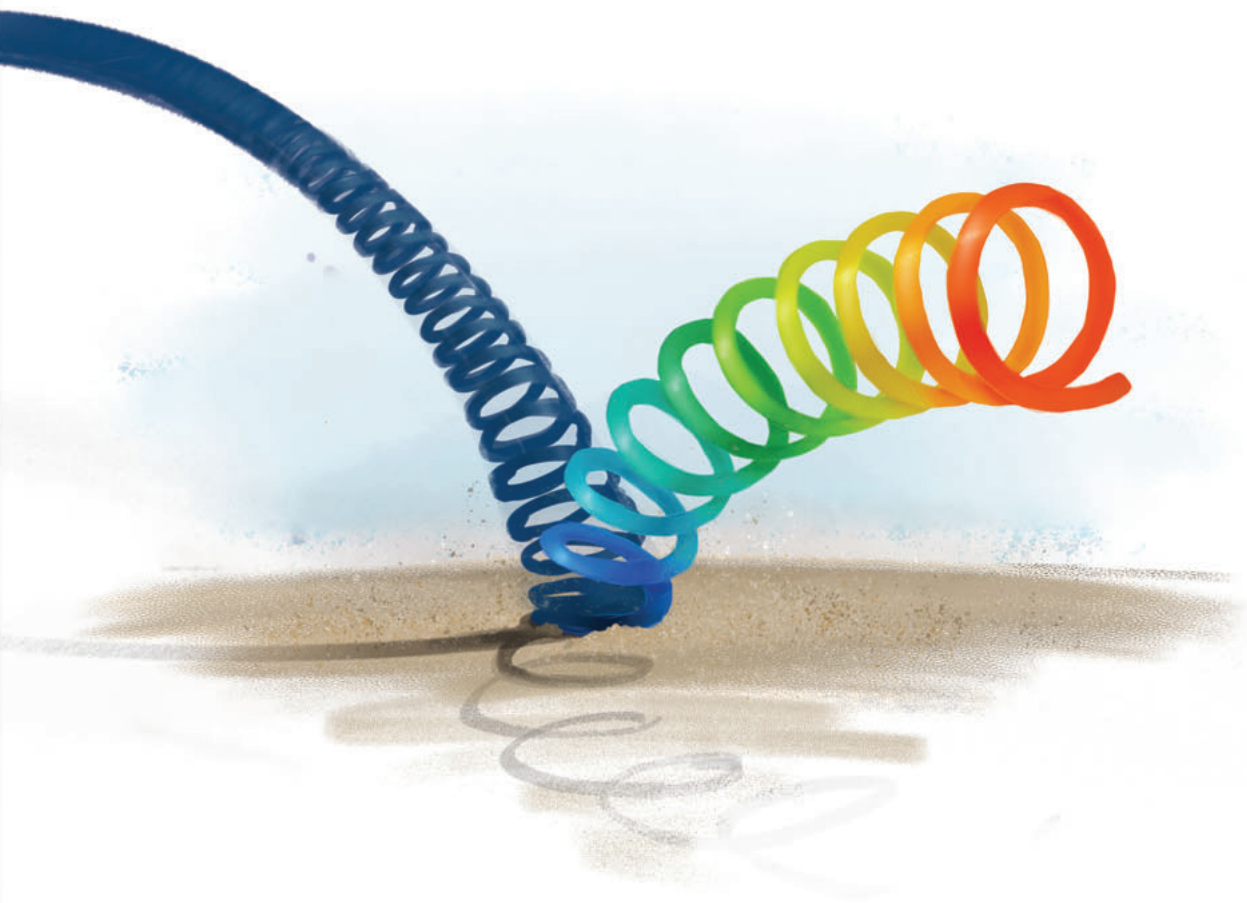




Retaining nursing students and novice nurses

The role of musculoskeletal symptoms
and physical work factors

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and physical work factors

Jos Kox

The studies presented in this thesis were conducted at Rotterdam University of Applied Sciences, Research Centre Innovations in Care, in collaboration with Erasmus MC, Department of General Practice, Rotterdam, The Netherlands, as part of the SPRiNG research project.

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The role of musculoskeletal symptoms
and physical work factors

Behoud van studenten verpleegkunde en beginnende verpleegkundigen

De rol van musculoskeletale symptomen
en fysieke arbeidsfactoren

Proefschrift

Ter verkrijging van de graad van doctor aan de
Erasmus Universiteit Rotterdam
op gezag van de
rector magnificus
Prof. dr. A.L. Bredenoord

en volgens het besluit van het College voor Promoties.
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Opgedragen aan mijn ouders
Sjef Kox († 05-12-2013)
Maria Kox-Schellens († 08-04-2015)

The greater our knowledge increases, the more our ignorance unfolds.
John F. Kennedy

Content

Chapter 1 General introduction	9
--------------------------------	---

PART I Mapping the motives and determinants that contribute to the intention to drop out and the actual drop-out rate among student and novice nurses

Chapter 2 Physical and mental determinants of dropout and retention among nursing students: protocol of the SPRiNG cohort study	25
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Chapter 3 Reasons why Dutch novice nurses leave nursing: a qualitative approach	47
---	----

PART II Determinants and predictors of intention to leave, actual dropout and musculoskeletal complaints in nursing students and novice nurses

Chapter 4 Do physical work factors and musculoskeletal complaints contribute to the intention to leave or actual dropout in student nurses? A prospective cohort study	77
--	----

Chapter 5 What sociodemographic and work characteristics are associated with musculoskeletal complaints in nursing students? A cross-sectional analysis of repeated measurements	117
--	-----

Chapter 6 Predicting late dropout from nursing education or early dropout from the profession	143
---	-----

PART III Effectiveness and feasibility of preventive interventions with regard to physical resilience

Chapter 7 Effective interventions for preventing work related physical health complaints in nursing students and novice nurses: A Systematic Review	167
---	-----

Chapter 8 Teaching ergonomic and haptonomic patient handling; the feasibility of an on-site course in clinical practice for nursing students	197
Chapter 9 General discussion	225
Summary	259
Samenvatting	267
Dankwoord	275
Curriculum Vitae	281
PHD Portfolio	285
List of publications	289



Chapter 1

General introduction

General introduction and outline of this thesis

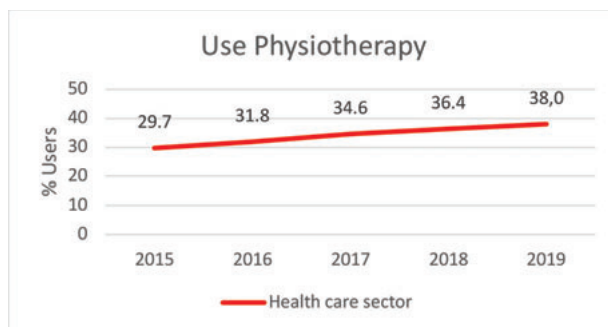
Challenges in the nursing workforce

The nursing profession is the largest group of healthcare professionals. Nurses are vital to the quality of care. The demand for nurses is high, but the nursing profession is under great pressure. Shortages in the nursing workforce are a growing challenge in the future, while the demand for nursing services will only increase due to a growing demand for care as a result of the aging population, a shrinking workforce and a growing outflow of nursing staff⁽¹⁾. It is therefore of great importance to train sufficient care professionals and to retain workers for care. Absenteeism among nurses however, is increasing and staff turnover in the nursing profession is high. In the Netherlands the absenteeism percentage among nurses is rising relatively quickly. The healthcare-wide absenteeism for the entire year 2020 was 7%, which is more than eleven percent higher than in 2019⁽²⁾. Figures from 2018 show an increase in the use of care by healthcare professionals, especially among nurses: mental complaints (severe fatigue, frustration, burn-out feeling) and musculoskeletal complaints of 25 and 40% respectively compared to 2014^(3, 4). Research among nurses with regard to physical and psychosocial workload showed that almost one in ten starting nurses are no longer working in healthcare within two years of graduation⁽⁵⁾.

This thesis will specifically focus on the physical resilience of nursing students and novice nurses in order to contribute to the retention of this particular group of (student) nurses.

Figure 1

Use of physiotherapy among healthcare workers⁽⁷⁾



The most commonly reported complaints (70%) at the General Practitioners in The Netherlands are related to the musculoskeletal system, especially knee, shoulder

and lower back complaints⁽⁶⁾. Figures from 2019 of health care use such as physiotherapy among health care professionals due to musculoskeletal complaints show an increase from 30% in 2015 to 38% in 2019 (figure 1)⁽⁷⁾.

Musculoskeletal complaints (MSC) in nurses and nursing students

Nursing work is demanding in many respects. Nurses often have to deal with a high level of physical strain during work. Nursing work involves various physical tasks such as lifting, bending, twisting, stooping, but also working in awkward positions and prolonged standing. Specific nursing activities such as bedding, lifting and moving patients and equipment, maintaining an uncomfortable posture, and standing for more than six hours a day, may lead to MSCs⁽⁸⁾. Nursing therefore is among the high-risk occupations with respect to work related MSCs. MSCs account for the greatest burden of all injury types in health care with respect to annual incidence⁽⁹⁾. Consistent with this, several studies found a high and sustained prevalence of low back pain among health care professionals^(10, 11) as well as in the general population⁽¹²⁾.

There is substantial research evidence on registered nurses with work related MSCs⁽¹³⁻¹⁵⁾, but research regarding work related MSCs among nursing students is limited. Nevertheless, studies among nursing students in various countries such as Ghana⁽¹⁶⁾, South Africa⁽¹⁷⁾, Australia⁽¹⁸⁾, Japan⁽¹⁹⁾, Hong Kong⁽²⁰⁾, US⁽²¹⁾, and India⁽²²⁾ show that MSCs occur regularly in this target group, due to clinical placements, worldwide.

Nursing student vs novice nurse dropout

Dropout is seen as a person who leaves school, college, or university before completing a qualification⁽²³⁾. It is commonly used in nursing students. When novice nurses leave the nursing profession we rather speak of turnover or attrition. Other terms used in this regard are failure, departure, wastage, leaving, and exit. Intention to leave is an individuals' own estimated subjective possibility or probability of leaving the organization or profession in near future^(24, 25). Various studies have explored reasons for dropout in nursing students^(26, 27), and turnover in novice nurses^(28, 29).

MSCs may contribute to productivity loss, absenteeism and dropout from the nursing profession⁽³⁰⁾. Work-related MSCs occur already during nursing education, especially in the later stages of the nursing educational programme⁽³¹⁾ or just after graduation⁽³²⁾, due to increased exposure to physical work factors and job demands. MSCs in novice nurses often had its onset during nursing training and clinical placements^(21, 33). Dropout from nursing care has been associated with MSCs, physical work factors and

increased job demands^(34, 35). In a two year prospective cohort study among qualified elder care workers, low back pain and disability due to low back pain during the last year of education were significant predictors for dropout 2 years after qualification⁽⁸⁾. Although the prevalence of MSCs in nursing school may not directly lead to dropout, they could contribute to increased dropout rates among novice nurses.

Main objectives and research questions in this thesis

Objective 1: Mapping the motives and determinants that contribute to the intention to dropout and actual dropout among student and novice nurses

1. Which physical complaints do nursing students experience during their clinical placements and which determinants play a role in this?
2. What are the reasons why Dutch novice nurses leave nursing?

Objective 2: To identify determinants and predictors for a) the intention to leave and actual dropout and b) musculoskeletal complaints and physical work factors among nursing students and novice nurses

3. Do physical work factors and musculoskeletal complaints contribute to the intention to leave and actual dropout in student nurses?
4. What sociodemographic and work characteristics contribute to experienced musculoskeletal complaints in nursing students?
5. What physical, mental or other determinants predict dropout in nursing students and novice nurses?

Objective 3: To investigate the feasibility and effectiveness of preventive interventions with regard to physical resilience

6. What preventive interventions that address these determinants are available and what can be concluded on the basis of scientific literature about the effectiveness of these interventions?
7. What potentially effective preventive intervention is feasible to implement in the study programme at nursing school or in the clinical workplace?

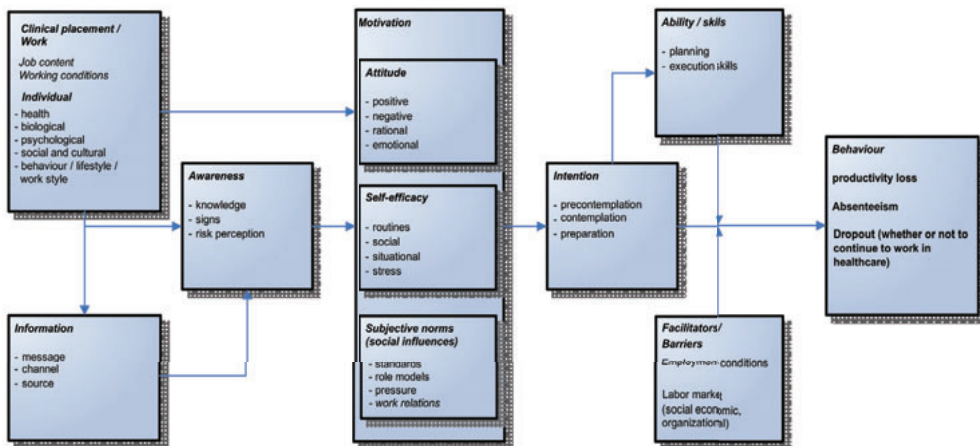
In this thesis, the research questions are explored in three parts: 1) Mapping the motives and determinants that contribute to the intention to dropout and the actual dropout rate among student and novice nurses, 2) Determinants and predictors for musculoskeletal complaints and dropout in nursing students and novice nurses, and 3) Effectiveness and feasibility of preventive interventions with regard to physical resilience.

