use time (30); years of study and computer usage (31); uncomfortable college furniture, using a heavy backpack, and sleeping in an uncomfortable bed (32).

Furthermore, patients have organized illness perceptions about their MSD. A systematic review revealed limited to moderate evidence of the association of illness perceptions and prognosis for pain and physical function in patients with musculoskeletal disorders (33). Among these illness perceptions, causal beliefs (attribution of pain) state an important dimension (33). However, profound research on the attributional beliefs of health professionals is lacking.

Courses of MSP

Clinical studies have shown a great variety in the development of MSD: spinal musculoskeletal pain (SMP) had a favorable short-term prognosis. The majority of patients were recovered within few weeks after pain onset (34, 35). Yet, both recurrences and the development of persistent pain were common. First, recurrences of another lower back pain episode (LBP) within 12 months after pain onset can occur in up to 69% (36). Second, 43–47% of patients with LBP/NP reported ongoing persistent pain 12 months after pain onset (37, 38). In addition, patients with NP experienced a pain reduction of 45%, 6.5 weeks after pain onset; however, no further improvement occurred thereafter (39). Lastly, only 36%/43% of patients with LBP/NP reported being pain-free 12 months after pain onset (35). Hence, reporting population-averaged pain scores at short-term follow-ups may be overly simplistic and not reflect individual pain patterns over time. In fact, recent studies on LBP trajectories demonstrated that LBP is a rather persistent or fluctuating long-lasting pain condition with low transition probabilities between conditions over time (40).

Similar to SMP, non-spinal musculoskeletal pain (NSMP) showed a rapid reduction of mean pain intensity in the first 3 months after onset. However, 45.6% (shoulder), 54.3% (elbow), 58.6% (wrist/hand), 51.2% (hip), 48.0% (knee), and 38.5 (ankle/foot) still reported a poor outcome (<30% improvement in pain intensity from baseline) at 3-month follow-up, whereas 43.0, 40.5, 47.1, 42.4, 33.1 and 24.9%, respectively, reported a poor outcome at 12-month follow-up (41).

Four distinct developmental trajectories represent the number of musculoskeletal pain sites, whereas 15% follow a trajectory of high pain sites, 24% of increasing pain sites, 41% of low pain sites, and 20% of decreasing pain sites (42).

Research questions

Most studies about MSD among HPs and HP students reported in the background section measured MSD at a one-time point only. Consequently, there is no evidence to support whether MSDs are acquired on the job in the health care system or occur beforehand. This information is crucial for the prevention of MSD in future HP. Therefore, we investigate the following issues in this longitudinal, observational study:

1) The prevalence of LBP, NP, AHP, and LFP among HP students at the end of their studies (baseline) and 1 year later after entering the health workforce (follow up); 2) The differences in the prevalence of MSD between the different health professions; 3) The individual dynamics of pain experience; and 4) The subjective attribution of causes that HP make for their MSP.

Methods

Study design

This study is a multi-center, follow up study with two measurement points. Data for the baseline was collected among HP students (occupational therapy, nutritional sciences, midwifery, nursing, and physiotherapy) studying at a Swiss university of applied sciences at the end of their last semester. Follow-up was 1 year later, after entering the health workforce.

Population and sample

The target population was all HP students obtaining a bachelor's degree from a Swiss university of applied sciences in 2016, 2017, and 2018. We derived data from the National Graduate Survey of Health Professionals from Universities of Applied Sciences (Nat-ABBE), a nationwide census survey of final HP students. A total of 5197 last year HP students were asked to fill in the questionnaire at the end of their sixth semester. HP students (n = 3103) responded to the baseline questionnaire (response rate: 59.7%); 1463 answered the follow-up questionnaire (response rate based on the population: 28.2%). We excluded the following groups from this sample: students of medical radiology because this subject can be studied only in the French-speaking part of Switzerland, part-time students because they already worked in the health care system during their studies and HP students who did not work in the health care sector 1 year after graduation. The final sample for this study included 1046 HP and a total of 2092 observations.

Data collection and data management

HP students were informed about the National Graduate Survey of Health Professionals (Nat-ABBE) at the end of the last semester during a lesson. This survey included questions about education, job expectations and plans, and questions about health. Subsequently, the HP students received an email inviting them to participate in this online survey; the participation was voluntary, and students were assured confidential treatment of their data. In the baseline survey, participants were asked to leave an email address at which they could be reached after finishing their studies. Participants provided informed consent in the online questionnaire for the use of their data. One year after graduation, the health professionals were invited to participate in the follow-up survey by email. The survey was administered by the quality and evaluation unit of the Health Department of the Zurich University of Applied Sciences. The data was anonymized and stored in accordance with the security regulations of the University. The data collection for the baseline started in the summer of 2016 and was repeated in 2017 and 2018. The last survey for the follow-up took place in May 2020.

