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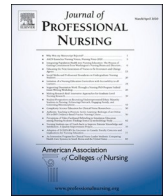
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Do physical work factors and musculoskeletal complaints contribute to the intention to leave or actual dropout in student nurses? A prospective cohort study

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ABSTRACT

Background: Little is known, whether physical workload and musculoskeletal complaints (MSCs) have an impact on the intended or actual dropout of nursing students in the later years of their degree program.

Purpose: Studying the determinants of intention to leave and actual dropout from nursing education. We hypothesized that physical workload and MSCs are positively associated with these outcomes.

Methods: A prospective cohort study among 711 third-year students at a Dutch Bachelor of Nursing degree program. Multivariable backward binary logistic regression was used to examine the association between physical work factors and MSCs, and intention to leave or actual dropout.

Results: Intention to leave was 39.9% and actual dropout 3.4%. Of the nursing students, 79% had regular MSCs. The multivariable model for intention to leave showed a significant association with male sex, working at a screen, physical activity, decision latitude, co-worker support, distress and need for recovery. The multivariable model for dropout showed a significant association with living situation (not living with parents), male sex, sick leave during academic year and decision latitude.

Conclusions: Our research shows that the prevalence of MSCs among nursing students is surprisingly high, but is not associated with intention to leave nor with actual dropout.

Introduction

The nursing profession is increasingly being challenged due to the aging population, high work pressure, high job demands and a decrease of available nurses (WHO, 2020). Many studies in various countries have investigated the organizational turnover intention among nurses (e.g., Chachula et al., 2015; Chênevert et al., 2016; Flinkman et al., 2013; Rudman et al., 2014). In the prospective cohort study of Moloney et al. (2018) among 2876 New Zealand nurses, high workload was one of the strongest predictors of the intention to leave the organization and the nursing profession. In order to continue to meet the standards in nursing care, it is imperative to maintain or even increase the current number of

nurses and to consider ways to retain the ones who intend to turnover.

The problem of nurse turnover is not limited to registered nurses. Dropout already starts within nursing education and occurs even in later stages of the nursing educational program, so called 'late dropout' (Bakker et al., 2019) and shortly after graduation (Parker et al., 2014). In the Netherlands, the organization of clinical placements may vary between nursing schools; the total duration of clinical placement is legally set at 2300 h (Nursing Education Requirements, 2011). However, little is known about the physical workload (e.g., lifting and bending) and physical health (e.g., MSCs) of nursing students and the impact of these strains on dropout.

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Literature review

Nursing student dropout is a concern. In 2017 in the United Kingdom 24% of nursing students left or suspended their studies (Beech et al., 2019). Dropout from nursing programs create a public health concern; every student who drops out before completing nursing education is a potential loss to the nursing workforce and community (Andrew et al., 2008), and represents a loss of human capital as well as financial capital. The problem of nursing student dropout is complex, widespread and focus of numerous research (e.g. Hamshire et al., 2019; Merkley, 2015; Mulholland et al., 2008; Pitt et al., 2012).

Much research has been done on factors influencing nursing school dropout. Demographic factors such as age, gender and ethnicity may be factors influencing dropout rates (Harris et al., 2014; Jeffreys, 2012; Mooring, 2016; Pence, 2011), though results from various studies are conflicting. In addition, psychosocial job factors, such as supervisor support and co-worker support, have shown to be related with the intention to quit nursing education (Bakker et al., 2021).

The nursing profession is a high-risk profession for developing musculoskeletal problems (Gilchrist & Pokorná, 2021; Latina et al., 2020; Lin et al., 2020), and these may contribute to leaving the profession (Fochsen et al., 2006; Gilchrist & Pokorná, 2021). Musculoskeletal problems already occur in nursing students (Antochevis-de-Oliveira et al., 2017), but we do not know to what extent these complaints lead to dropping out of nursing school. Previous studies have shown an association between occupational physical activities, such as lifting, stooping, bending and patient transfers, and MSCs in student nurses (Backåberg et al., 2014; Menzel et al., 2016; Mitchell et al., 2009; Mitchell et al., 2010) and in registered nurses (Choi & Brings, 2016; Lövgren et al., 2014; Nourollahi et al., 2018; Paul et al., 2018; Pompeii et al., 2009; Smith & Leggat, 2004). Low back pain in graduated nurses often had its onset during nursing education (Menzel et al., 2016; Mitchell et al., 2009). From all MSCs among Australian nursing students, low back pain was the most common (59.2%) (Smith & Leggat, 2004).