A theoretical framework

The basis for this thesis is formed by a prospective cohort study. 711 student nurses were monitored for 2.5 years from the third year of their study until one year after graduation. The study was named SPRiNG; Studying Professional Resilience in Nursing students and new Graduates. The aim of this research was to develop a prediction model for dropout with which targeted preventive interventions can be applied. Targeted interventions on the determinants of behaviour at the right time increases the effectiveness of measures to prevent dropout⁽³⁶⁾. Such interventions should affect the behaviour and require behaviour change of the participants. Therefore the research for determinants of dropout of nursing students or dropout from the first phase of the career due to musculoskeletal problems is formed by an integrated explanatory model for behavioural change⁽³⁷⁾, also known as the ASE model (figure 2). ASE is short for Attitude, Social influence and Effectiveness. This model assumes that the intention to display certain behaviour leads to the actual performance of that behaviour.

Figure 2

Integrated explanatory model for behavioural change as a framework for determinant research. Based on de Vries, Dijkstra⁽³⁷⁾



Results of preventive interventions will depend on the effectiveness of the intervention itself, but also on the appropriate implementation of this intervention in the actual

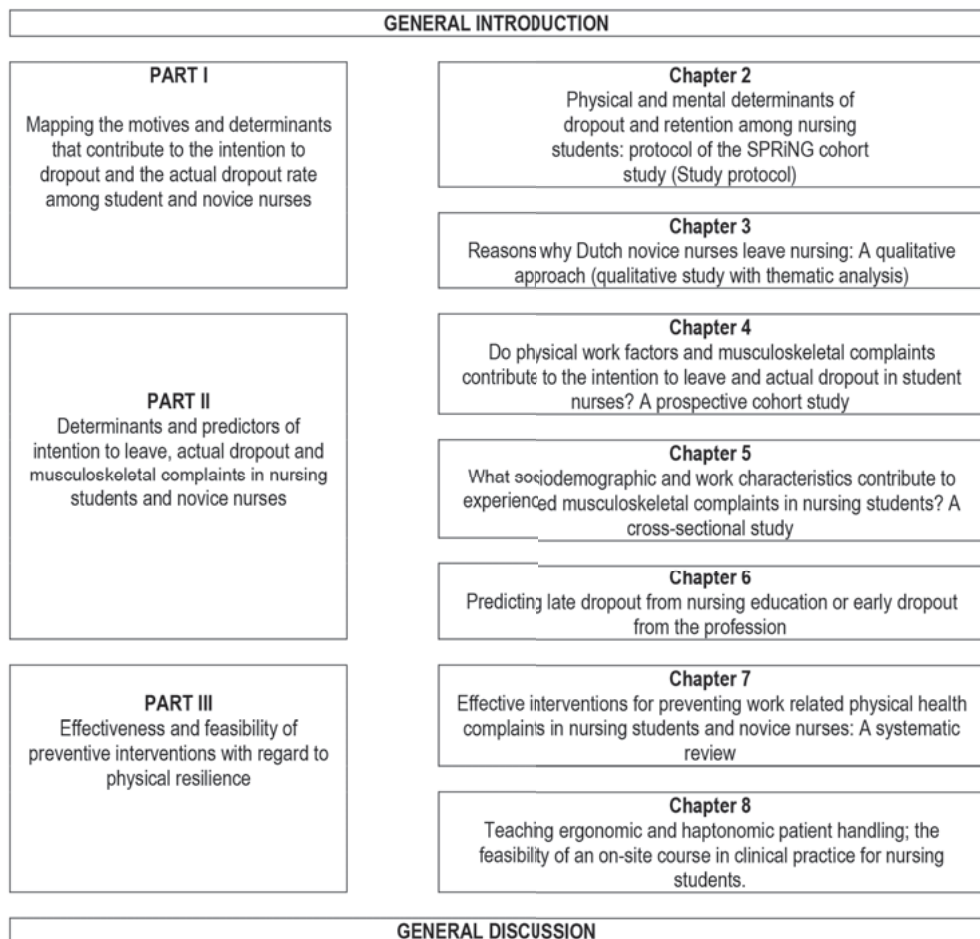
work situation⁽³⁸⁾. The ASE model can be used to describe the determinants associated with work behaviour, in which preventive interventions are actually applied or not⁽³⁹⁾. This model was chosen because it provides a broader overview of the various aspects that influence conscious behavioural change. The model has been applied successfully in the employment context in several previous studies^(40, 41)

Outline of this thesis

Thesis outline and methodological approach (Figure 3).

Figure 3

Thesis outline and methodological approach



PART I Mapping the motives and determinants that contribute to the intention to dropout and the actual dropout rate among student and novice nurses.

PART I contains two chapters about determinants of dropout and retention among nursing students and novice nurses. **Chapter 2** outlines the protocol of the SPRiNG cohort study. At this stage, it is unclear to what extent nursing students perceive a physical and mental workload leading to health problems during their nursing education and placement, and to what extent these health problems cause students to dropout from nursing education. Three cohorts of third-year nursing students from the Bachelor of Nursing programme of the Rotterdam University of Applied Sciences will be followed for 2.5 years with a self-administered questionnaire. Primary outcome is dropout from nursing education and dropout from the nursing profession. Main aims of this study were to determine: 1) the prevalence and incidence rates of dropout, 2) the protective and risk factors, and early indicators of dropout, and 3) the interaction between these factors and the indicators.

Chapter 3 describes the reasons of novice nurses to leave the nursing profession. This qualitative study explored Dutch novice nurses' motives for leaving the profession. Individual semi-structured interviews were held with seventeen former novice nurses who had decided to leave nursing within two years after graduation. The aim of this study was to unravel Dutch former novice nurses' reasons, experiences and the circumstances (possible unknown determinants) that contributed to their professional turnover from bedside nursing.

PART II Determinants and predictors of intention to leave, actual dropout and musculoskeletal complaints in nursing students and novice nurses.

PART II involves third year students of the Rotterdam University of Applied Sciences, Bachelor of Nursing programme. A prospective cohort study was conducted to investigate: 1) the association between physical work factors and late dropout from nursing education, 2) determinants that are significantly associated with experienced MSCs in three different anatomical areas, and 3) to identify predictors of late dropout due to physical, mental or other determinants.

In **chapter 4** the association between physical work factors and late dropout from nursing education among students was explored. Baseline questionnaire data from three third-year nursing student cohorts (N=711) were used. Dropout data was obtained from the university's student administration. The aim of this study was to investigate whether physical work factors are associated with late

dropout from nursing education, in addition to possible other determinants, such as sociodemographic characteristics, previous musculoskeletal complaints, psychosocial work factors, and considering to quit nursing education.

The aim of the study described in **chapter 5** was to investigate the (sociodemographic and workplace) determinants that are significantly associated with experienced MSCs in three different anatomical areas, i.e. upper extremities, low back and lower extremities among Bachelor of nursing students. This cross-sectional study included two measurements among third-year students from three cohorts (N=711 at baseline and N=359 at follow-up). Questionnaire data on MSCs, background characteristics and physical and psychosocial work factors were used.

Chapter 6 provides insights in the predictors of late dropout due to physical, mental or other determinants among student nurses. For this study, all students from cohort 1 and 2 who completed the baseline questionnaire and consented to participate were followed (N = 406). The aim of this study was to identify predictors of late dropout due to physical, mental or other determinants in student nurses, and derive a simple model for identifying students with significant increased dropout risk.

PART III Effectiveness and feasibility of preventive interventions with regard to physical resilience.

PART III contains two chapters that address the effectiveness and feasibility of preventive interventions with regard to physical resilience. **Chapter 7** provides an overview of interventions preventing physical health problems in nursing education and early career. For this study a systematic review was performed. Primary outcome of interest was education/work dropout. Secondary outcomes were musculoskeletal symptoms. This review aimed 1) to provide an overview of interventions available for student or novice nurses with a focus on their physical health and wellbeing and the effect of these interventions on the prevention of dropout and 2) to provide an overview of the effect of these interventions on physical health problems.

In **Chapter 8**, the feasibility of a training based on physically safe and respectful patient transfer techniques was evaluated. This training is based on the principles of ergonomics in combination with the philosophy of haptonomy. The primary aim of this explorative study was to investigate the feasibility of the “ergonomic and haptonomic patient handling” intervention, aimed at preventing physical health

problems. The secondary aim was to foster students to be prepared to move and mobilize patients in a correct and ergonomically responsible manner, with attention to their own physical capacity. In this study we investigated the feasibility of the intervention and the findings in real clinical practice.

This thesis concludes with a general discussion (**Chapter 9**).

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PART I

Mapping the motives and determinants
that contribute to the intention to drop
out and the actual drop-out rate among
student and novice nurses



Chapter 2

Physical and mental determinants of dropout and retention among nursing students: protocol of the SPRiNG cohort study

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ABSTRACT

Background: The shortage of nursing professionals is of growing concern. The causes of this include the demanding physical and mental workload, leading to a dropout of nurses that may start during their education. However, it is unclear to what extent nursing students already perceive a physical and mental workload leading to health problems during their nursing education and placement, and to what extent these health problems cause students to dropout from nursing education. Very few prospective cohort studies have investigated protective and risk factors in relation to dropout and retention among nursing students.

Methods: Three cohorts of third-year nursing students will be followed for 2.5 years. Students will be enrolled from the Bachelor of Nursing program of the Rotterdam University of Applied Sciences. At baseline, students will receive a self-administered questionnaire. Primary outcome is dropout from nursing education and dropout from the nursing profession. Data on dropout from nursing education will be retrieved from the student administration on a yearly basis. Dropout from the nursing profession will be measured one year after graduation, using the self-reported questionnaire. Secondary outcomes are presenteeism and sick leave (during internship/work). In addition to student characteristics, the questionnaire asks about physical and mental internship/work characteristics, personal and behavioral factors, and experienced physical and mental burden.

Main aims of this study are to determine: 1) the prevalence and incidence rates of dropout, 2) the protective and risk factors, and early indicators of dropout, and 3) the interaction between these factors and the indicators.

Discussion: Data analysis of a large, prospective cohort study with regard to determinants of dropout and retention of nursing students and newly graduated nurses is in progress. Findings emerging from this study can be used to develop a predictive model to identify the first indicators of dropout from nursing education and nursing profession, for which targeted interventions can be deployed.

Keywords: Nursing students, Dropout, Attrition, Sickness absence, Distress, Musculoskeletal complaints, Physical activity, Engagement, Work-related determinants, Cohort study

BACKGROUND

In an aging population, a shortage of nurses poses a serious threat to the continuity and quality of health care. This shortage often results from increased demand combined with a declining number of new workforce entrants⁽¹⁾. In the Netherlands, the number of registered nurses has decreased since 2013⁽²⁾ and there is a shortage of specialized nurses (i.e. emergency and intensive care, oncology, neonatology nurses)⁽³⁾. Moreover, the demand for nurse practitioners in the Netherlands is expected to double by 2028⁽⁴⁾.

The shortage of nursing professionals is also a growing concern in the European Union⁽⁵⁾. The European Commission Health workforce acknowledges that there is a significant employee turnover in some fields of health care due to the demanding working conditions⁽⁶⁾. Dropout of nursing students and the early exit of nurses starting their career contribute to this shortage. Research in Australia⁽⁷⁾, the USA⁽⁸⁾, Canada⁽⁹⁾, the UK^(10, 11), Finland⁽¹²⁾, Ghana⁽¹³⁾, Japan⁽¹⁴⁾ and Sweden⁽¹⁵⁾ has shown that, among nurses, physical and mental health problems can lead to dropout and early exit, and that this is a global problem.

The numbers of dropout differ between countries. For example, in the UK in 2015 the average dropout rate for student nurses at universities was $\geq 20\%$ ⁽¹⁶⁾. In Italy in 2011 the nursing students' academic failure rates were 35-37%⁽¹⁷⁾. In the Netherlands, the dropout rate among nursing students increased slightly between 2005 and 2013 from 20.5% to 21.1%, respectively⁽¹⁸⁾.

Dropout is a complex issue involving a wide range of factors. In Europe, two studies investigated the early exit of nurses and both reported that a considerable proportion of nurses considered giving up nursing^(19, 20). In 2003, the multinational NEXT study⁽¹⁹⁾ showed that the proportion of participants considering leaving nursing (several times per month, or more often) ranged from 8.8-36.2% in the participating countries^(19, 21). In the RN4CAST study (a cross-sectional study including 12 European countries), the percentage of nurses that intended to leave their current job ranged from 19-49%⁽²⁰⁾. In the LANE study, the career pathways in three cohorts of Swedish nursing students were prospectively followed for the first three years of their working life⁽²²⁾. The intention to leave the profession one year after graduating ranged from 10-20% and was more common among younger nurses; in the 2002 cohort, about 2% of the participants had actually left the nursing profession within five years after graduation⁽²²⁾. This indicates that the intention to leave does not necessarily lead to actual turnover.