Measurement of self-reported MSP and attribution of MSP to studies or work

The Nat-ABBE online questionnaire contained a list of health problems, including LBP, NP, AHP, and LFP. These items were adopted from the Swiss Health Survey. This survey by the Swiss Federal Statistical Office repeats every 5 years (since 1992) based on the Federal Statistics Act of 1992. Participants were asked the following question: “In the past year, have you had one or more of the following health problems?”. Responses were captured using a four-point ordinal scale (no, rarely, occasionally, often). To make the results more comparable to other studies, we derived a subject-specific binary outcome for LBP, NP, AHP, and LFP (yes/no), indicating the presence of any pain frequency (rarely, occasionally, often) or absence of pain, comprising the category “no”.

If pain was reported in the online questionnaire, an additional question asked for the causal attribution of this pain: “Do you think that these complaints are related to your studies/ to your work?” Responses were: no, partially, yes.

Statistical analyses

We used Stata 15.1 (StataCorp, College Station, TX, USA) for all statistical analyses. Participants’ characteristics were analyzed using descriptive statistics with mean values (including standard deviation), minimum and maximum value, or, in the case of factor variables, with absolute and relative frequencies. We used McNemar’s $\chi 2$-Test to assess differences in HP students’ pain experience between baseline and follow-up. Generalized estimating equation (GEE) models of the binomial family with log links were employed to estimate adjusted pain prevalences in HP students. Corresponding normal-based 95% confidence intervals were derived using the bootstrap method with 1000 replications. We adjusted for gender and age, centered at the mean. Furthermore, we used cumulative odds models adjusting for clustering to assess HP students’ pain attribution. Statistical significance was established at $p < 0.05$.

Results

Demographic characteristics of HP sample

Demographic characteristics of the 1046 participants are shown in Table 1:

Table 1

Demographic characteristics of HP sample (n= 1046)

Age at baseline:	**N**	**%**	Range 21-57, Mean: 25.0, Median: 24.0
21-25	775	74.9	
26-30	203	19.6	
31-35	27	2.6	
36-40	10	1.0	
41-45	10	1.0	
46 -57	10	1.0	
Gender:			
Men	94	9.4	
Women	1039	90.3	
missing	7	0.7	
Professions			
occupational therapy	112	10.7	
nutritional sciences	83	7.9	
midwifery	107	10.2	
nursing	481	46.0	
physiotherapy	263	25.1	

Yearly prevalence of MSD

Figure 1 gives an overview of the four MSD under consideration at baseline and follow-up.

[**INSERT HERE**: **Figure 1**]

Low back pain (LBP)

At baseline, the adjusted yearly prevalence of LBP [mean (95% CI) was 75.8% (73.2–78.5)] in the total sample of HP students (Figure 1). We found the highest adjusted yearly prevalence of LBP in midwifery students [81.3% (74.3–88.8)], followed by students of occupational therapy [78.4% (70.6–86.1)], nursing students [76.1% (72.3–80.0)], and physiotherapy students [73.3% (67.9–78.6]. Nutritional sciences students had the lowest prevalence [71.6% (61.7–81.5)]. However, at baseline, differences in LBP prevalence among HP students were not statistically significant.

At follow-up, yearly LBP in the total sample was 73.0% (70.7–75.9). Again, we found the highest adjusted yearly prevalence of LBP was in midwifery students [83.2% (76.1–90.2)], and the lowest prevalence of LBP was in nutritional sciences students [60.0% (49.5–70.5)]. LBP prevalence in the remaining HP students was 78.4 (74.8–82.0) in nursing students, followed by students of occupational therapy [67.6% (58.7–76.5)], and physiotherapy students [66.8% (61.0–72.6)]. At follow-up, differences in prevalence were substantial between physiotherapy students compared to midwifery students ($p = 0.0005$) and nursing students ($p = 0.0008$). Moreover, differences in LBP at follow-up were significant between nutritional sciences students as compared to midwifery students ($p = 0.0002$) and nursing students ($p = 0.0010$) as well as students of occupational therapy as compared to midwifery students ($p = 0.0065$) and nursing students ($p = 0.0308$). In summary, LBP prevalence in midwives and nurses compared to the other HP groups was substantially higher at follow-up.

Within HP student groups, differences between baseline and follow-up were not statistically significant at the 5% level. However, LBP prevalence between baseline and follow-up declined in students of occupational therapy [-10.1% (-22.7–1.1)] and reached borderline significance ($p = 0.0750$). Likewise, detected a decline between baseline and follow-up in physiotherapy students [-6.5% (-14.5–1.5)] and nutritional sciences students [-11.6% (-25.9–2.7)] with near borderline significance ($p = 0.1130$ and $p = 0.1120$, respectively).

Neck and shoulder pain (NP)

At baseline, the adjusted yearly prevalence of NP was 75.7% (73.3–78.2) in the total sample of HP students (Figure 1). We found the highest adjusted yearly prevalence of NP in midwifery students [82.2% (75.0–89.5)], followed by students of occupational therapy (81.1% [73.7–88.5)], nutritional sciences students [80.2% (71.5–89.0)], nursing students [74.2% (70.4–78.1)], and physiotherapy students [72.1% (66.7–77.5)]. At baseline, the prevalence of NP was substantially higher in midwifery students compared to physiotherapy students ($p = 0.0258$) and nursing ($p = 0.0565$). However, the latter difference was only borderline significant.