The results of a study by Fochsen et al. (2006) showed an association between MSCs and leaving the nursing profession. However, it is not known to what extent MSCs are associated to dropout intention and actual dropout from nursing education, despite the known high prevalence of MSCs in nursing students.

Research question

The aim of our study was to explore the determinants of intention to leave the nursing education and actual dropout from nursing education. We hypothesized that high physical workload and presence of MSCs are positively associated with these outcomes. In addition, we assessed possible other determinants, such as sociodemographic characteristics (e.g., sex, age, length, Body Mass Index (BMI), living situation, ethnicity, native language, previous education, and study route) and psychosocial work factors (e.g., decision latitude, psychological job demands, physical job demands, supervisor support, co-worker support, distress and need for recovery). We chose to investigate late dropout, since the motives for early dropout from nursing education may be more related to academic life or the cognitive demands of the education (Blackwell, 2020; Pryjmachuk et al., 2009). Moreover, nursing students in the Netherlands spend more time on placement in the later stages of the nursing educational program.

Methods

Design

This research was a prospective cohort study to explore the determinants of intention to leave the nursing education and actual dropout from nursing education.

Setting

Rotterdam University of Applied Sciences has $\geq 39,000$ students and offers a wide variety of educational programs. One of these programs is the Bachelor of Nursing degree program with an annual number of 400–500 first-year students (Vereniging Hogescholen, 2020). This is a four-year accredited program, including four 20-week clinical placements, one in the second year (32 h per week), two in the third year (24 h per week) and one in the fourth year (24 h per week) of the program. Since the Dutch Bachelor of Nursing degree program might differ from such programs in other countries, context information is provided in Supplements 1 and 2. The current study is a sub-study of the research project SPRiNG that was initiated in 2016 (Bakker et al., 2018). SPRiNG is an acronym for Studying Professional Resilience in Nursing students and new Graduates.

Participants

All third-year students from three consecutive academic years (2015/2016, 2016/2017, and 2017/2018) were invited to participate in the cohort study during their third clinical placement.

Data collection

Students received an online questionnaire by e-mail. To enhance the response, completion of the questionnaire was integrated into the educational program, during lectures addressing professional development and research skills. Participation was voluntarily. At the end of the questionnaire, students could indicate whether they gave consent to use their data for research purposes. Refusal to participate had no influence on their grades. Participation did not yield extra credits. Prior to the questionnaire they received extensive information about the study orally and in writing.

Outcome measures for the current study

The outcomes of interest of the study were intention to leave nursing education and actual dropout from nursing education.

Intention to leave was measured by one question: 'I am considering quitting my study'. Answers were rated on a 10-point Likert scale ranging from 'definitely not' (score 1) to 'definitely yes' (score 10). We dichotomized responses into 'not considering quitting nursing education' (score 1) and 'considering quitting nursing education' (scores 2 to 10). Data on student status (actual dropout) was retrieved from the university's student administration and was classified into two categories: dropped out and not dropped out. Students who had quit education in the third or fourth year of the program without a certificate were considered students with late dropout. Students still registered in the program, that is, students with study delay, were classified into the 'not dropped out' category, together with graduated students. The end date of follow-up at which student status was determined was 1 September 2019; this was within the planned graduation date of the 2017–2018 cohort.

Determinants and domains

The questionnaire was composed on the basis of (parts of) validated instruments. For the use of these instruments, permission was obtained from the copyright holders where necessary. A detailed description of these instruments and its validation can be found in Supplement 3.