The intention to leave nursing education or the nursing profession is associated with determinants of study burnout⁽²³⁾, job satisfaction, organizational commitment⁽²⁴⁾, job demands and work engagement⁽²⁵⁾. In 2003 the determinants of stress, burnout and attrition in nursing students, and the relationships between these determinants, were measured in a prospective longitudinal cohort study; the results show that stress, burnout and attrition might be indirectly associated⁽²⁶⁾.

In the Netherlands, research among 11,000 healthcare employees (including 3,057 nurses) revealed that many suffered from physical or mental health complaints due to work-related issues⁽²⁷⁾. Nurses reported problems related to the locomotor system, severe fatigue, and feelings of frustration or burnout. In the latter study, half of the nurses reported to have visited a healthcare professional for physical problems, and one out of six for mental problems⁽²⁷⁾.

It is unclear to what extent (student) nurses already perceive these health problems during their nursing education and/or at the beginning of their career, and to what extent these health problems cause students to dropout from nursing education or their profession. Therefore, the SPRiNG (Studying Professional Resilience in Nursing students and Graduates) project was started. SPRiNG is a collaboration between Rotterdam University of Applied Sciences (RUAS), Erasmus University Medical Center, VU University Medical Center, and the Netherlands Institute for Health Services Research (NIVEL).

This article describes the protocol of the SPRiNG cohort study. The aim of this prospective study is to examine dropout and retention of nursing students during their education and/or at the start of their career, and the related protective and risk factors.

METHODS

Study design

This is a prospective cohort study including three consecutive cohorts of third-year nursing students from RUAS, followed until one year after graduation.

Setting

Rotterdam is the second largest city in the Netherlands, with $\geq 600,000$ inhabitants. The RUAS has $\geq 36,000$ students and offers a wide variety of programs in almost all educational sectors. The Bachelor of Nursing is their accredited four-year nursing

educational program. According to the Netherlands Association of Universities of Applied Sciences (NAUAS)⁽¹⁸⁾, the inflow of nursing student varies between the 15 Dutch universities of applied sciences and per year. In 2015 the Bachelor of Nursing program of RUAS had the largest inflow with 443 nursing students starting their first year. In 2016, RUAS had dropped to the eighth place, with 345 students.

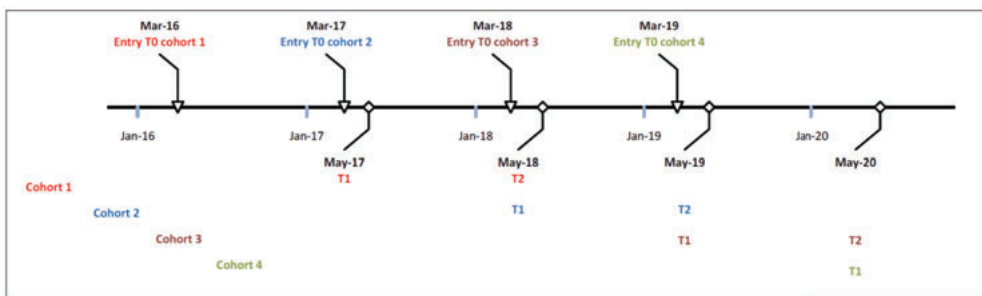
In recent years, the majority of nursing students has failed to finish the program within four years. The graduation rate after five years of study among fulltime students dropped from 56.9% in 2007 to 39.8% in 2011. Students with a non-western migrant background had the lowest graduation rate, i.e. 33.3% in 2007 and 19.8% in 2011. Within the RUAS nursing program, dropout rates between 2002 and 2012 increased from 20% to 26.5%.

Study population

For the present study, three cohorts of third-year nursing students will be followed for three years. They will receive a self-administered questionnaire in the third (t0) and fourth (final) year of their nursing study (t1), and again in their first year as a graduate nurse (t2). The first and the second cohort will be followed for three years and we plan to continue monitoring the third and fourth cohort (Fig. 1).

Fig. 1

Timeline of the SPRiNG cohort study



Participation by the nursing students is facilitated within the educational program, by offering questionnaires as part of the curriculum during lessons that address their professional development. They will be informed about the study before being approached for participation. Students can choose whether or not to make their

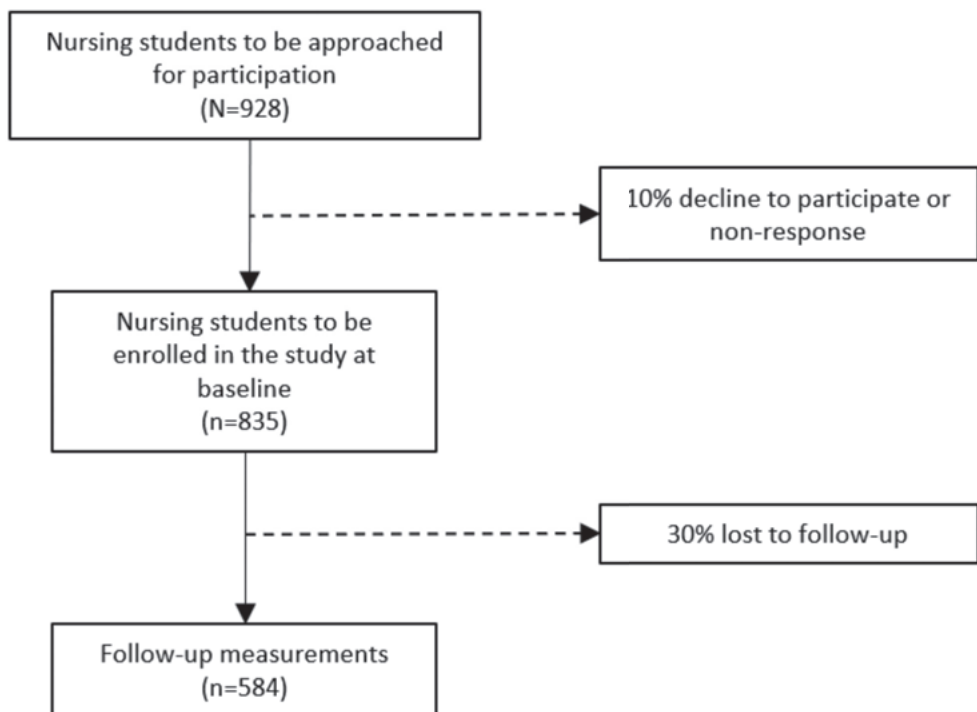
data available for this research. All students who complete the questionnaire at t0 and give informed consent will be followed yearly.

Alumni and social networks will be used to restore lost contacts after the student has left the university. Non-respondents will be contacted by telephone to try and retrieve their job status.

The inclusion of students started in May 2016 (Fig. 2). Based on the response rate at t0 from the first two cohorts, and at t1 from the first cohort, we estimated the numbers expected to be included in this study.

Fig. 2

Flowchart of recruitment, study procedures and the expected response



Primary outcome

The primary outcome is dropout from nursing education in the second half of the educational period and dropout from the nursing profession during the first year of their career. Dropout from education will be retrieved from the student administration on a yearly basis. In addition, one year after graduation (t2), dropout among working nurses will be measured using a self-reported questionnaire.

Secondary outcomes

Sickness presenteeism

Presenteeism is defined as ‘Going to work despite judging one’s current state of health as such that sick leave should be taken’ and will be measured by the following question: ‘*Did it happen during your current internship/work that you have gone to internship/work despite the feeling that you really should have taken sick leave because of your state of health?*’⁽²⁸⁾. This is a translation of the question used in the original Dutch-language questionnaire ‘Healthy Working in Healthcare’ (i.e. *Gezond werken in de zorg*)⁽²⁷⁾.

Sick leave

Absenteeism due to illness will be measured by three questions included in the Netherlands Working Conditions Survey 2014⁽²⁹⁾: ‘*Have you ever been on sick leave during this academic year?*’ (‘Yes’/‘No’), ‘*How often have you been absent due to sickness?*’ (number of times), and ‘*How many days of work, all together, have you been on sick leave by estimation?*’ (number of days).

Absenteeism due to physical and mental health complaints

A question on absenteeism due to physical health complaints was taken from the Dutch Questionnaire on Experience and Evaluation of Work (VBBA) 1994⁽³⁰⁾. In 1999, the Commission Testing Affairs Netherlands (COTAN) of the Dutch Association of Psychologists (NIP) judged the VBBA to be good in terms of reliability and construct validity⁽³⁰⁾. Five questions were used to measure physical health symptoms from neck, back and limbs; responses were scored on a 4-point Likert scale ranging from ‘always’ to ‘never’.

The Labour Monitor Municipalities (Arbomonitor Gemeenten)⁽³¹⁾ will be used to measure absenteeism due to work pressure/work stress. The questions on

absenteeism due to work pressure/work stress were developed in collaboration with AStri, an independent policy research agency in the field of work and income⁽³¹⁾.

Six specific questions will be used to measure absenteeism due to mental health complaints, with response options: 'Yes'/'No'.

Professional support regarding physical health problems, mental health problems and social problems, will be measured with three items of the Healthy Working in Health Care questionnaire⁽²⁷⁾.

1) Physical: *'In the current internship/work period did you look for help regarding the previously mentioned physical complaints?'* Response options are: 'No'; 'Yes, a general practitioner/company doctor'; 'Yes, a physiotherapist'; or 'Yes, another healthcare professional'.

2) Mental: *'In the current academic year did you visit a healthcare professional for mental help or support?'* Response options are: 'No'; 'Yes, a general practitioner'; 'Yes, a psychologist/psychiatrist'; 'Yes, a university counsellor'; or 'Yes, another'.

3) Social: *'Do you have at this moment due to social problems like financial problems, housing problems etc. a referral to/contact with...?'* Response options are: 'No'; 'Yes, a social worker'; 'Yes, a psychologist'; 'Yes, a debt counsellor'; or 'Yes, another'.

The composite questionnaire will include the secondary outcomes (sickness presenteeism and sickness absenteeism), and various general, physical and mental health items. Specific areas include: demographics, internship/work characteristics, personal and behavioural factors, and mental and physical health. Table 1 presents an overview of the instruments to be used for the measurements at t0, t1 and t2.

The digital questionnaire ensures standardized responses to questions and eliminates out-of-range responses. As backup, a paper version of the questionnaire will be available for students. Whenever available, validated constructs will be used. If necessary, questions are rephrased to fit the target group. For example, when the original question is about paid work, it is rephrased as 'internship/work', to address a student.

Table 1*Overview of the study outcomes and scales*

Outcomes	Instrument and source
Primary outcome	
dropout	(retrieved from student administration)
Secondary outcomes	
presenteeism (during internship/work)	Sickness Presenteeism, Aronsson and Gustafsson, 2005 ⁽²⁸⁾
sick leave (during academic year)	Sickness Absenteeism, NEA, Hooftman, Mars 2015 ⁽²⁹⁾
Determinants/Potential predictors	
<i>Internship/work characteristics (general)</i>	
decision latitude (skill discretion + decision authority)	JCQ, Karasek, Brisson, 1998 ⁽³²⁾
psychological job demands	
physical exertion	
social support from supervisor	
social support from co-workers	
<i>Internship/work characteristics (physical)</i>	
lifting and bending	NEXT, Kümmerling, Hasselhorn, 2003 ⁽³³⁾
monitor work	VBBA, van Veldhoven and Meijman, 1994 ⁽³⁰⁾
<i>Internship/work characteristics (mental)</i>	
aggression and violence	COPSOQ II, Pejtersen, Kristensen, 2010 ⁽³⁴⁾
bullying	
slander	
discrimination	NEA, Hooftman, Mars, 2015 ⁽²⁹⁾
<i>Personal and behavioral factors</i>	
work engagement (vigor, dedication, absorption)	UWES-S, Schaufeli and Bakker, 2006 ⁽³⁷⁾
occupational self-efficacy	Occupational Self-Efficacy Scale short version, Rigotti, Schyns, 2008 ⁽³⁹⁾
work-family conflict, family-work conflict	WFC scale and FWC scale, Netemeyer, Boles, 1996 ⁽³⁵⁾
physical activity	SQUASH, Wendel-Vos, Schuit, 2003 ⁽⁴⁰⁾
<i>Experienced physical burden</i>	
musculoskeletal symptoms	DMQ, Hildebrandt, 2001 ⁽⁴⁶⁾
use of support for physical health problems	'Gezond werken in de zorg' [Healthy Working in Healthcare] questionnaire, Bronkhorst, ten Arve, 2014 ⁽²⁷⁾
<i>Experienced mental burden</i>	
distress	Distress Screener, Braam, van Oostrom 2009 ⁽⁴¹⁾
need for recovery	NFR scale, Van Veldhoven and Broersen, 2003 ⁽⁴⁴⁾
use of support for mental health problems	VBBA, van Veldhoven and Meijman, 1994 ⁽³⁰⁾

Population characteristics

Questions on respondent characteristics include: gender (male/female), age (years), body height and weight (BMI), educational background (secondary vocational education/higher professional education/university), nursing educational pathway (fulltime, part-time, in-service), ethnicity (Dutch/western migrant/non-western migrant), Dutch as first language (yes/no), and housing circumstances (living with parents or caregivers/ living on one's own/ living on one's own with kids/living on one's own with partner/living on one's own with partner and child(ren)).