At follow-up, yearly NP in the total sample was 72.4% (69.6–75.1). Again, we found the highest adjusted yearly prevalence of NP in midwifery students [84.1% (77.1–91.1)] and the lowest prevalence of NP in physiotherapy students [67.2% (61.5–72.9)]. NP prevalence in the remaining HP students was 75.3

(65.3–85.3) in nutritional sciences students, followed by students of occupational therapy [74.8% (66.3–83.2)], and nursing students [71.5% (67.4–75.5)]. At follow-up, differences in prevalence were substantial between midwifery students as compared to nursing students ($p = 0.0027$), physiotherapy students ($p = 0.0002$), and students of occupational therapy ($p = 0.0861$). However, the latter was only borderline significant. In summary, at follow-up, NP prevalence was substantially higher in midwifery students than all other HP student groups, except nutritional sciences students.

Within HP student groups, differences between baseline as compared to follow-up were not statistically significant. However, in the total sample of HP students, NP prevalence declined slightly between baseline and follow-up [-3.4% (-7.2–0.3)] and reached borderline significance ($p = 0.0760$).

Pain in arms and hands (AHP)

At baseline, the adjusted yearly prevalence of AHP was 22.5% (20.0–25.1) in the total sample of HP students (Figure 1). We found the highest adjusted yearly prevalence of AHP in students of occupational therapy [34.2% (25.1–43.4)], followed by physiotherapy students [27.1% (21.9–32.3)], nursing students [19.5% (15.9-23.1)], midwifery students [19.2% (12.1–26.4)], and nutritional sciences students [13.9% (6.1–21.7)]. At baseline, the prevalence of AHP was substantially higher in students of occupational therapy as compared to midwifery students ($p = 0.0115$), nursing students ($p = 0.0028$), and nutritional sciences students ($p = 0.0009$). Similarly, the prevalence of AHP was higher in physiotherapy students as compared to nursing students ($p = 0.0182$), nutritional sciences students ($p = 0.0052$), and midwifery students ($p = 0.0811$). However, the latter difference was only borderline significant.

At follow-up, yearly adjusted AHP in the total sample was 27.6% (24.8–30.3). We found the highest adjusted yearly prevalence of AHP in physiotherapists [42.4% (36.3–48.4)] and the lowest prevalence of AHP again in nutritional scientists [11.1% (4.1–18.2)]. AHP prevalence in the remaining HP was 37.8 (28.4–47.3) in occupational therapists, followed by nurses [22.2% (18.4–26.0)] and midwives [16.8% (9.8–23.8)]. At follow-up, differences in AHP prevalence were substantial between physiotherapists as compared to nurses ($p < 0.0001$), nutritional scientists ($p < 0.0001$), and midwives ($p < 0.0001$). Similarly, AHP prevalence was higher in occupational therapists as compared to nurses ($p = 0.0038$), nutritional scientists ($p = 0.0000$), and midwives ($p = 0.0007$). In summary, AHP prevalence in occupational therapists and physiotherapists compared to all other HP groups was substantially higher at follow-up. Within HP student groups, adjusted AHP prevalence increased in physiotherapy students [15.3% (7.3–23.2)] as well as in the total sample of HP students [5.0% (1.3–8.8)] ($p = 0.0000$ and $p = 0.0080$ respectively).

Pain in legs and feet (LFP)

At baseline, the adjusted yearly prevalence of LFP was 35.6% (32.9–38.5) in the total sample of HP students (Figure 1). We found the highest adjusted yearly prevalence of LFP in nursing students [42.8%

(38.3–47.2)], followed by physiotherapy students [34.8% (29.0–40.7)], midwifery students [33.0% (24.0–42.0)], students of occupational therapy [22.5% (14.8–30.3)], and nutritional sciences students [19.0% (10.1–27.9)]. At baseline, the prevalence of LFP was substantially higher in nursing students as compared to physiotherapy students ($p = 0.0413$), students of occupational therapy ($p < 0.0001$), and nutritional sciences students ($p < 0.0001$), and midwifery students ($p = 0.0510$). The latter difference reached only borderline significance. Similarly, the prevalence of LFP was higher in physiotherapy students than students of occupational therapy ($p = 0.0120$) and nutritional sciences students ($p = 0.0033$). Moreover, midwifery students had a higher prevalence of LFP than nutritional sciences students ($p = 0.0349$) and students of occupational therapy ($p = 0.0824$; borderline significant).

At follow-up, yearly adjusted LFP in the total sample was 39.2% (36.2–42.1). Again, we found the highest adjusted yearly prevalence of LFP in nursing students [52.2% (47.7–56.8)] and the lowest prevalence of LFP in nutritional sciences students [18.5% (10.0–27.1)]. LFP prevalence in the remaining groups was 39.3 (30.2–48.4) in midwifery students, followed by physiotherapy students [29.9% (24.5–35.3)], and students of occupational therapy [20.9% (13.1–28.8)]. At follow-up, differences in LFP prevalence were substantial between nursing students as compared to midwifery students ($p = 0.0111$), physiotherapy students ($p < 0.0001$), students of occupational therapy ($p < 0.0001$), and nutritional sciences students ($p < 0.0001$). Similarly, LFP prevalence was higher in midwifery students as compared to students of occupational therapy ($p = 0.0030$), nutritional sciences students ($p = 0.0009$), and physiotherapy students ($p = 0.0784$, borderline significant). Moreover, LFP prevalence was higher in physiotherapy students than nutritional sciences students ($p = 0.0295$) and students of occupational therapy ($p = 0.0691$; borderline significant). In summary, LFP prevalence at baseline and follow-up has been particularly high in nursing students and particularly low in nutritional sciences students. Within HP student groups, adjusted LFP prevalence significantly increased in nursing students [9.5% (3.1–15.8), $p = 0.0040$].