Determinants of interest were categorized in the following domains:

1) Sociodemographic characteristics

The determinants within this domain were sex, age, length, Body Mass Index (BMI), living situation, ethnicity, native language, previous

education, and study route. Living situation was collapsed from six categories into living with parents or not living with parents. Students who lived alone, with partner, with partner and children, with children, or with others, were classified as not living with parents. Ethnicity was collapsed into Western background or migration background. According to the definition by Statistics Netherlands (CBS, 2020), students of whom both parents had been born in one of the European countries (excluding Turkey), North-America and Oceania, and Indonesia and Japan were classified as students with a Western background. Native language was classified into native Dutch or non-native Dutch. Previous education levels were senior general secondary or pre-university education, academic higher education or vocational education and training, in-service training, or other. There are three study routes: full-time, part-time, or combined study-work program.

2) Physical work factors

Physical work factors were lifting and bending, working at a screen, total time working at a screen, the number of colleagues on-site on an average working day, the number of patients under care on an average working day, current clinical placement setting, and physical activity level. Exposure to lifting and bending was assessed with the 8-item ‘lifting and bending’ scale from the NEXT questionnaire (Hasselhorn et al., 2003), resulting in a weighted sum score ranging from 0 to 100. Questions on the frequency (no-little/often-always) and duration (mean number of hours per day) of working at a screen were taken from the Dutch Questionnaire on the Experience and Evaluation of Work (VBBA) (Van Veldhoven & Meijman, 1994). The number of colleagues on-site was dichotomized into ‘0 to 1’ and ‘2 or more’. Current clinical placement settings were hospital care, nursing home care, home care, mental health care, and other (including care for disabled, youth healthcare, and other settings). Physical activity behavior was assessed using the Short Questionnaire to Assess Health-enhancing Physical Activity (SQUASH), with questions on the frequency, duration and intensity of four activity domains (commuting activities, leisure time activities, household activities, and activities at work and school). The questionnaire provides an indication of the number of days per week with at least 30 min of moderate physical activity (Wendel-Vos et al., 2003).

3) MSCs at baseline

MSCs were assessed with the Dutch Musculoskeletal Questionnaire (DMQ) (Hildebrandt, 2001), including questions about having musculoskeletal ache, pain, or discomfort in each of twelve body regions supported by a body map diagram (Fig. 1).

Complaints at the twelve body regions were merged into three anatomical areas (Deurloo et al., 2019; Beumer et al., 2012; Staal et al., 2017): 1) complaints of arm, neck, shoulders (CANS), 2) back complaints (lower back and pelvis), and 3) complaints of the lower extremities (thighs, knees, lower legs and ankles/feet).

MSC variables were modelled as dichotomous variables per anatomical area; ‘MSCs’ (including ‘yes, long-lasting’ or ‘yes, regularly’) and ‘no MSCs’ (including ‘yes, once in a while’ or ‘no, never’).

Other determinants within this domain were the consultation of healthcare providers for physical health complaints (yes/no), whether the complaints were related to the clinical placement (yes/no), and absence during academic year due to sickness (yes/no).

4) Psychosocial factors

Selected psychosocial factors were decision latitude (the worker’s control over the performance of his or her own job), psychological job demands, physical job demands, supervisor support, co-worker support, distress and need for recovery. Decision latitude (composed of decision authority and skill discretion), psychological job demands, and supervisor and co-worker support are subscales of the Job Content