Information on these characteristics will be collected at t0 only.

Determinants

Internship/work-related physical and psychosocial risk factors

For these determinants, six subscales of the validated Dutch version of the Job Content Questionnaire (JCQ) will be used⁽³²⁾, i.e. skill discretion, decision authority, psychological job demands, physical exertion, social support from supervisor, and social support from co-workers. The JCQ measures the physical and psychological characteristics of an imbalance between job demands and resources within an organization. Four self-formulated questions regarding feedback and guidance from the instructor and colleagues will be added ('My instructor gives me constructive feedback'; 'My colleagues give me constructive feedback'; 'When I got stuck in my learning process I have somebody to discuss this with', and 'My instructor has enough time for my guidance'). Responses are on a 4-point Likert scale ranging from 'totally disagree' to 'totally agree'.

Lifting and bending, Visual Display Units work

For these determinants, 13 questions related to lifting and bending were taken from the NEXT study⁽³³⁾. A scale assessing lifting and bending was developed by the NEXT Study Group on the basis of own validity measurements including pre-tests, in order to quantify the specific physical demands in the nursing profession. The scales were translated from English into Dutch and back to English by four independent native English/Dutch speakers, in order to validate the scales in Dutch language for the SPRiNG study.

Two questions on Visual Display Unit work were taken from the Dutch Questionnaire on the Experience and Evaluation of Work (VBBA)⁽³⁰⁾.

Aggression and violence, bullying, slander, discrimination

Three single-item questions on aggression and violence, bullying, and slander were taken from the second version of the Copenhagen Psychosocial Questionnaire (COPSOQ II)⁽³⁴⁾. The Dutch translation was obtained from the Healthy Working in Healthcare questionnaire⁽²⁷⁾ and was used among healthcare professionals, including nurses. Discrimination will be measured by one question from the Netherlands Working Conditions Survey 2014⁽²⁹⁾.

Work-family conflict, family-work conflict

Work-family conflict and family-work conflict will be measured using the Netemeyer, Boles scales⁽³⁵⁾. These authors defined work-family conflict as: *"A form of interrole conflict in which the general demands of time devoted to and strain created by the job interfere with performing family-related responsibilities"*; and family-work conflict as: *"A form of interrole conflict in which the general demands of time devoted to and strain created by the family interfere with performing work-related responsibilities."*⁽³⁵⁾.

Personal and behavioral factors**Work engagement**

Schaufeli & Bakker⁽³⁶⁾ defined work engagement as *"...a positive, fulfilling, work-related state of mind that is characterized by vigor, dedication, and absorption."* Work engagement will be measured with the 9-item short version of the Utrecht Work Engagement Scale-Short (UWES-S)⁽³⁷⁾.

Occupational self-efficacy

Occupational self-efficacy refers to the confidence a worker has in his/her perceived ability to successfully perform job tasks⁽³⁸⁾. This will be measured with the six-item short version of the Occupational Self-efficacy scale⁽³⁹⁾.

Physical activity

The Short QUestionnaire to ASses Health enhancing physical activity (SQUASH), will be used to measure physical activity⁽⁴⁰⁾. SQUASH is a fairly reliable ($r=0.58$) and reasonably valid ($r=0.45$) questionnaire to measure physical activity. SQUASH will assess the activities during a regular week in the past month with regard to the duration, frequency, and intensity of leisure time activities, household activities, activity at work and school, and commuting activities⁽⁴⁰⁾.

Mental and physical health

Distress

To measure non-specific distress we will use the Distress Screener, which comprises three items of the 4DSQ distress subscale. The 4DSQ is a self-report 50-item questionnaire that measures non-specific distress, depression, anxiety and somatization. For the purpose of this study a short questionnaire, and a sensitive instrument able to detect early signs of mental health problems, are needed. The Distress Screener (developed for early identification of non-specific distress) has three items; we will use a cut-off point > 4 to detect moderate distress⁽⁴¹⁾. The Distress Screener is a valid instrument for early identification of distress in employees on sick leave as well as for non-sick listed employees at risk of future mental sickness absence⁽⁴²⁾.

Need for recovery

Need for recovery has been conceptualized as the experience of accumulating work-induced fatigue and is an early indicator of risk of depression⁽⁴³⁾. The Need for Recovery after work (NFR) scale⁽⁴⁴⁾ is a part of the VBBA⁽³⁰⁾. The NFR scale consists of 11 dichotomous items ('Yes'/'No') and has good reliability, concurrent validity and sensitivity to change⁽⁴⁵⁾.

Musculoskeletal symptoms

Questions related to health (particularly musculoskeletal symptoms) from the Dutch Musculoskeletal Questionnaire (DMQ) will be used⁽⁴⁶⁾. The phrasing of these questions regarding prevalence is comparable with the Nordic Questionnaire on Musculoskeletal Disorders⁽⁴⁷⁾, including definition of the areas of the body using a mannequin. The DMQ enables global assessment of physical workload and other potentially hazardous working conditions. Most indices show significant associations with low back and/or neck-shoulder symptoms; therefore, these indices can be used as one of the means to identify risk groups⁽⁴⁶⁾. In the t0 questionnaire this will be asked two times (for the current training and the previous practical training), since most third-year students do a practical training in the first semester of the academic year and another in the second semester. This type of retrospective measurement will give an indication about the accumulation of musculoskeletal symptoms.

Expectations regarding the nursing program and nursing profession

Expectations about the nursing program and profession will be measured using seven self-formulated questions: *'My internship/work corresponds with my expectations of the nursing profession'; 'My internship/work corresponds with what I learn at the university'; 'I expect to stay working in the healthcare sector after graduation'; 'I expect to finish nursing school with a diploma'; 'I expect to stay working as a nurse after graduation'; 'I am expecting a study delay'; and 'I consider to quit my study'*. Answers are rated on a 10-point Likert scale ranging from 'definitely not' to 'definitely yes'.

Data handling and statistical analyses

Key aims of this study are to determine: 1) incidence rates of dropout, 2) protective and risk factors, and early indicators of dropout, and 3) interactions between these factors and indicators.

Data handling

Data will be collected using Limesurvey (Version 2.06lts Build 160524). Data will be exported to a secured SPSS database for management and analyses. To avoid potential conflict of interest, the principle researchers will be blinded from any results that can relate data back to the individual respondents; therefore, this work will be done by independent researchers. Personal data will be extracted from the dataset before analysis takes place. Analyses will be carried out using IBM SPSS Statistics, version 24 or higher (IBM Corp., NY, USA).

Preliminary analysis and transformation of variables

First, for each cohort the differences in demographics (age, gender, educational level at entrance, and study route) and the primary outcome 'dropout' between students included and not included (non-responders) in the cohort will be compared. For students in the cohort, data from the student administration will be used.

Second, descriptive statistics of outcomes and determinants will be provided and quantitative variables will be depicted graphically using histograms and normal probability plots.

Assessment of prevalence and incidence

In the study population, point prevalence will be estimated for mental and physical health problems, absenteeism, presenteeism, and sick leave at baseline (t0), after

one year (t1), and one year after graduation (t2), in order to characterize the cohort. Incidence in the study population will be calculated for mental and physical health problems, absenteeism, presenteeism, and dropout after one year (t1) and also one year after graduation (t2).

Regression and covariate adjustment

To relate dropout and retention to potential determinants and covariates, regression analyses will be conducted. First we will analyse the univariate relationships between all potential determinants (protective and risk factors, and early indicators) and outcomes (dropout, absenteeism, presenteeism, retention). Then, a multivariate model will be constructed for all determinants with an association of $p < 0.05$. To study the relation between one or more independent variables with the continuous dependent variables (absenteeism, presenteeism), linear regression analyses will be used. Logistic regression analyses will be conducted to study the relation with dependent dichotomous variables (intention to leave nursing school or profession, actual dropout).

A latent class analysis⁽⁴⁸⁾ will be performed to identify subgroups. This analysis will focus on the relations between individual participants, instead of the relations between variables. Response patterns can be revealed that might be distinctive for a subgroup and will differ from response patterns in other subgroups.

Missing data

We expect to have follow-up data (determinants and secondary outcomes) from at least 80% of all students. Primary outcome data (dropout) will be available for all students from the student administration. We will anticipate to the possible missing values (MCAR & MAR). For statistical analysis techniques will be used that are robust for missing values (modelling to collected data) and sensitivity analyses will be performed on multiple imputed data sets⁽⁴⁹⁾.

DISCUSSION

This study will provide information on 1) the prevalence and the incidence rates of dropout, 2) the protective and risk factors, and early indicators of dropout, and 3) the interactions between these factors and indicators. This article describes the protocol and methodology of the study.

Strengths and limitations

Few longitudinal studies are available on nursing students and recently graduated nurses. The actual shortage of nurses necessitates the prevention of avoidable dropout. Implementation of effective preventive interventions with regard to physical and mental resilience may help to ensure a sufficient number of nurses, which is an essential condition to guarantee adequate quality of care. Therefore, we need to know which determinants play an important role and which of these determinants are modifiable.

A potential limitation of the present study is that respondents originate from RUAS only. To generalize our results to the national population of nursing students and new graduates, we will investigate to what extent the population characteristics of our Rotterdam sample differ from the national population of nursing students and new graduates, as available through NAUAS⁽¹⁸⁾.

The findings of this study can be used to develop a predictive model that identifies early signals for dropout from nursing education and nursing profession, for which potentially targeted interventions can be deployed. Plans within the SPRiNG project include exploring yet unknown reasons for dropout through qualitative research, systematic reviews of effective preventive interventions, and testing of the most feasible interventions in a pilot study. These steps will provide an additional toolbox with targeted interventions that can be implemented in nursing education or nursing practice to prevent dropout.

Abbreviations

4DSQ, Four-Dimensional Symptom Questionnaire; **BMI**, body mass index; **CBS**, Centraal Bureau voor de Statistiek [Statistics Netherlands]; **COPSOQ**, Copenhagen Psychosocial Questionnaire; **COTAN**, Commissie Testaangelegenheden Nederland [Commission Testing Affairs Netherlands]; **DMQ**, Dutch Musculoskeletal Questionnaire; **FWC**, Family-work conflict; **JCQ**, Job Content Questionnaire; **NAUAS**, Netherlands Association of Universities of Applied Sciences; **NEA**, Nationale Enquête Arbeidsomstandigheden [National Questionnaire Working Conditions]; **NEXT**, Nurses' Early Exit Study; **NFR**, Need For Recovery; **NIP**, Nederlands Instituut van Psychologen [Dutch Association of Psychologists]; **NIVEL** Nederlands instituut voor onderzoek van de gezondheidszorg [Netherlands institute for health services research]; **NWO**, Netherlands Organisation for Scientific Research; **RUAS**, Rotterdam University of Applied Sciences; **SPRiNG**, Studying Professional Resilience in Nursing

students and Graduates; **SQUASH**, Short QUestionnaire to ASses Health enhancing physical activity; **UWES-S**, Utrecht Work Engagement Scale – Short; **VBBA**, Vragenlijst Beleving en Beoordeling van de Arbeid [Questionnaire Experience and Evaluation of Work]; **VDU**, Visual display Unit; **WFC**, Work-family conflict.

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AVAILABILITY OF DATA AND MATERIALS

Data and questionnaires will be available upon request.

AUTHORS' CONTRIBUTIONS

PR, EB, JK, HM jointly produced the study design. PR, EB, JK, HM, AvB, CB, JR, SBZ developed the SPRiNG questionnaire. EB and JK produced the first draft of the article outline with guidance of PR, CB, JR. All authors (EB, JK, CB, JR, PR, HM, AvB, SBZ, PR) contributed substantially to the manuscript and critically revised the content. All authors read and approved the final version of the manuscript.

COMPETING INTERESTS

All authors declare that they have no competing interests.

CONSENT FOR PUBLICATION

Not applicable.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study will be 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 Medical Ethical Review Committee of the Erasmus Medical Center Rotterdam approved the study (MEC number: FMS/sl/273789). The study complies with the Netherlands Code of Conduct for Scientific Practice from the Association of Universities in the Netherlands (VSNU). Participants will be informed about the study orally and in writing, before being approached for participation. Consent for participation will be given by written informed consent.

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Chapter 3

Reasons why Dutch novice nurses leave nursing: a qualitative approach

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ABSTRACT

Shortages in the nursing profession are increasing. It is, therefore, imperative to understand why novice nurses are leaving the profession. This qualitative study explores Dutch novice nurses' motives for leaving the profession. Individual semi-structured interviews were held with seventeen former novice nurses who had decided to leave nursing within two years after graduation. Data was collected and analysed following the principles of Thematic Analysis, leading to six themes; 1) Lack of challenge; ambitious to progress further in management or research roles. 2) Lack of passion; no feeling of passion for patient care. 3) Lack of perceived competence; not feeling "up to the challenge". 4) Lack of job satisfaction due to heavy workload; work-life imbalance and inability to deliver high-quality care. 5) Lack of work capacity due to non-work-related health conditions; unmet requirements for job or work environment adjustment. 6) Lack of feeling of belonging; suffering from a negative attitude of colleagues to one another. To prevent novice nurse professional turnover, measures such as capacity building, supervisor support and a tailored personal development plan could be taken. To make novice nurses feel safe and reassured, support from colleagues and supervisors is important. Such measures require thoughtful implementation and evaluation.