Individual dynamics of pain experience

Depending on the type of pain, HP students experienced different patterns of change in pain over time (Figure 2). Most students who reported LBP at baseline ($n = 785$) also reported LBP at follow-up ($n = 646$). Overall, the LBP condition did not change for 75.5% of HP students, 62.1% consistently reported LBP at both times, and 13.4% reported no LBP at both times. LBP was no longer present at follow-up in 13.4% of the students, and 11.2% experienced new LBP. While more students experienced an improvement in their LBP condition, the overall change over time was not sufficient to achieve statistical significance (McNemar's $\chi 2(1) = 2.07$; $p = 0.1498$).

Similarly, the overall NP condition did not change for 74.7% of HP students, 61.4% consistently reported NP at both times, and 13.3% reported no NP at both times. NP was no longer present at follow-up in 14.5% of the students, and 10.8% experienced new NP. Overall, the NP experience for HP students did change over time (McNemar's $\chi 2(1) = 5.78$; $p = 0.0162$), i.e., more students improved their NP condition over time.

Most HP students experienced no AHP (59.5%), and 9.8% reported AHP at both times. Moreover, 12.8% who reported AHP at baseline did not report AHP at follow-up. Finally, 17.9% of HP students experienced a change for the worse and reported AHP at follow-up. Overall, the AHP experience for HP students changed slightly over time (McNemar's $\chi 2(1) = 8.56$; $p = 0.0034$), i.e., more students experienced a change for the worse over time compared to students that no longer had AHP at follow-up.

LFP or no LFP at both times was reported by 45.6% and 20.6% of HP students, respectively. LFP was no longer present at follow-up in 15.1% of the students, and 18.6% with no LFP at baseline reported LFP at follow-up. Overall, the LFP experience students slightly changed over time (McNemar's $\chi 2(1) = 3.72$; $p = 0.0536$; borderline significant), i.e., the overall burden of LFP increased over time.

[**INSERTE HERE**: **Figure 2**]

Attribution of pain

Only a minority of HP students reported that LBP was not related to either their studies at baseline or to work at follow-up (26.8% (23.8–29.7) and 19.0% (16.6–21.4) respectively). Moreover, those who attributed LBP to studies/work increased significantly and substantially at follow-up by 10.3% (6.6–14.0), while the percentage of HP students who did not attribute LBP to work or attributed LBP partly to work declined by 7.8% (4.9–10.6) and 2.5% (1.4–3.7) respectively (Figure 3).

A minority of HP students did not attribute NP to studies at baseline [19.7% (17.2–22.3)] or to work at follow-up [20.5% (17.9-23.1)], 35.7% (33.1-38.3) and 36.1% (33.5-38.7) partly attributed NP to work at baseline or follow-up, and a majority attributed NP to studies/ work at both times [44.6% (41.1-48.0) and 43.4% (40.0–46.7)]. Attribution of NP did not significantly change over time.

At baseline, roughly one-third of HP students reported AHP to be unrelated to their studies, partly related to studies, or related to studies [34.3% (28.0–40.5), 31.5% (27.2–35.8), and 34.3% (28.2–40.4) respectively]. At follow-up, the percentage of HP students attributing AHP to work substantially and significantly increased by 17.9% (10.6–25.3), while those partly attributing or not attributing AHP to work declined by 3.6% (1.6–5.6) and 14.3% (8.0–20.6) respectively.

At baseline, most HP students did not attribute LFP to their studies [46.4% (41.4–51.3)], 27.7% (24.3–31.2) partly attributed LFP to their studies, and a minority of 25.9% (21.8–30.0) reported LFP to be related to their studies. At follow-up, however, a substantial majority attributed LFP to work [45.9% (41.2–50.6)], 27.8% (24.4–31.2) partly attributed LFP to work, and 26.2% (22.2–30.3) did not attribute LFP to work. Thus, to summarize, the percentage of students who perceived LFP to be unrelated to work declined substantially and significantly while those who attributed LFP to work increased.

Overall, we found that – except for NP – the percentage of HP students attributing pain to work had substantially increased at follow-up.

[INSERT HERE: Figure 3]

Discussion

In this longitudinal, observational study, we investigated the prevalence and individual courses of MSDs in HP at the end of their studies (baseline) and 1 year after entry into working life (follow-up). The second aim was to assess whether HP related their pain to study or work conditions. Since the results were similar, we discuss LBP and NP together first and then the results for AHP and LFP.