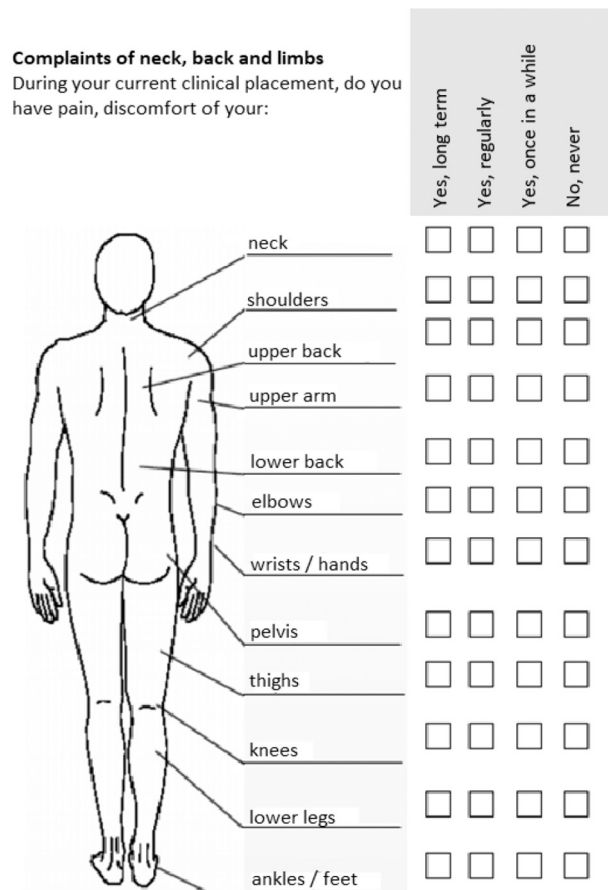


Fig. 1. Body map diagram.

Questionnaire (JCQ) (Karasek et al., 1998). To maintain JCQ coherence, the JCQ physical job demands subscale was included in this domain. For each subscale, a sum score was calculated.

The 3-item Distress Screener (Braam et al., 2009), with questions about suffering from worry or listlessness, and feeling tense during the past week, was used to measure non-specific distress. Students with a total score of 4 or higher were scored as distressed according to the Distress Screener.

Need for recovery was assessed with a subscale from the Dutch Questionnaire on the Experience and Evaluation of Work (Van Veldhoven & Broersen, 2003), consisting of 11 dichotomous items (yes/no), including ‘At the end of a working day I am really feeling worn out’ and ‘I find it hard to relax at the end of a working day’. A sum score, ranging from 0 to 100, was calculated, with higher scores indicating a higher need for recovery.

Data analysis

First, we checked the normality of distributions, and performed descriptive analyses for all variables. Next, we checked for multicollinearity by calculating the correlation coefficient Spearman’s rho (with cut-off <0.7). Of any two variables showing (multi)collinearity, we kept the variable with the strongest association to the primary outcome in the univariable analysis; for the current study, BMI was kept over weight, and ‘absence during academic year due to sickness’ over ‘number of sick leave days’. Next multicollinearity was also checked for the remaining variables using Variance Inflation Factors (VIF) for each independent variable (with cut-off <2.5); VIFs ranged from 1.06 to 1.97, indicating that there is no strong multicollinearity among the independent variables. Subsequently, we assessed the association between the

variables within each domain and late dropout, using binary multiple logistic regression analysis with backward elimination ($p \geq 0.1$ for removal); we calculated the odds ratios with 95% confidence intervals of each and variance in each domain. Finally, all remaining variables with p -values < 0.1 were included in a final backward stepwise binary multiple logistic regression model to obtain a final model. This procedure was repeated for intention to leave.

We performed a sensitivity analysis to correct for cohorts, as cohort 1 in our study had more follow-up time than the other two cohorts. We therefore analyzed the final model again with cohort number added as a categorical variable. All analyses were performed in IBM SPSS version 26.0.

Ethics approval and consent to participate

This study was conducted according to the principles of the Declaration of Helsinki, 64th World Medical Association General Assembly, Fortaleza, Brazil, October 2013, and in accordance with the Dutch Medical Research Involving Human Subjects Act. The study meets the requirements of the Netherlands Code of Conduct for Scientific Practice from the Association of Universities in the Netherlands (VSNU). The Medical Ethical Review Committee of the Erasmus Medical Center Rotterdam approved the study (MEC number: FMS/sl/273789).

All participants received information about the study orally and in writing, and were assured of complete confidentiality. All participants gave written consent. No identifying information of participants is presented.

Results

Response and participants' sociodemographic characteristics

Of all 995 invited nursing students, 711 students (response, 71%) gave consent to use their data for the study. Baseline characteristics are presented in Table 1. The mean age of the participants was 23.5 (SD 5.5) years and 90.2% were female. 70.0% were from Dutch origin and 56.3% lived with their parents. Average BMI was 23.7 (SD 4.2).