Key words: Professional turnover, Attrition, Dropout, Novice nurses, Thematic analysis

HIGHLIGHTS

- This study addresses reasons for professional turnover of Dutch novice nurses.
- Six core themes emerged as motives for leaving the profession in novice nurses.
- No single motive for leaving the profession dominates.
- To retain novice nurses, supervisor support and personal development are important.

INTRODUCTION

The demand for nurses is high worldwide⁽¹⁾, but the dropout rates are high as well⁽²⁾. Novice nurses are especially vulnerable for dropout from the nursing profession^(3, 4). They undergo a period of stress and anxiety, role adjustment and shock when faced with the reality of beginning practice as a licensed nurse⁽⁵⁻⁹⁾, and do not feel skilled, comfortable or confident for up to one year after being employed as a nurse. The reality of independent nursing practice far exceeds the artificial experiences of nursing school and hospital-based trainings⁽¹⁰⁾. Some nurse administrators, nurse managers and physicians, on the other hand, expect the novice nurses to rapidly function as competent nurses⁽¹⁰⁻¹²⁾.

Considering the challenges accompanying the transition from student nurse to novice nurse, the reasons for turnover in novice nurses will be different compared to nurses with longer professional experience.

Definitions of nurse turnover vary. Brewer, Kovner⁽¹³⁾ define turnover as occurring when a nurse leaves a health care organisation rather than their nursing job, profession or career. In this definition, a novice nurse can still continue working as a nurse in another nursing job (job turnover). Professional turnover is defined as occurring when a nurse leaves the nursing profession or career⁽²⁾.

Novice nurse job turnover has been the subject of many qualitative and quantitative studies^(3, 13-16). Only few studies^(17, 18) explicitly studied professional turnover.

Actual figures on novice nurse professional turnover are scarce. Studies in New Zealand, Canada and Europe show that the percentage of novice nurses leaving the nursing profession may be as high as 30%^(17, 19, 20). In the Netherlands, approximately one out of ten graduated nurses are not working in the field of nursing one year after graduation⁽²¹⁾. Insight in the reasons for novice nurses to leave the profession can provide direction for strategies that may contribute to their retention. In the Netherlands, guidelines to support novice nurses in their first job after graduation are lacking⁽²²⁾. Novice nurses often start their career as a registered nurse without a transition programme. The length and content of transition programmes, if any, vary per health care institution. This is not different in the United States or the United Kingdom, where a broad range of transition programmes exists^(23, 24). However, there is no conclusive evidence for the efficiency of such programmes^(23, 24). Insight in the reasons for professional turnover in novice nurses may guide the development of a possible transition intervention. Our qualitative study on the

reasons for professional turnover in novice nurses is performed in the context of a larger study on professional resilience in nursing students and new graduated nurses (SPRiNG) in the Netherlands^(25, 26).

In the current study, we define novice nurse professional turnover as the turnover from bedside nursing or from the nursing profession altogether.

AIM

This study aimed to unravel Dutch former novice nurses' reasons, experiences and the circumstances that contributed to their professional turnover within two years after graduation, based on interviews with 17 participants who had left the nursing profession as bedside nurses.

RESEARCH DESIGN

We performed an exploratory qualitative study using semi-structured interviews to gather in-depth information on the reasons, experiences and circumstances that contribute to novice nurse turnover from bedside nursing or from the nursing profession altogether.

METHODS

Sample, participants, recruitment and selection

The study population consisted of Dutch intermediate vocational and Bachelor degree nurses who had decided to leave the profession within two years after graduation. A volunteer (convenience) sample was used because there is no registry of professional turnover. For the recruitment of participants, we made use of the following recruitment methods. An advert was posted in the community forum of Stichting IZZ (a health insurance company for healthcare professionals), through deRotterdamseZorg (a health care employment network in Rotterdam), in Nursing (a Dutch sector magazine for the nursing profession) and in personal (JK) networks and social media (LinkedIn, Twitter, and Facebook). In total, 37 former nurses reacted to these adverts by sending an email to the research team. In response they received a standardised email invitation and, if necessary, a reminder within 2 weeks. Unfortunately, 18 respondents did not meet the criteria for inclusion, because they were still working as a nurse, they had not graduated as a nurse, or

had been working as a graduated nurse for more than two years; or they decided not to participate. Two other respondents did not respond to the initial nor the reminder email invitation. Finally, we recruited seventeen respondents for our study, involving former registered nurses from both Bachelor and intermediate vocational level, from a good national spread all over urban and rural areas in The Netherlands. All included respondents considered themselves to have dropped out of the nursing profession. Table 1 shows the characteristics of the included respondents. Our sample was not as diverse regarding gender and ethnical background as we would have wished for if purposeful sampling had been possible; we could include only one male participant and none of the respondents had a non-Western background.

Data collection

Individual face-to-face semi-structured interviews were conducted between January and June 2018 by two healthcare researchers JK (male) and PH (female)), trained in qualitative research. Both interviewers have a Master's degree and are registered nurses and lecturers in nursing. An interview guide with topics and open questions was used (Appendix 1). The interview guide was constructed using relevant literature^(14, 17, 22, 27-29) and by discussing the topics with all co-authors. The order in which the questions were presented depended on the replies of the respondents. Respondents were encouraged to give in-depth information regarding their reasons for leaving the nursing profession. The interviews lasted for about one hour and were held at a place preferred by the respondent. All interviews were audio-recorded and transcribed verbatim. One interview took place in the presence of the respondent's mother; this had no impact on the quality of the collected data. At the start of each interview, demographic data were collected, such as age, gender, educational level, and time between graduation and exit (see table 1).

Table 1*Characteristics of included respondents*

Respondent	Gender	Age	Nursing education^a	Last clinical area	Time between graduation and exit (in months)	Current occupation; study^c
1	Female	27	BN	General hospital (internal medicine unit)	2 months	Trainee teacher (in nursing); studying Master of Nursing Science
2	Female	27	BN	District nursing (home care)	24 months	Trainee teacher (in nursing)
3	Female	24	BN	District nursing (home care)	15 months	Workplace trainer
4	Female	40	BN	Mental health care (addiction and psychosis unit)	12 months	Researcher; PhD candidate
5	Female	27	BN	Did not work as a RN (last internship: health technology unit)	N/A ^b	Teacher; teacher training (in nursing)
6	Female	25	BN	Elderly care	24 months	N/A ^b (maternity leave)
7	Male	37	VN	General hospital (emergency unit – observatory)	24 months	Pharmaceutical account manager
8	Female	23	BN	General hospital (flexpool)	12 months	Catering sector/travelling; studying Master of Health Sciences
9	Female	22	BN	Did not work as a RN (last internship: General hospital - cardiology unit)	N/A ^b	N/A ^b (in between studies); registered for studying Master of Political Science
10	Female	29	VN	Geriatric rehabilitation care	24 months	Childcare/after-school care
11	Female	35	BN	Nursing home	12 months	Intake coordinator for elderly care (no nursing requirement)
12	Female	21	VN	Secondment agency (rehabilitation center)	10 months	Surgical technician; surgical technology training
13	Female	30	VN	Centre for disabled & handicapped adults	21 months	N/A ^b (sick leave)

14	Female	25	BN	General hospital (gastrointestinal and nephrology unit)	8 months	N/A ^b (in between jobs)
15	Female	23	BN	General hospital (stroke unit)	2 months	Temporary agency worker (helpdesk for Electronic Patient Records)
16	Female	24	BN	General hospital (gastrointestinal and liver surgical unit)	21 months	N/A ^b (Wants work in a different job abroad, not nursing)
17	Female	29	BN	General hospital (maternity and obstetrics unit)	9 months	Junior safety instructor at an emergency response office

^a BN = Bachelor degree trained nurse; VN = intermediate vocational degree trained nurse. In the Netherlands, the nursing profiles and nursing activities of Bachelor degree and intermediate vocational degree nurses are indistinguishable in daily practice⁽²⁷⁾. Formally, Bachelor degree and intermediate vocational degree nurses are both registered under the title ‘nurse’ in the official Dutch registry for nurses (the ‘BIG-register’).

^b N/A = Not Applicable

^c Some of the respondents chose for another role in health care instead of bedside nursing, meeting our definition of novice nurse professional turnover.

Ethical considerations

All respondents received verbal and written information about the study, and were assured of complete confidentiality and the possibility of opting out during the study. All respondents gave written consent. No identifying information of respondents is presented and all quotes are anonymised.

The study meets the requirements of the Netherlands Code of Conduct for Scientific Practice from the Association of Universities in the Netherlands⁽³⁰⁾. The study was exempted from formal medical ethical review in accordance with the Dutch Medical Research Involving Human Subjects Act (WMO)⁽³¹⁾.

Data analysis

For data analysis, the principles of Thematic Analysis were followed⁽³²⁾. Two authors (JK and HG) independently analysed all interviews.

First, transcripts were read and reread to become familiar with the data. Second, an inductive analysis was performed by assigning codes to meaningful lines or fragments of data texts. For this analysis, relevant attributes were elaborated and cases were defined, grouped and constructed by means of these attributes. Next, common themes were identified, differences in themes were discussed and overlapping themes were combined or renamed. The research process moved from data collection to data analysis and back until the description was comprehensive, as an iterative process. This analysis process continued until no new information was identified; Hennink, Kaiser⁽³³⁾ suggest that meaning saturation may be obtained with 16–24 interviews. Each co-author (EB, SBZ, JR, PR, HM) analysed one or two interviews, eight in total, in order to reach consensus on the major themes. Key points from each interview were summarised on an A4 sheet and discussed by all authors.

The qualitative analysis package Atlas.ti 7.5.7 was used for analysis⁽³⁴⁾. The results of the study were reported using a 32-item checklist for interviews and focus groups: Consolidated Criteria for Reporting Qualitative research (COREQ)⁽³⁵⁾.

Strategies to ensure rigour

The first two authors (JK and HG) analysed the ad-verbatim transcripts of all interviews. They discussed the assigned codes to come to an agreement. Investigator

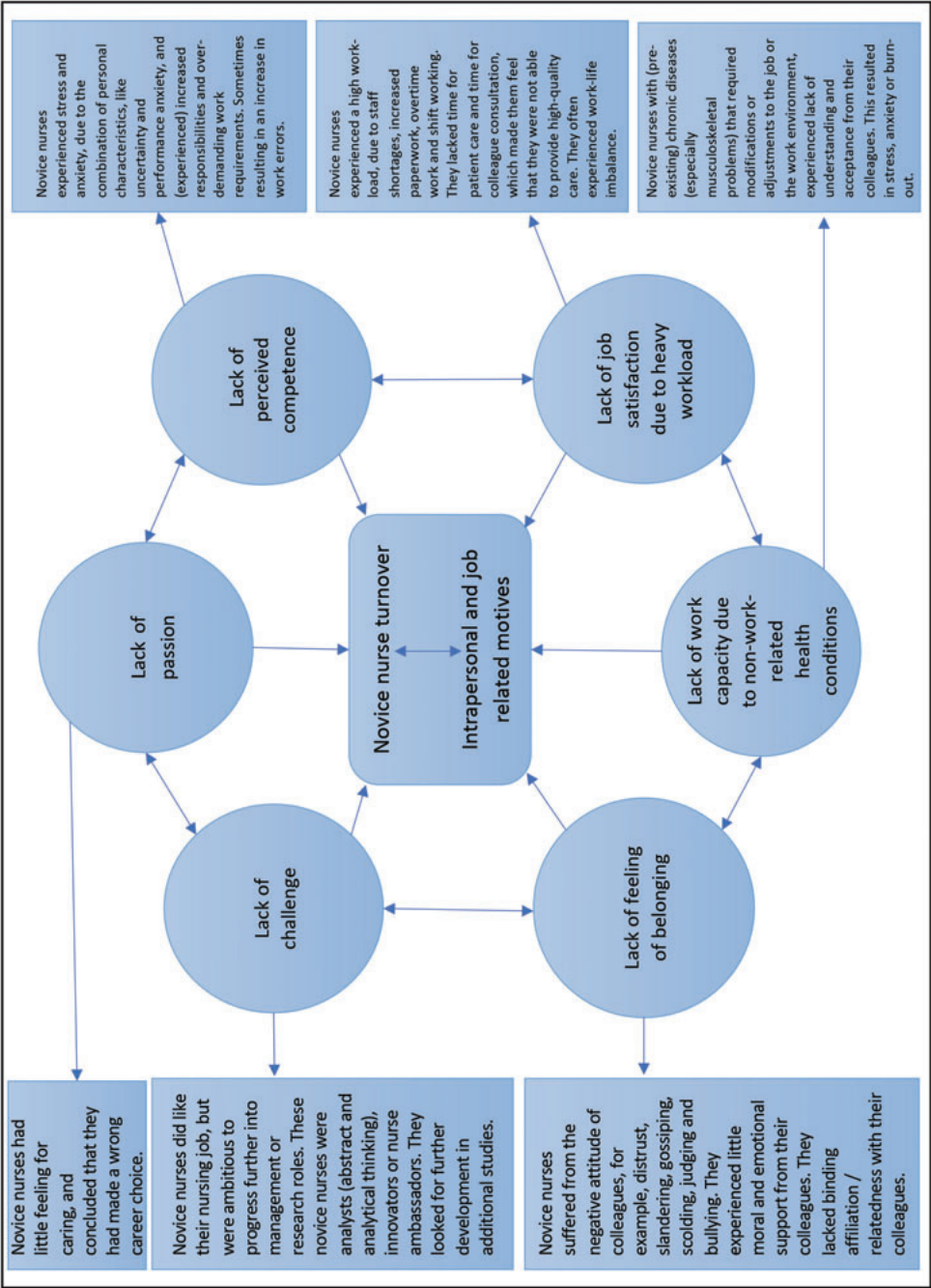
triangulation was applied to increase credibility⁽³⁶⁾, by in-depth discussion with each co-author of the major themes of one interview and collaborate discussion of the key-points of all interviews. To ensure dependability, all research steps, including data gathering, data analysis and manuscript preparation were well-documented. Reflections on reflexivity, in particular potential preconceptions, were discussed between the first and second author.