Main results for LBP and NP

The prevalence of LBP and NP ranged between 72.4% and 75.8% at both measurement time points. Midwives and, to a lesser degree, nurses seem to be more susceptible to LBP and NP than other HP. The overall change between the two measurement time points was not significant. However, the slight overall decrease of LBP and NP between baseline and follow-up is noteworthy; a slight increase was observed only in midwives (LP and NP) and nurses (BP). Individual trajectories showed little change: HP with LBP or NP in college also suffered from it in their professional lives (LBP: 62.1%; NP 61.4%). Most participants thought their LBP (73.2%) and NP (80.3%) to be related at least partly with study or work conditions.

Discussion of LBP and NP

The prevalence of LBP and NP was within the range of other studies involving HP or HP students (16-24). Nevertheless, it is alarmingly high if we consider that this study examined mostly young HPs at the beginning of their professional careers. Moreover, if we consider the results of clinical follow-up studies (34-39), which mostly suggest a chronic or intermittent course for LBP and NP, this gives a poor prognosis for the future when so many HP already start their career with LBP and NP. Thus, LBP and NP are not only a burden for those affected, but they are a public health issue in two respects: First, the high prevalence is a risk and burden for the general public in terms of health insurance costs, occupational insurance costs, and increasing tax transfers. Second, considering the shortage of health care professionals, they are a threat to the health care system: qualified health professionals leaving the workforce prematurely due to health problems compromise healthcare for the entire population, i.e., potentially causes a shortage in the provision of essential health care services.

From the available data, we cannot infer the causes of LBP/NP. However, the majority of HP relate their LBP and NP to their studies/work. In the last year of study, students write their bachelor’s thesis, which involves long hours of work on the computer/laptop, and they are also often in an internship. The most pronounced decrease in LBP and NP among nutritional scientists is an indication that the posture at the computer is partly responsible for LBP and NP. This profession does not perform physically demanding work after graduation, such as bending and lifting, which could cause LBP or NP. In contrast, nurses and midwives are confronted with unfamiliar and physically demanding tasks after entering the profession (e.g., bending and lifting), which may explain the small increase in LBP in those two professions and in NP among nurses. Our results align with studies finding an association between MSP and clinical training load (30) and computer usage (31).

Regardless of the effective causes, HP relates their pain burden to a large extent to study or work. Therefore, two consequences must be discussed:

1. HP students and HPs associate their LBP and NP with study and the profession, respectively. This negative connotation may prevent positive feelings about the profession and reduce motivation to pursue it for as long as possible. Therefore, this negative connotation must be avoided.

2. A large proportion of HPs experience LBP and NP already during their studies. This period also holds great potential for the prevention of these health problems. The universities of applied sciences have the know-how and the infrastructure to integrate the prevention of LBP and NP into the curricula and to apply prevention measures during the studies. Computer work and physically demanding tasks cannot be avoided in the health professions. Therefore, health self-care for these known risks must become an integral part of health professionals' education.

Main results for AHP and LFP

The results for AHP and LFP differ in many respects from LBP and NP: The overall prevalence of AHP (baseline: 22.5%; follow-up: 27.6%) and LFP (baseline: 35.6%; follow-up: 39.2%) was lower than the prevalence of LBP and NP. The prevalence of AHP and LFP increased slightly between baseline and follow-up. There are pronounced differences between the professions: Occupational therapists and physical therapists had more AHP than their study counterparts at both measurement time points. Physical therapists had a significant increase of 15.3% in AHP between baseline and follow-up. Nurses were most affected by LFP, followed by midwives and physiotherapists. The nurses' increase of 9.5% between baseline and follow-up was significant. The new onset of AHP and FLP 1 year after starting to work as an HP were more frequent than the onset of LBP and NP. HP students did not associate their AHP and LFP as clearly with their studies as they did with LBP and NP. This changed after 1 year on the job: 80.0% associated AHP and 73.7% LFP fully or at least partially with their work.

Discussion of AHP and LFP

The prevalence was within the range of other studies (20, 23). Only for knee pain, Chinese HP reported a higher prevalence of (65%) (23). The higher prevalence of AHP in occupational therapists and physiotherapists can be explained by the higher strain on arms and hands, e.g., due to manual therapies, which are common in these professions. The marked increase in LFP among midwives and nurses is probably associated with standing and walking for long periods, which is common in the daily routine of these professions. In Switzerland, about 78% of nurses work at least half of their working time in a standing position, and 65% must do so for at least three-quarters of their work. These rates are higher than in other professions: only 46% of medical doctors and 59% of other health professions spend at least half of their work time in a standing position (24). Although many nurses are affected by LFP, LFP gets little intention compared to other MSDs. In a recent systematic review investigating interventions to prevent musculoskeletal injuries among nurses (43), none of the 20 included studies focused on lower limbs. Most of the interventions are aimed at the prevention of back pain. Almost ironically, in this context, an intervention study investigating the effects of unstable shoes focused on lower back pain and disability as outcome variables (44). Therefore, more research is needed to better understand causes and develop interventions to reduce LFP in nursing and midwives and AHP in physiotherapists and occupational therapists.