Intention to leave and actual dropout

Of all 711 students, 39.9% had an intention to leave at baseline. The late drop-out rate was 3.4% (24 of 711 students). According to the student registration, in total 74 of 995 invited third-year students (7.4%) dropped out from nursing school during the third or fourth year of the program, meaning a drop-out rate of 17.6% (50 of 284) among the students who gave no consent.

MSCs at baseline

Of 711 students, 559 (78.6%) reported having regular or long-lasting MSCs or discomfort in one or more body parts; 555 (78.1%) indicated that these complaints were partly or fully clinical placement related. Among the students reporting regular or long-lasting MSCs, 57.0% reported complaints of arm, neck and shoulder (CANS), 56.1% reported low back pain, and 41.2% reported complaints of the lower extremities (Table 1). Within these percentages, students reporting only occasionally occurring MSCs were not included (30.0% for CANS, 28.0% for low back complaints, and 32.0% for complaints of the lower extremities).

Univariable associations

The full list of univariable associations between the determinants in the four domains and the intention to leave and actual dropout are presented in Supplements 4 and 5.

Fifteen determinants were significantly associated with intention to leave ($p < 0.1$). These were: study route (i.e. study-work program);

Table 1
Participants' baseline characteristics.

	N (%) unless specified otherwise
Sample size, N	711
Sex (% female)	641 (90.2%)
Age (years), mean \pm SD (Range)	23.50 \pm 5.46 (19–55)
BMI ^a (kg/m ²), mean \pm SD	23.71 \pm 4.18
Height (cm), mean \pm SD	170.37 \pm 8.26
Living situation (% with parents)	400 (56.3%)
Ethnicity (% Western background)	498 (70%)
Native Dutch (% native Dutch)	614 (86.4%)
Previous educational level	
• Senior general secondary education	393 (55.3%)
• Pre-university education & academic higher education	106 (14.9%)
• Intermediate vocational education and training & in-service training & other	212 (29.8%)
Educational routing	
• fulltime program	439 (61.7%)
• study-work program	212 (29.8%)
• part-time study program	60 (8.4%)
Current clinical placement setting	
• hospital	338 (47.5%)
• elderly care	81 (11.4%)
• home care	189 (26.6%)
• mental healthcare	55 (7.7%)
• other	48 (6.8%)
Overall MSC at any body part (% regular/long-lasting)	558 (78.5%)
Complaints of the upper extremities area (% regular/long-lasting)	405 (57.0%)
• neck	258 (36.3%)
• shoulder	267 (37.6%)
• upper back	242 (34.0%)
• upper arm	39 (5.5%)
• elbows	18 (2.5%)
• wrists/hands	93 (13.1%)
Complaints of the lower back area (% regular/long-lasting)	399 (56.1%)
• low back	390 (54.9%)
• hips	62 (8.7%)
Complaints of lower extremities (% regular/long-lasting)	293 (41.2%)
• thighs	33 (4.6%)
• knees	151 (21.2%)
• lower legs	86 (12.1%)
• ankles/feet	209 (29.4%)
Complaints related to the clinical placement (% (yes, partly/yes entirely))	555/558 (99.5%)
Absence during academic year due to sickness (% yes)	345 (48.5%)
Intention to leave nursing education (% any intention)	284 (39.9%)

^a Body mass index (BMI).

working at a screen; clinical placement (i.e. elderly care); physical activity level; complaints of arm, neck, shoulders (CANS); back complaints (i.e. lower back and pelvis); complaints of the lower extremities (i.e. thighs, knees, lower legs and ankles/feet); absence during academic year due to sickness; decision latitude; psychological job demands; physical job demands; supervisor support; co-worker support; distress; and need for recovery.

Seven determinants were significantly associated with actual dropout ($p \leq 0.1$). These were from the sociodemographic characteristics: male sex, BMI, and living with parents; from the physical work factors: total time spent working at a screen, clinical placement setting (elderly care); from the MSC determinants: absence during academic year due to sickness, and from the psychosocial work factors: decision latitude.

Table 2
Statistically significant determinants for intention to leave nursing education.