RESULTS

Six main themes emerged from the interviews as reasons for turnover (see figure 1). The six themes and their interrelationships will be explained in more detail.

Figure 1

Interaction of themes in novice nurse turnover



Lack of challenge

Lack of challenge concerned the lack of diverse and more complex technical nursing tasks as well as the absence of professional opportunities, such as for clinical leadership or innovation. Various respondents had ambitions to improve the quality of care and sought to empower the nursing profession. However, the professional culture in various healthcare settings hampered novice nurses to take the lead in innovations. In this context, several respondents mentioned that it is important that motivated nurses are offered opportunities for their professional and personal development. Some respondents, decided to leave the profession because they were unable to do anything with their ambitions:

But that aspect of thinking at a higher level... that just didn't happen there. [...]. I soon noticed that I couldn't get enough out of it for myself, that there was nothing more in it for me at that time. You know, that puzzle of... gosh, he [the patient] needs this, but I can offer that, how are we going to do this? That's the real reason why I left the profession in that way. That I wasn't really getting out of it what I'm actually looking for. (2)

I still found the contact with the people very nice and interesting. But I wanted some more intellectual challenges. I wanted to do more... I wanted to think and work more on a higher level and not so much the practical work, but higher level stuff. Policy management, that kind of thing. That's what I very much missed in my work as a nurse [...] Then you're doing things and then you have to ask the doctor again, like gosh, I've done this or that. [...]. I wanted to think about it myself. [...](4)

Some respondents mentioned the discrepancy they experienced between nursing as it was taught at school and how it was in practice. Two respondents had expected nursing to be more theoretical and analytical, but felt in practice that it mainly involved practical work, which did not satisfy their ambitions. These respondents were pessimistic about their career opportunities as a practical nurse and saw this as 'hitting a dead end':

In practice, you have to perform every role; you're a phone operator and you have to make the beds and you have to help patients go to the toilet, and yes. Just a lot of minor tasks. That was ultimately not my ambition. [...] At one point I thought, it feels a bit like a dead end, and then what? Being a nurse, OK, and that's it. Yes, I think that is in fact the difference between what you are trained for and what you really do in practice. (7)

Generally, the respondents who experienced a lack of challenge made a more rational decision to leave bedside nursing rather than an emotional decision. They made a deliberate choice to switch to a career outside (bedside) nursing.

Most respondents did not mention the salary as the principal reason for leaving the nursing profession. For some respondents, however, especially the ones who lacked challenge in their nursing work, the salary was an issue:

And then there's also the fact that I thought gosh..., it sounds bad, because I really don't need a top salary from a bank or whatever. But I found the salary very minimal. I thought, we have to promote ourselves much more as a profession and then the salaries can also increase. (4)

Lack of passion

Some respondents had wanted to become a nurse from childhood, but felt very soon during their nursing education that nursing was not their dreamed-off profession. Their expectations did not match the workplace reality. Typically, they liked the theoretical courses, such as anatomy and pathology. However, when doing their practical training, they discovered that they lacked the affinity with caring work, and this did not change after graduation. During the interviews it became clear that these respondents had already had doubts during their study about whether their ambition to become a nurse was the right one. They said they lacked the passion for working as a nurse:

Well what I noticed during the training, there were always girls who had [...] a real passion for the work, you know. And that is what I noticed in my colleagues as well. They have real passion, and that's what they say as well. And then I think yeah, I just don't feel that. I really don't feel it. (16)

But, yeah, I don't know, I still kept noticing, the further I got in my education, that I missed a certain passion. The work pressure was incredibly high. And I didn't really feel the passion to continue with what I was doing. [...] that was really a critical point for me. (15)

Lack of perceived competence

After graduating, some respondents felt that they were not yet “up to the challenge”. They experienced a large transitional gap from student nurse to a more autonomous professional role. These respondents lacked confidence and missed the back-up from experienced nurses, which they had experienced during their practical training.

After graduation, they felt that they were supposed to know everything. Due to staff shortages, however, the backup from more experienced nurses was often missing. Some respondents had mixed feelings about their perceived inability to cope with the increased responsibilities of patient care being the reason for leaving nursing so soon after graduation:

I continuously felt that I was not up to the challenge. Yes, of course, I was competent, but in community care, there weren't so many nursing procedures to be done. So for almost all procedures, I first needed to become competent myself. I didn't have that much experience. So if someone told me "Oh, that patient needs to be catheterised this afternoon, you can do that, can't you, because you're qualified". Well then I really thought, gosh, I'll have to look up the protocol first, and can someone please talk me through it. (11)

I also struggled with the responsibility there [internal medicine ward]. Indeed, the idea that when patients deteriorate, like oh, what have I done. Have I got a good overview? Did I forget anything? And I think that there wasn't enough attention [from colleagues] for me to express my doubts, or for discussing things or working together. OK, perhaps I shouldn't see things so negatively, that everything is purely my responsibility, but that I also have colleagues who can support me. That I don't have to do things all by myself. (14)

Lack of job satisfaction due to heavy workload

In several cases, job satisfaction was hampered by a heavy workload due to staff shortages, rotating night shifts, working overtime, increased paperwork and patient violence.

With regard to staff shortages, some respondents mentioned that they, as novice nurses, had sole responsibility for the ward, or had responsibility together with inexperienced staff such as temporary workers. It was also reported that new colleagues are used, or even misused, to fill in the unpopular gaps in the work schedule. One respondent said that novice nurses should be aware of that and set limits for themselves for their own protection, to make them less vulnerable early in their career:

When there is a new colleague, the first response is "great, we have staff". We'll use her to fill the holes everywhere. And before you know it you're just scheduled, and then you just have to deal with it. Of course that shouldn't be the case, because you

also have a voice yourself, and you can also say what your limits are. And it sounds really bad, but you should be strict with your employer. And please pay attention to yourself [...]. I've learned all the rules, but that feeling you get when someone oversteps your personal boundaries, that needs training. (13)

In some instances, shift work made the work more burdensome. In particular, rotating night shifts had a negative effect on their family life and social life. Some respondents stated that they would never work shifts again because of the negative effect on their private life.

Other respondents mentioned that they frequently had to work overtime. They were called too often to work on their days off to cover for a sick colleague. It was hard for them to resist these calls, because they often felt responsible for both patients and colleagues. Respondents had to be assertive to refuse to go to work on their days off, but even if they did so, they sometimes felt guilty about letting down their patients or their team. For example, one of the respondents mentioned that she had to work for 12 hours because the colleague that was scheduled for the next shift called in sick:

And that overwork, working overtime every day [...]. Officially after a late shift, my shift ended at 11:30 p.m., but most of the time I finally started the information handover to my colleague at 12:30 a.m., because of numerous patient calls. In such a situation I don't leave my night-shift colleague alone. It's not fair on the patients, not nice for my colleague, or for me, for anyone. So then we would do a patient round together, do the information transfer and finally, one hour or one and a half hours later, I could leave. Regularly. (10)

The unforeseen impact of patient violence, or violence by the patients' relatives, also contributed to the workload. Some respondents reported how the continuous threat of violence contributed to a feeling of unsafety and therefore to the psychosocial workload:

Well, I expected it [nursing] to be a tough job, yes, I did have that in mind. [...] Only that workload issue, the mental workload and aggression, I didn't see that coming. [...] Actually, we had to look over our shoulder regularly [...] and where the management fails to take measures, well, then you really feel like fair game. (17)

Respondents felt that the heavy workload hampered direct patient care. They were frustrated at not being able to provide the quality of care they wished to deliver. They would have liked to spend more time with their patients:

Not being able to offer the care that you would like to offer. And that was actually when I thought: No, this is just getting worse. The [staff] shortages will only increase and I don't want to continue like this. [...]. And there's always something up everywhere, that's true, [...] but in the end it's at the expense of patient care and that, yeah, that was really gnawing at me. (12)

Some respondents described how the heavy workload led to (near) incidents. Others were sometimes not sure whether they had done a specific task, or had done it correctly. One respondent spoke about her experience with the death of a patient, which kept her wondering for two days whether the patient's death was caused by her actions:

Yes. And that really gnaws at you, that when you're at home you start thinking, yes, hm, hm. Even when incidents happen that you're not directly involved in, you still think about them. I [as a district nurse] had a client who died very suddenly. I'd given insulin in the morning, and in the afternoon she was admitted with a hypo. And she died in the hospital that night; I thought, did I give her the right thing? Did I perhaps work in too much of a hurry? Well, in retrospect it turned out to be something else, but I felt very guilty about it for two days. Because you're just... you, you need to double check everything [...], but in the end you get round the rules, because how can I double check things when I'm working on my own and the patient is blind as anything. (6)

Most novice nurses who had experienced a lack of work pleasure also reported having developed stress symptoms such as fatigue, sleeping problems, nightmares, tense muscles, headaches, worrying about the work, or lack of confidence at work:

You need to pay close attention to yourself, because if you were to drive yourself into the ground that would be quite a pity, of course. The only thing that bothered me was just tense muscles and my shoulders, but yeah, that was partly due to lifting, but also because of the work pressure on the ward, actually, due to stress. (8)

Quite frankly, I don't exactly know what happened with it [a nursing home that had fallen into disrepute] afterwards. But it meant [...] that during those six months, for example, I often dreamt that I was locked up in that ward. (9)

Lack of work capacity due to non-work-related health conditions

Some respondents were less employable due to pre-existing non-work-related diseases. They did not always have the ability to work at full capacity. For instance, neuromusculoskeletal diseases hampered heavy lifting. Some respondents might have benefitted from flexible working conditions, e.g., starting later in the morning.

Often, they were confronted with a hostile attitude to their limited employability from their colleagues. This lack of understanding, acceptance and support from their colleagues added to the burden of work. As such, this theme was related to the theme 'lack of feeling of belonging'. One respondent found it hard to see her colleagues taking care of patients, but not taking care of each other:

Create a bit of acceptance in the workplace, I would say. Well, so that nurses and nursing assistants accept each other's disabilities, so to say. Instead of having to go on and on caring for other people. But actually, you have to take care of yourself first before you can take care of others. And that hardly happens at all in health care nowadays. (5)

[...] Well, if I could have said; "Girls, I don't feel well in my joints today, I'm luxating and I'm in pain. Would it be possible to do the drugs round or would it be possible to just support the less complex patients with their ADL [Activities of Daily Living] instead of bed-bathing a patient?" [...] But well, because the culture wasn't like that, I didn't do that, which was what I found most difficult. (1)

Lack of feeling of belonging

Some respondents did not feel really understood or supported by their colleagues. Sometimes, older colleagues had difficulty accepting the novice nurse's attitude and (novel) ideas. Such colleagues were reluctant to bring about changes in the way they used to provide care, and to make changes in their work routines. One respondent indicated that it was not easy to start working as a novice nurse because she, as a bachelor-trained nurse, was more qualified than most of her colleagues, who had received intermediate vocational training or less and who did not accept her innovative ideas. She was judged to be too young and inexperienced:

There were quite a few 50+ nursing assistant colleagues who thought it [a novice nurse doing management tasks] wasn't appropriate. I was 24 when I started working there [in home care]. "No, you're far too young, what do you know?" and "You've

just got a Bachelor degree, so all you've got is book learning". That kind of things. Obtaining their acceptance was very difficult. (6)

Sometimes there was a negative atmosphere at work due to the negative interpersonal relationships among colleagues, including distrust, slandering, gossiping, scolding and bullying. Some respondents felt unwelcome and undervalued. Although this negativity was not always directed towards the respondent, sometimes it was directed towards a colleague, but it still affected the respondent. Some respondents related this negative atmosphere to the predominantly female presence in the workplace. Unfortunate conditions, such as a sick colleague or organisational changes, could make the work atmosphere even less pleasant:

When the three of us [bachelor nurses] would sit down for an hour, for example [to discuss work strategies]. Then the team would say, "They are gossiping about everyone." Well, that kind of ideas. [...] We have had three communication training sessions, that also didn't have the intended result. Things just got worse. Everyone was getting suspicious. And there was no longer a safe climate. Hardly anyone came to the district nurses' office. (3)

How they [colleagues] behaved towards one another, it was a real revelation to me. Because it was, well, it was a women's world in fact. And that's what you feel, it's so nasty, it's so sly, so underhand, so... (1)

DISCUSSION

As far as we know, this is one of the few qualitative studies on the personal experiences of former novice nurses who left the profession within two years after graduation (professional turnover). Seventeen former novice nurses from The Netherlands were interviewed about their reasons for leaving bedside nursing. Six core themes emerged from the interviews.