Strengths, weaknesses, and limitations of this study

With its two repeated intra-individual measures of pain, the longitudinal design is a major strength of this study. This allowed us to demonstrate that many HPs suffer from LBP and NP during their studies and that these complaints are not acquired during their professional lives. However, several study limitations must be kept in mind. First, our study was exclusively investigating the presence of pain. Other relevant factors, such as pain intensity and chronicity, could not be considered due to missing data. Second, participant dropout was comparably high, i.e., more than 50% of the students who completed the baseline questionnaire did not participate in the follow-up and were not included in the study. Consequently, selective response bias may have influenced our results. While our sensitivity analyses, in which we assessed pain at baseline between participants and non-participants of the follow-up (adjusting for age, gender, and type of health profession), did not reveal any significant differences, selective response bias may still be present. Third, all data are self-reported. As such, they may be subject to recall bias, social desirability bias, or may be contingent on social and professional experiences and meanings derived from respondents’ social environment (Lebenswelt).

Conclusions

LBP and NP are very common in all HP and arise during studies. Universities and professional schools have a responsibility for the health of their students and the upcoming generation of health professionals. Preventive and health-promoting interventions must become an integral part of the studies and guarantee health care for the entire population. AHP and LFP do not affect all HP equally. Future research aims to clarify the profession-specific causes of MSP in upper and lower extremities to be able to develop preventive measures.

Abbreviations

AHP: pain in arms or hands

HP: health professionals

HP students: students of health professions

LBP : Low back pain

LFP: pain in legs or feet

MSD: musculoskeletal disorders

NP: neck pain

Declarations

Ethics approval and consent to participate

For the National Graduate Survey of Health Professionals the need for ethics approval was waived. An anonymized questionnaire study does not require approval by the cantonal ethics committee. (https://www.zh.ch/de/gesundheit/ethik-humanforschung/zustaendigkeit-kantonale-ethikkommission.html). Students were informed about the purpose of the data collection and they provided informed consent in the online questionnaire for the use of their data. The participation in the survey was voluntary. The participating universities gave their permission to use the data for this study.

All methods were performed in accordance with the relevant guidelines and regulations. The data of the survey was anonymized and stored by quality and evaluation unit of the Health Department of the of the Zurich University of Applied Science ZHAW according to the universities' regulations. Researchers analyzing the data are not able to track the selected data back to the participating students.

Consent for publication

Not applicable.

Availability of data and materials

The dataset analysed during the current study is available in the digital collection of the ZHAW, https://digitalcollection.zhaw.ch/ (the exact link will be provided, as soon as available)

Competing interests

The authors declare that they have no competing interests.

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Authors' list and contributions

TB was responsible for the study design, the data collection, and the manuscript draft. TV was responsible for the data analysis and the editing of the results. All authors contributed to the literature search, the manuscript draft, the discussion of the results, reviewing and editing the manuscript. All authors approved the final version of the manuscript.