Determinants	OR ^a	95% CI ^b	p-Value	R ² ^c
				0.166
Sex (male)	2.035	1.186–3.492	0.010	
Working at a screen (intensive)	0.669	0.455–0.983	0.040	
Physical activity level	1.032	1.00–1.064	0.047	
Decision latitude	0.552	0.348–0.877	0.012	
Co-worker support	0.610	0.413–0.901	0.013	
Distress (yes)	1.88	1.32–2.679	0.000	
Need for recovery	1.01	1.003–1.017	0.005	

^a Odds ratio.

^b Confidence interval.

^c Explained variance by Nagelkerke R-square test.

Multivariable associations

For intention to leave, multivariable logistic regression per domain showed that socio-demographic characteristics explained 4.3% of the variance, physical work factors explained 3.7%, MSCs explained 4.2%, and psychosocial factors explained 14.5%. The full list of multivariable associations between intention to leave and the determinants in the four domains are presented in Supplement 6.

The determinants with *p*-values <0.1 were included in the final model. Statistically significant positive associations were found for male sex, physical activity level, distress and need for recovery. Intensive working at a screen, co-worker support and decision latitude were statistically significantly but negatively associated with intention to leave. This model explained 16.6% of the total variance (Table 2).

For actual dropout, multivariable logistic regression per domain showed that the socio-demographic characteristics explained 6.9% of the variance, physical work factors explained 6.1%, MSCs explained 2.7%, and psychosocial factors explained 3.6% of the variance. The full list of multivariable associations between actual dropout and determinants in four domains are presented in Supplement 7.

The determinants with *p*-values <0.1 were included in the final model. Male sex, living situation (not with parents), and absence due to sickness during academic year, were statistically significantly positively associated with actual dropout in the final model, whereas decision latitude showed a statistically significant but negative association. This model explained 7.3% of the total variance of actual dropout (Table 3).

Discussion

Intention to leave and actual dropout from nursing education in the third or fourth year of the nursing education are multifactorial processes. We hypothesized that high physical workload and presence of MSCs are positively associated with these outcomes. We found no statistically significant association between physical workload or MSCs and actual dropout from nursing education. As for the intention to quit nursing education, working at a screen and physical activity, both in the domain of physical workload, were related. In addition, we found a

number of other determinants that were significantly related to the outcomes of this study. The explained variances in the final models, however, were quite low, with 17% for intention to leave and only 7% for actual dropout. This means that the physical work factors and musculoskeletal complaints do not or hardly explain the intention to leave and actual drop-out. Earlier research has shown that psychological factors also play a role. Bakker et al. (2019) found two core themes in their qualitative study on late dropout among nursing students: ‘ending up in a downward spiral’ and ‘experiencing an increasing mismatch between expectations and reality’. The first theme involves students losing their grip on the learning process. The lack of support from clinical supervisors and study career coaches, and an increase of physical, psychological and social problems, contributed to this. The second theme involves students who had developed doubts about a nursing career during nursing education and had come to realize that nursing was not what they wanted to pursue (Bakker et al., 2019). The psychological burden associated with nursing, experiences of lateral violence, incivility and bullying (Bambi et al., 2018), or the burden of irregular working hours, may also contribute to the actual dropout from nursing education. Another study showed that pursuit of another career, starting a family or disillusionment with nursing and health concerns were major factors for late dropout (Eley et al., 2010).

We have no sound explanation for the positive association between physical activity level and the intention to leave nursing education. It might be, however, that the physical activity level relates to the study-work-life balance, as the used SQUASH instrument measures time spent on physical activity. It is possible that time spent on household chores or mobility may unfavorably compete with study time. We also find it hard to explain the inverse association with working at a screen, but increased working at a screen may be associated with more hours spent at assignments for school, making the student feel more in control of their study.

Although MSCs were not related to actual dropout from nursing education, the percentage of students who reported having regular or long-lasting MSCs in one or more parts of the body was very high (78.6%). Most students (99.5%) indicated that these complaints were clinical placement related. In an Australian study, low back pain prevalence rates increased from first-year nursing students (12 months prevalence: 71%) to graduate nurses who had been working for about one year (12 months prevalence: 90%) (Mitchell et al., 2008). This increase may be explained by a rise in occupational exposure. MSCs are unmistakably common and underestimated in nursing schools, and warrant targeted interventions in order to decrease the risk of recurrence and chronicity of MSCs due to long-lasting, occupational exposure (Mitchell et al., 2008).