One of the core themes found in our study was the lack of challenge. Some nurses decided to leave the nursing profession to fulfil their need for further professional and personal growth. The lack of intellectual challenge, restricted professional autonomy and limited professional opportunities in relation to dropout intention has also been reported by others^(37, 38). The intention to leave is also influenced by dissatisfaction with the remuneration^(37, 39). Salary issues were also mentioned in our study as a contributing factor, but not as the main reason.

Lack of passion was another theme. For some respondents, their expectations of being a nurse did not match the workplace reality. Already during their practical training, they realised that they had made a wrong career choice, and this realisation was reinforced when they started working as a graduate nurse. A dissonance between expectations and experiences in novice nurses has been reported previously, resulting in a desire to leave the profession⁽⁴⁰⁾. Such dissonance is also reported in nursing students and was described as ‘increasingly experiencing a mismatch between expectations and reality’⁽²⁶⁾.

A third theme was lack of perceived competence. The transition from student to graduate nurse is challenging and may lead to stress, lack of confidence, feeling insecure and performance anxiety^(41, 42). Some respondents in our study were not able to cope with this transition because they did not feel “up to the challenge” and experienced increased responsibilities and excessively demanding work requirements. They were regularly troubled by a fear of making work errors. In addition, they received little or no back-up support from experienced colleagues due to staff shortages. This phenomenon already occurs in nursing students during internships. Bakker, Verhaegh⁽²⁶⁾ described this as ‘ending up in a downward spiral’, where students lose their grip on the learning process and lack the support from the programme organization.

Lack of job satisfaction related to the heavy workload and excessive work requirements was another important reason for professional turnover in our study. The high workload of nurses is a topical and worldwide problem because of an ageing population⁽⁴³⁾, the increased number of people with comorbidity, and the decreasing number of nursing staff available. Almost all respondents mentioned staff shortages, resulting in a lack of time for patient care and lack of time for consultation with colleagues. Increased paperwork was another reason mentioned by our respondents. Shift work, working overtime on a regular basis and unfavourable nurse-patient ratios were also recognised as factors in nurse turnover by Flinkman, Isopahkala-Bouret⁽³⁷⁾ and Shields and Ward⁽⁴⁴⁾. Several respondents in our study experienced an imbalance between their work and their personal life. This was also acknowledged in the studies of Boamah and Laschinger⁽⁴⁵⁾, Leong and Crossman⁽⁴⁶⁾, Ten Hoeve, Kunnen⁽²²⁾, and Yamaguchi, Inoue⁽⁴⁷⁾. Ten Hoeve, Kunnen⁽²²⁾ related this work-life imbalance to lower mental and physical well-being.

Lack of work-capacity due to non-work-related health conditions, such as chronic physical and mental health problems, was another theme. These health problems

existed before starting working as a nurse. A qualitative study among registered nurses with various disabilities (mainly neurological and musculoskeletal disorders), some of whom were no longer working in nursing, reported that in order to retain nurses with disabilities, they should be supported by employers and colleagues⁽⁴⁸⁾. This support should include possibilities and suggestions for work that these nurses could do without experiencing problems. Another qualitative study⁽⁴⁹⁾ revealed that nursing students with disabilities experienced difficulties in getting assistance or support in class and in clinical practice. In their study many participants felt compelled to hide their disability and were more likely to disclose it to a trusted fellow student than to faculty.

The theme 'lack of a feeling of belonging' can be associated with relatedness. In their qualitative study of diary-described experiences of novice nurses during their first two years after graduation, Ten Hoeve, Kunnen⁽²²⁾ found that 'relatedness', meaning the need to experience a sense of belonging and attachment to other people, was one of the most reported themes. Both positive and negative experiences with regard to relatedness were reported. Positive perceptions made the nurses feel respected and contributed to job satisfaction, while negative experiences contributed to the intention to leave. A supporting working environment is essential for novice nurses and facilitates sharing their experiences and asking for help in stressful situations. This may help novice nurses to stay committed to the nursing profession⁽²²⁾. In our study, support from colleagues and supervisors was considered important as well. Several respondents, however, had negative relatedness experiences, such as distrust, slandering, gossiping, scolding and bullying. Novice nurse scolding was also described by Leong and Crossman⁽⁴⁶⁾ and was the major reason for leaving the nursing profession for some respondents. Whereas the negative relatedness in the study of Ten Hoeve, Kunnen⁽²²⁾ mainly involved the relationship between novice nurses and physicians, in our study it mainly involved the direct nursing colleagues. Some respondents felt unwelcome and undervalued. This was also seen in the study by Chachula, Myrick⁽¹⁷⁾. Positive collegial support in the first 12 months after graduation is considered to be essential for novice nurses to become more familiar with the job, and contributes to more self-confidence and job satisfaction⁽²²⁾.

A strength of this study is that we gained in-depth, detailed information about the various professional turnover reasons from seventeen former novice nurses from various areas throughout The Netherlands; covering eight of twelve Dutch provinces and various clinical areas. The included respondents all considered themselves

as dropouts from the nursing profession. Almost all of them, however, still felt a certain degree of affinity with the nursing profession and nursing work. Eight of them still have a job which is associated with the nursing profession. They are no longer providing direct bedside care, but work in a profession relating to nursing education or research. The vast majority of respondents ruled out to start working as a bedside nurse again in future, but some did not.

Limitations

Although Hennink, Kaiser⁽³³⁾ suggest that meaning saturation can be obtained with 16–24 interviews, certain topics in our study may not have reached meaningful saturation; some codes had stabilised and reached saturation, while aspects of other codes were still emerging. We may have missed themes related to dropout in novice nurses that would have appeared if we had a more diverse sample.

Also a limitation of the study was the volunteer sample of respondents. Because it was difficult to reach members of the target group, most of the respondents were recruited through an advert in a Dutch sector magazine for the nursing profession. Considering the relatively large number of novice nurses who dropout, we were only able to recruit 17 eligible respondents. Our study sample consisted of former registered nurses; the majority ($n=13$) from Bachelor degree and four from intermediate vocational degree. In the Netherlands, the nursing profiles and nursing activities of these groups are indistinguishable in daily practice⁽²⁷⁾. None of the participants in our study had a non-Western cultural background. This is quite remarkable as the proportion of inhabitants with a migrant background in the Netherlands in 2018 was 23.1%⁽⁵⁰⁾, so, one would expect some respondents with a migrant background. This is a result of the sampling method. Also, the proportion of male respondents was small ($n = 1$). Among all health care workers in the Netherlands, the ratio of male nurses to female nurses is 2.3% to 14.4%⁽⁵¹⁾. We cannot be sure whether other reasons for leaving the profession might have been put forward if there had been more respondents from these subgroups.

CONCLUSIONS AND RECOMMENDATIONS

We aimed to explore the experiences and circumstances of former novice nurses that contributed to their professional turnover. Six themes could be distinguished as reasons for leaving the nursing profession within two years after graduation. Four of these themes are related to intrapersonal motives for leaving, that is, lack of

challenge, lack of passion, lack of perceived competence, and lack of work capacity due to non-work-related health conditions. Two themes concern job-related motives, that is, lack of job satisfaction due to a heavy workload, and lack of feeling of belonging.

To prevent novice nurse professional turnover, various measures can be taken. Based on our findings, we recommend capacity building for student and novice nurses, including provision of mentors and enhancement of the individual's self-esteem. Novice nurses with further professional, personal and intellectual ambitions should be given the opportunity to develop further in order to keep them motivated. Supervisor support and the development of a tailored personal development plan are essential for this.

Bedside nursing is a high workload profession. The effect of excessive workload is adverse on patient care and results in dissatisfaction, burnout and turnover among novice nurses. Healthcare organisations and governments should seek to manage the nursing workload effectively in order to reduce dissatisfaction and burnout.

To prevent attrition, it is essential that novice nurses receive effective support from their teams, colleagues and supervisors, so that they feel supported and reassured. In this context, it is also necessary for colleagues and supervisors to observe physical or psychological symptoms in novice nurses, and to provide an adequate response. A more welcoming workplace culture, as well as a supportive and coaching attitude of colleagues and supervisors, can help novice nurses to feel more affiliation, and feel more related.

It is important that the above-mentioned measures are not limited to novice nurses only. Nursing students can benefit from these measures as well, especially during the practical traineeships of their nursing education.

Future research is needed to develop and evaluate intervention programmes that contribute to a supportive environment with tailored coaching opportunities for both nursing students and novice nurses working in the different clinical areas.

DECLARATION OF COMPETING INTEREST

The authors declare that they have no conflicting interests.

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Appendix: Interview guide

- How did you experience your nursing training?
- How did you experience the transition from student nurse to graduate nurse?
- What challenges did you experience during your work as a novice nurse?
- How did you deal with work pressure during your work as a novice nurse?
- Who or where could you go to for support during difficult periods at work as a novice nurse?
- Why did you stop working as a nurse?
- What led to the decision to stop?
- What do you think should be done in the workplace to prevent novice nurses from dropping out?
- What were your motives for choosing your current work?

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PART II

Determinants and predictors of
intention to leave, actual dropout and
musculoskeletal complaints in nursing
students and novice nurses



Chapter 4

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.

Key words: Attrition; Dropout; Intention to leave; Musculoskeletal complaints; Retention; Student nurse

HIGHLIGHTS

- Musculoskeletal complaints (MSCs) occur in four out of five nursing students
- MSCs nor physical work factors are related to late dropout from nursing education
- Male sex and decision latitude are associated to both late dropout and intention to leave
- MSCs are so common that they may not be distinctive for late dropout.
- Prevention of MSCs deserves more attention in nursing schools

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⁽¹⁾. Many studies in various countries have investigated the organizational turnover intention among nurses^(e.g. 2-5). In the prospective cohort study of Moloney, Boxall⁽⁶⁾ among 2,876 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'⁽⁷⁾ and shortly after graduation⁽⁸⁾. In the Netherlands, the organization of clinical placements may vary between nursing schools; the total duration of clinical placement is legally set at 2300 hours⁽⁹⁾. 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.

LITERATURE REVIEW

Nursing student dropout is a concern. In 2017 in the United Kingdom 24 percent of nursing students left or suspended their studies⁽¹⁰⁾. 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⁽¹¹⁾, 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. 12-15).

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⁽¹⁶⁻¹⁹⁾, 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⁽²⁰⁾.

The nursing profession is a high-risk profession for developing musculoskeletal problems⁽²¹⁻²³⁾, and these may contribute to leaving the profession^(21, 24). Musculoskeletal problems already occur in nursing students⁽²⁵⁾, 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⁽²⁶⁻²⁹⁾ and in registered nurses⁽³⁰⁻³⁵⁾. Low back pain in graduated nurses often had its onset during nursing education^(28, 29). From all MSCs among Australian nursing students, low back pain was the most common (59.2%)⁽³⁵⁾.

The results of a study by Fochsen, Josephson⁽²⁴⁾ 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^(36, 37). 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⁽³⁸⁾. This is a four-year accredited program, including four 20-week clinical placements, one in the second year (32 hours per week), two in the third year (24 hours per week) and one in the fourth year (24 hours 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 supplement 1 and 2. The current study is a sub-study of the research project SPRiNG that was initiated in 2016⁽³⁹⁾. 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⁽⁴⁰⁾, 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⁽⁴¹⁾, resulting in a weighted sum score ranging from 0-100. 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)⁽⁴²⁾. 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 minutes of moderate physical activity⁽⁴³⁾.

3) MSCs at baseline

MSCs were assessed with the Dutch Musculoskeletal Questionnaire (DMQ)⁽⁴⁴⁾, including questions about having musculoskeletal ache, pain, or discomfort in each of twelve body regions supported by a body map diagram (figure 1).

Figure 1
Body map diagram

Complaints of neck, back and limbs
During your current clinical placement, do you have pain, discomfort of your:

	Yes, long term	Yes, regularly	Yes, once in a while	No, never
neck	☐	☐	☐	☐
shoulders	☐	☐	☐	☐
upper back	☐	☐	☐	☐
upper arm	☐	☐	☐	☐
lower back	☐	☐	☐	☐
elbows	☐	☐	☐	☐
wrists / hands	☐	☐	☐	☐
pelvis	☐	☐	☐	☐
thighs	☐	☐	☐	☐
knees	☐	☐	☐	☐
lower legs	☐	☐	☐	☐
ankles / feet	☐	☐	☐	☐

Complaints at the twelve body regions were merged into three anatomical areas⁽⁴⁵⁻⁴⁷⁾: 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 Questionnaire (JCQ)⁽⁴⁸⁾. 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⁽⁴⁹⁾, 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⁽⁵⁰⁾, 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 0-100, 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: MEC-2016-203).

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 dropout 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 dropout 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).

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 ¹ (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%)

¹ Body mass index (BMI)

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); 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 ($p = < 0.1$). 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.

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).

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

Determinants	OR [†]	95% CI [‡]	p-value	R ^{2§}
				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	

[†]odds ratio; [‡]confidence interval; [§]explained variance by Nagelkerke R-square test.

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).

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

Determinants	OR [†]	95% CI [‡]	p-value	R ^{2§}
				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	

[†]odds ratio; [‡]confidence interval; [§]explained variance by Nagelkerke R-square test.