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Figures

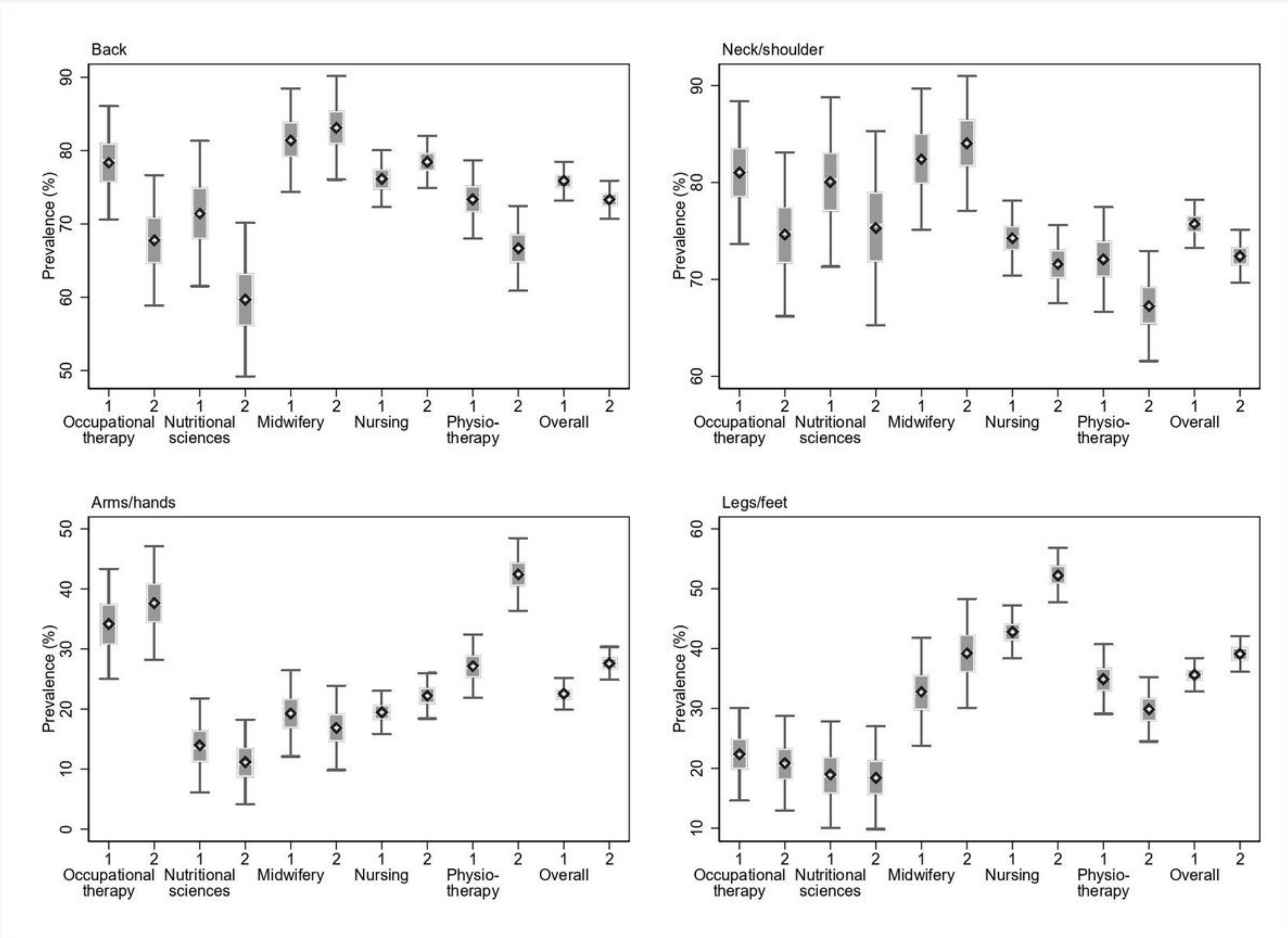

Figure 1

Persistence and change of musculoskeletal pain from baseline to follow-up in Swiss health professionals

Legend figure 1: Grey box comprises the interquartile range of bootstrap prevalence estimators. The white line within the box is the median bootstrap prevalence estimator. The whiskers show the bootstrap 95% normal based confidence intervals. 1= baseline at the end of studies; 2= follow up after one year of working in the health care workforce