It is possible that third-year nursing students with MSCs who are doubting a nursing career because of their physical health, decide to pursue their bachelor’s degree and quit the nursing profession after graduation (Kox et al., 2020a). MSCs were neither mentioned in the systematic review of Eick et al. (2012) who investigated placement-related attrition, nor in the above-mentioned interview study of reasons for dropout among Dutch nursing students (Bakker et al., 2019).

Table 3
Statistically significant determinants for actual dropout from nursing education.

Determinants	OR ^a	95% CI ^b	p-Value	R ² ^c
				0.073
Sex (male)	3.096	1.089–9.804	0.034	
Living situation (not with parents)	2.259	0.966–5.280	0.060	
Absence during academic year due to sickness	2.166	0.906–5.177	0.082	
Decision latitude	0.393	0.154–1.001	0.050	

^a Odds ratio.

^b Confidence interval.

^c Explained variance by Nagelkerke R-square test.

Sex and decision latitude were both significantly associated with intention to leave and actual dropout. The proportion of male students of 10% is representative for the average number of male nurses in the healthcare sector worldwide (Hodges et al., 2017). The association between being male and (late) dropout is in line with previous findings (Prymachuk et al., 2009; White et al., 1999). Gender-based barriers, such as lack of history about men in nursing, lack of role models, and gender discrimination present important challenges to men on their journey towards nursing as a career and may contribute to dropout from nursing education when these barriers are too high (Hodges et al., 2017; MacWilliams et al., 2013; Stott, 2004). Regarding decision latitude, we found that students who have less opportunities to make work-related decisions independently, are more likely to drop out from nursing education or intend doing so. Student nurses are inclined to follow the instructions of practical trainers and supervisors. This could make them feel having less latitude in making decisions about patients' care. This is in line with a study by Galbany-Estragués and Comas-d'Argemir (2017) who found that graduated nurses felt less latitude in making decisions about patients' care in case of power relations between physicians and nurses. High decision latitude exists in organizations that value nurses' contributions to policy affairs and to patient care delivery decisions (Kowalski et al., 2010).

In our study, students who receive more support from their colleagues had less intention to leave. The importance of co-worker support during clinical placement was also found by Ujváriné et al. (2011), who looked at the intention to graduate as a nurse among 381 fourth-year Hungarian nursing students. According to the systematic review of Eick et al. (2012), the attitude and support of placement staff contributes to the intention to leave. Possible positive effects of social support from important key figures, including close colleagues, should not be underestimated (Heijden et al., 2009), and health care institutions as well as nursing schools should find opportunities to obtain more social support for nursing students.

In addition to sex and decision latitude, living situation and absence due to sickness during academic year were significantly associated with actual dropout. In the Netherlands, some students stay and live with their parents during their study, whereas other students choose to start living independently (Beekhoven et al., 2004). In our study, 44% of the nursing students had left the parental home. We have no explicit explanation for the higher dropout risk of students living independently, but students who live with their parents are more likely to receive parental support (Strom & Strom, 2005), whereas students living independently (alone, with peers or with a partner) may have other responsibilities, e.g., finding themselves a job on the side to maintain a living (Hovdhaugen, 2013) or caring for their own spouse and children (Montgomery et al., 2009).

The association between absence due to sickness and a higher dropout risk is supported by a study by Josephson et al. (2008), who found that multiple factors, such as social exclusion in the workplace, negative consequences of organizational changes and poor self-rated general health, contribute to both absenteeism and the risk of dropout from the nursing profession.

Future research

The explained variance in our study was quite low. Therefore, more research is needed, including other possible determinants. This means that more research, preferably qualitative studies, into the reasons for nursing students to consider quitting nursing education or actual dropout is necessary. Since being male was associated with a higher dropout rate, further research on this is recommended. We also suggest taking the severity of musculoskeletal pain into account for future research, to be able to distinguish between mild pain and moderate or severe pain, as more intense pain may be more distinctive for dropout.

Recommendations for nursing education

It is important that nursing schools invest to retain long-term delayed students, preventing them from dropping out and helping them graduate. This may contribute to reduce nursing shortages. However, nursing schools have to realize that there are other factors contributing to dropout as well, more specifically social support and a sufficient level of decision latitude during clinical placement seem desirable. Systematic exit interviews or surveys with students that have decided to quit nursing education may provide better insight in the reasons for dropout, and, thus, may provide guidance to the prevention of late dropout.

We assumed that physical complaints that already occur during nursing training would contribute to the students' intention to leave or actual dropout. However, we did not find such association. Yet, MSCs among our students are highly prevalent. That is why we think it is important to offer nursing students a proper physical workload training, aiming at prevention or timely detection of MSCs, as early in nursing education as possible. The development, implementation and evaluation of such ergonomic intervention, however, may be a challenge, given the limited and conflicting evidence on the effectiveness of preventive interventions for work-related physical health complaints of nursing students and novice nurses (Kox et al., 2020b).

Intention to leave is a proxy for actual dropout. In our study similarities and differences in determinants for intention to leave and actual dropout were observed, but the causal pathway between them remains unclear.

Limitations

The data for this study was collected between 2016 and 2019, up and till the planned graduation date of the third-year students of the 2017/2018 group. The data collection is still ongoing, as we include every year a new cohort of third-year students. This study was limited to students and their follow-up within the pre-covid era. It is, however, worthwhile to assess the drop-out of nursing education in later cohorts.

The participation rate of nursing students at baseline was adequate (71.5%). University registry-based data provided the possibility to evaluate the dropout of nursing education for all students in our study cohort. The total dropout was 7.5%. The dropout rate, however, was much lower in the student group who gave consent to participate (3.4%) compared to the student group who did not give consent (22.5%). Here, non-response bias may have played a role: students who declined to participate may have been the more vulnerable students for dropout.

Furthermore, the duration of the follow-up was different for the three academic years. For students of the academic year 2017–2018 follow-up was shorter than for those of the academic year 2015–2016. For students with study delay, the study status (graduated or dropout) was not definite. Therefore, we may have underestimated the actual dropout rates, especially of students from the third sub-cohort. To assess whether the differences in duration of follow-up could have influenced our results, we performed a sensitivity analysis correcting for the three sub-cohorts/academic years. This did not alter the results (Tables 2 and 3).

In addition, the relatively low prevalence of late dropout in our study group limited the statistical power of our analyses. Overfitting of the model may be a limitation, due to the large number of factors relative to the number of events, especially in the case of actual dropout.

Due to financial restraints we were limited to collect the data from only one school in one geographic region. Therefore, the generalizability and applicability of our findings are limited.

Conclusion

In our study among a cohort of Dutch nursing students, we found no association between physical work factors nor MSCs and the intention to leave nursing education or actual dropout. Risk factors for the intention to leave nursing education were male sex, high physical activity level,

distress and need for recovery; protective factors were intensive working at a screen, co-worker support and decision latitude.

Risk factors for actual drop-out were male sex, living situation (not with parents), and sickness absence during the academic year. Decision latitude was a protective factor.

This suggests that more attention should be paid to the students' personal circumstances during nursing education and that they should be given decision-making opportunities. The dropout determinants in our study explained only 7.3% of the total variance of late dropout from nursing education. Therefore, further research focusing on other determinants that were not included in our study is needed.

Even though MSCs have no correlation with intention to leave and actual dropout, the high prevalence of MSCs should be a major point of concern for nursing education and future research.

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Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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CRedit authorship contribution statement

PR and HM initiated and designed the SPRiNG cohort study. JK and EB performed the data collection. Formal data analysis was done by JK, under supervision of JR, HG and PR. Data outcome was discussed with JK, JR, HG, PR and SBZ. JK produced the first draft of the manuscript with guidance from JR, HG, PR and SBZ. All authors (JK, JR, HG, SBZ, EB, HM and PR) contributed substantially to the manuscript and critically revised the content. All authors read and approved the final version of the manuscript.

Declaration of competing interest

None.

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