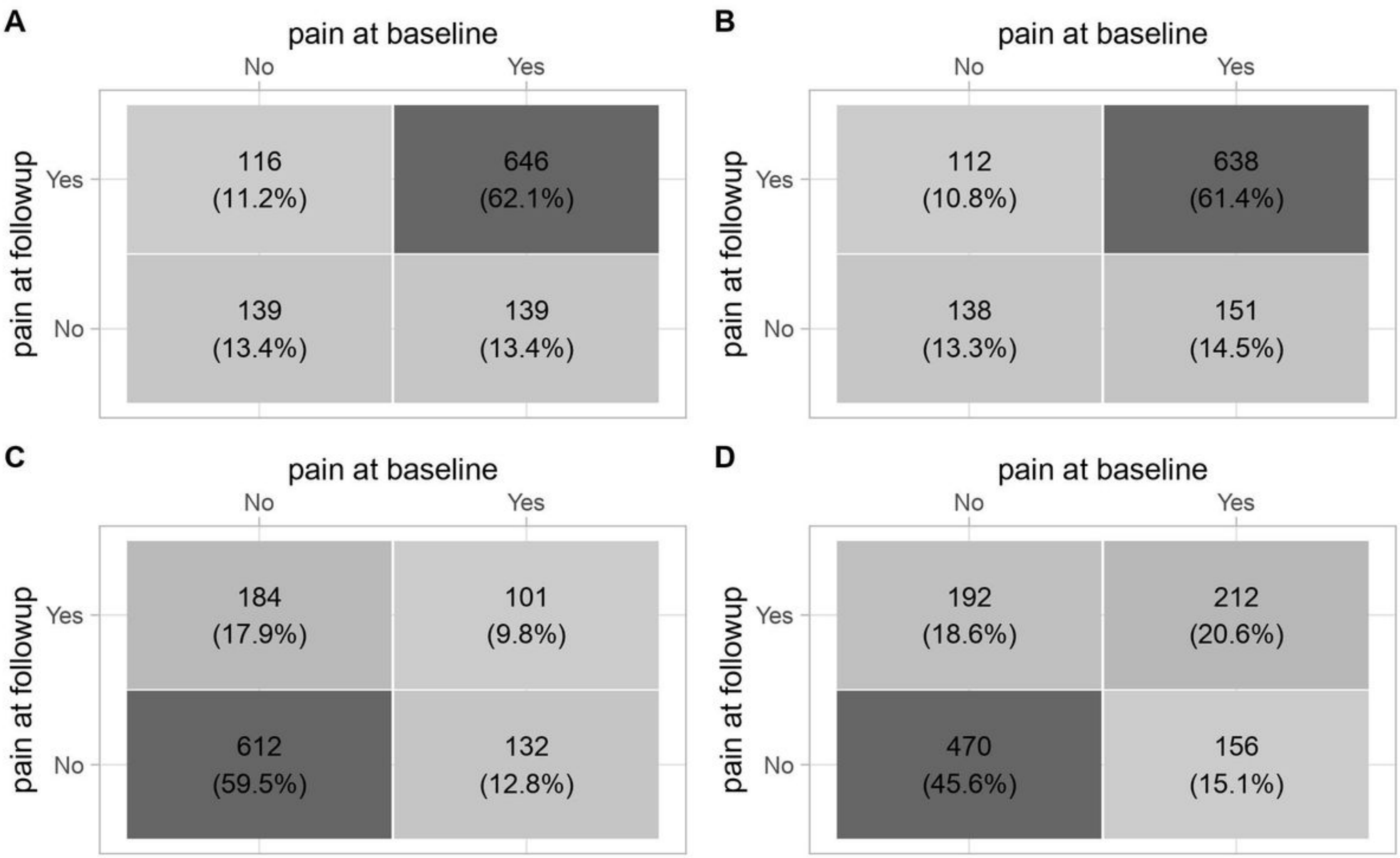

Figure 2

Patterns of change in musculoskeletal pain experience from baseline to follow-up

Legend figure 2: A: Lower Back pain; B: Neck and shoulder pain; C: Pain in arms/hands; D: Pain in legs/feet]

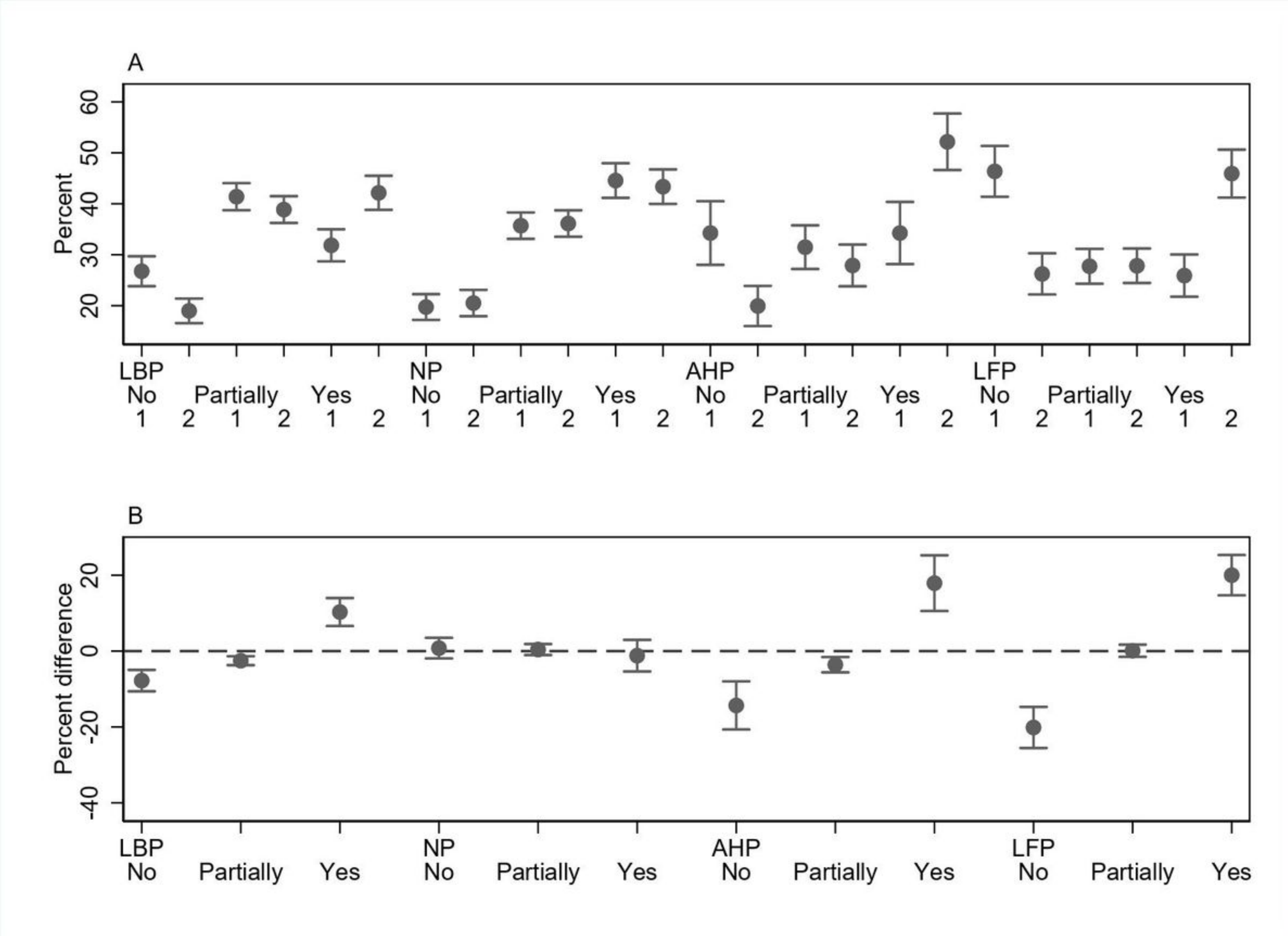

Figure 3

Attribution of causes of musculoskeletal pain

Legend Figure 3: A: Estimated percent by response category at baseline (1) and follow-up (2) with 95% confidence intervals; B: Estimated percent difference between baseline (1) and follow-up (2) by response category with 95% confidence intervals