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 dropout. Earlier research has shown that psychological factors also play a role. Bakker, Verhaegh⁽⁷⁾ 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⁽⁷⁾. The psychological burden associated with nursing, experiences of lateral violence, incivility and bullying⁽⁵¹⁾, 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⁽⁵²⁾.

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%)⁽⁵³⁾. 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⁽⁵³⁾.

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⁽⁵⁴⁾. MSCs were neither mentioned in the systematic review of Eick, Williamson⁽⁵⁵⁾ who investigated placement-related attrition, nor in the above-mentioned interview study of reasons for dropout among Dutch nursing students⁽⁷⁾.

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⁽⁵⁶⁾. The association between being male and (late) dropout is in line with previous findings^(36, 57). 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^(56, 58, 59). Regarding decision latitude, we found that students who have less opportunities to make work-related decisions independently, are more likely to dropout 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⁽⁶⁰⁾ 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⁽⁶¹⁾.

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, Zrínyi⁽⁶²⁾, who looked at the intention to graduate

as a nurse among 381 fourth-year Hungarian nursing students. According to the systematic review of Eick, Williamson⁽⁵⁵⁾, 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⁽⁶³⁾, 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⁽⁶⁴⁾. 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⁽⁶⁵⁾, 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⁽⁶⁶⁾ or caring for their own spouse and children⁽⁶⁷⁾.

The association between absence due to sickness and a higher dropout risk is supported by a study by Josephson, Lindberg⁽⁶⁸⁾, 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⁽⁶⁹⁾.

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 dropout 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 (Table 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 dropout 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.

DECLARATIONS

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.

Declarations of interest

None

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Authors' contributions

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.

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Supplement 1

Characteristics of the Dutch Bachelor of Nursing degree programme (Bakker et al., 2019)



Dutch Bachelor of Nursing programme

- 17 Dutch universities of applied sciences
- NVAO accredited



Duration of the programme

- four years
- 240 ECTS (1ECT = 28 hrs)



Entrance requirements

Certificate of:

- higher secondary education
- secondary vocational training



Content programme

- 1535 hrs theoretical - 2300 hrs practical
- clinical placements in various healthcare settings



Support structure

- personal study career coach
- clinical supervisor and/or mentor
- student counsellor on demand



Educational trajectories

- full-time/ part-time,
- combined work-study trajectories
- honors programme

Supplement 2

Characteristics of the Bachelor of Nursing degree programme in the Netherlands (Bakker et al., 2019)

Setting: The Bachelor of Nursing programme in the Netherlands is offered by 17 universities of applied sciences.

Duration of the programme: Four years (equal to 240 ECTS according to the European Credit Transfer and Accumulation System; one ECTS represents 28 hours of students' work). A shorter programme is possible for students who already have a certificate of vocational nursing training.

Entrance requirements: A certificate of higher secondary education (in Dutch: HAVO or VWO) or secondary vocational training (in Dutch: MBO).

Different educational trajectories: Full-time; part-time (for students with a secondary vocational nursing certificate who can combine the programme with paid work in a healthcare institution); combined work and study trajectories (possible from year 3); honours programme (for students who require an extra challenge through extra-curricular modules and/or opportunities to graduate in less time).

Nature and content of the programme: Students are trained for various healthcare settings, such as mental healthcare, community-based healthcare, hospital care, nursing-home care and disabled care. The broad programme is based on the principles of competency-based learning and contains a combination of theoretical training (1535 hours), practical skills training and clinical training in various settings (2300 hours in total).

Main content of the full-time study programme per year, for the two included universities:

- Year 1: theoretical training and practical skills training, including a short introductory internship (between 1 and 10 weeks)
- Year 2: theoretical training and practical skills training, including one long or two short internships (18-20 weeks in total)
- Year 3: long internships (18-20 weeks), supported by theoretical training and minor subject or long internships (18-20 weeks)
- Year 4: minor subject or long internship (18-20 weeks), one long internship (18-20 weeks) and/or graduation assignment

Support structure: During their four years of study nursing students receive coaching regarding their study progress from a faculty member, mostly a master prepared RN, in the role of study career coach. In case of special needs students can apply for counselling on demand. During the internships, every student is supervised by a registered nurse, preferably with a Bachelor's degree, and is assigned to a faculty staff member who monitors the progress in the clinical training, the quality of the learning climate, and is responsible for the final assessment and grading.

Supplement 3

Overview of the study outcomes, instruments and source

Outcome	Instrument and source	Number of items	Sample items	Answer categories	Scoring	Validity / Reliability
Physical work factors						
Lifting and bending	Lifting and bending scale, NEXT Study-Group (Kümmerling & Hasselhorn, 2003)	8	"How often on an average workday are you personally occupied with the following tasks?" "bedding and positioning patients"; "transferring or carrying patients"; "lifting patients in bed without aid"; "mobilizing patients"; "clothing patients"; "helping with feeding"; "making beds"; "pushing patient's beds, food trolleys or laundry trolleys"	'0-1 times a day', '2-5 times a day', '6-10 times a day', and 'more than 10 times a day'.	Weighted sum score; possible range: 0-100	Cronbach's alpha: .86 (NL)
Working at a screen	Dutch Questionnaire on the Experience and Evaluation of Work (VBBA), van Veldhoven and Meijman, 1994	2	"Do you work at a monitor, laptop or notebook during your clinical placement/ work?" "On average, how many hours a day do you work on a screen in total?"	'always', 'often', 'sometimes', 'never'. Total number of hours	N/A N/A	N/A
Physical activity	Short Questionnaire to Assess Health-enhancing Physical Activity SQUASH, Wendel-Vos et al. 2003	7	Questions on the frequency, duration and intensity of commuting activities, leisure time activities, household activities, and activities at work and school	Days per week and mean time per day	Total activity score	Overall reproducibility: .58

physical job demands	Job Content Questionnaire (JCQ), Karasek, Brisson, 1998	5	"My job requires a lot of physical effort"; "I often have to move or lift very heavy loads in my job"; "My work requires rapid and continuous physical activity"; "I often have to work for long periods in awkward body positions"; "I often have to work for long periods of time with my head and/or arms in awkward positions"	"totally disagree" (1), "disagree" (2), "agree" (3), "totally agree" (4)	JCQ scale score	Cronbach's alpha: .79 (women); .86 (men)
MSCs at baseline						
Musculoskeletal symptoms	Dutch Musculoskeletal Questionnaire (DMQ) (Hildebrandt, 2001)	12	"During your current clinical placement, do you have pain or discomfort of your..." "neck", "shoulders", "upper back", "upper arm", "lower back", "elbows", "wrists/hands", "hips", "thighs", "knees", "lower legs", "ankles/feet"	"Yes, long term", "Yes, regularly", "Yes, once in a while", "No, never"	N/A*	Fair convergent validity / fair divergent validity
Consultation of healthcare providers for physical health complaints	'Gezond werken in de zorg' [Healthy Working in Healthcare] questionnaire, Bronkhorst, ten Arve, 2014	1	"Did you seek help from a health professional for one or more of the aforementioned physical complaints in the current clinical placement/work period?"	"no", "yes, with a general practitioner/company doctor", "yes, with a physiotherapist (e.g. physiotherapist, occupational therapist, manual therapist, Cesar Mensendieck therapist)", "yes, with another healthcare provider"	N/A	N/A
Absence during academic year due to sickness	Sickness Absenteeism, NEA, Hooftman, Mars, 2015	1	"Have you ever been absent this academic year?"	"yes", "no"	N/A	N/A

Psychosocial factors					
Decision latitude (skill discretion + decision authority)	Job Content Questionnaire (JCQ), Karasek, Brisson, 1998	9	“My job requires that I learn new things”; “My job allows me to make a of decisions on my own”; “My job always involves the same short-term activities”; “My job requires me to be creative”; “My job requires a high degree of professional competence”; “I get to do lots of different things at work”; “I have the opportunity to develop my own competence”; “I have very little freedom in my work to decide how to do my job”; “I have a lot of say in deciding what happens in my work”	“totally disagree” (1), “disagree” (2), “agree” (3), “totally agree” (4)	weighted sum of skill discretion + decision authority Cronbach’s alpha: .82 (women); .81 (men)
Psychological job demands	Job Content Questionnaire (JCQ), Karasek, Brisson, 1998	5	“My job requires working very fast”; “My job requires working very hard”; “I am not asked to do too much excessive work”; “I have enough time to get the job done”; “I do not receive conflicting demands from others”	“totally disagree” (1), “disagree” (2), “agree” (3), “totally agree” (4)	JCQ scale score Cronbach’s alpha: .63 (women); .63 (men)
Social support from supervisor	Job Content Questionnaire (JCQ), Karasek, Brisson, 1998	4	“My supervisor is concerned about the welfare of those under him or her”; “My supervisor is helpful in getting the job done”; “My supervisor pays attention to what I say”; “My supervisor manages to get people to work together”	“totally disagree” (1), “disagree” (2), “agree” (3), “totally agree” (4)	JCQ scale score Cronbach’s alpha: .84 (women); .84 (men)

Social support from co-workers	Job Content Questionnaire (JCQ), Karasek, Brisson, 1998	4	"People I work with are competent in doing their jobs"; "People I work with take a personal interest in me"; "People I work with are friendly"; "People I work with are helpful"	"totally disagree" (1), "disagree" (2), "agree" (3), "totally agree" (4)	JCQ scale score	Cronbach's alpha: .77 (women); .75 (men)
Distress	Distress Screener, Braam, van Oostrom, 2009	3	"During the past week, did you suffer from worry?"; "During the past week, did you suffer from listlessness?" and "During the past week, did you feel tense?"	"no" (0), "sometimes" (1), and "regularly or more often" (2)	Sum score; cut-off point < 4 'screened negative'; >= 4 'screened positive'	High correlation (.82) with 4DSQ distress subscale; test-retest reliability: .83
Need for recovery (NFR)	NFR scale (Dutch Questionnaire on the Experience and Evaluation of Work), Van Veldhoven and Broersen, 2003	11	"I find it difficult to relax at the end of a working day"; "Because of my job, at the end of the working day I feel rather exhausted"	Yes/No	Sum score	Cronbach's alpha: .88; high content validity

*For the current study 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').

Supplement 4*Univariable associations of determinants with Intention to leave (n = 711)*

Determinant	Univariate analysis		
	OR [†]	95% CI [‡]	R ^{2§}
Sociodemographic characteristics			
Sex (reference: female)	1.386	0.84-2.27	0.003
Age	0.978	0.95- 1.01	0.004
Length	0.992	0.97-1.01	0.001
BMI	0.997	0.96-1.03	0.000
Previous education level (Reference: Senior general secondary education)			0.002
Pre-university education & academic higher education	0.963	0.62-1.94	
Intermediate vocational education and training & in-service training & other	0.821	0.58-1.16	
Native Dutch (no/yes) (reference: Dutch)	1.013	0.65-1.57	0.00
Ethnicity (reference: Dutch background)	1.25	0.90-1.73	0.03
Living situation (with parents yes/no) (reference: with parents yes)	1.147	0.85-1.55	0.002
Study mode in nursing education (full time or dual/part-time) (reference: fulltime)			0.017
Dual	0.596*	0.42-0.84	
Part-time	0.731	0.42-1.28	
Physical work factors			
Lifting and bending	1.002	0.99-1.01	0.000
VDU work (reference: no / little VDU work)	0.579*	0.41-0.83	0.017
Total time spent on VDU work	0.992	0.94-1.05	0.000
Number of colleagues number of colleagues on-site on an average working day (0-1 vs 2 -more) (reference: 0-1)	1.271	0.90-1.80	0.003
Number of patients under care on an average working day	1.00	0.97-1.03	0.000
Current clinical placement setting (reference: hospital)			0.012
Elderly care	1.662*	1.02-2.71	
home care	1.121	0.78-1.62	
mental healthcare	0.974	0.54-1.76	
other	1.704	0.93-3.13	
Physical activity level (SQUASH-score)	1.035*	1.01-1.07	0.011
Musculoskeletal complaints at baseline			
complaints of arm, neck, shoulders (CANS) (reference: no/little CANS)	1.554*	1.14-2.11	0.015
Back complaints (lower back and pelvis) (reference: no/little low back/pelvis complaints)	1.604*	1.18-2.18	0.017

Complaints of the lower extremities (thighs, knees, lower legs and ankles/feet) (reference: no/little lower extremities complaints)	1.580*	1.17-2.14	0.016
Consultation of healthcare providers for physical health complaints (reference: yes, seeking help)	1.103	0.79-1.54	0.001
Absence during academic year due to illness (reference: no absence)	1.464*	1.08-1.98	0.012
Psychosocial work factors			
Decision latitude	0.307***	0.21-0.46	0.067
Psychological job demands	1.550*	1.14-2.10	0.015
Physical job demands	1.520*	1.18-1.96	0.020
Supervisor Social support	0.485***	0.37-0.63	0.061
Co-worker support	0.395***	0.28-0.56	0.057
Distress (reference: distress)	2.710***	1.99-3.69	0.076
Need for recovery	1.019***	1.01-1.03	0.073

[†]odds ratio; [‡]confidence interval; [§]explained variance by Nagelkerke R-square test.

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Supplement 5*Univariable associations of determinants with dropout (n = 711)*

Determinant	Univariate analysis		
	OR [†]	95% CI [‡]	R ^{2§}
Sociodemographic characteristics			
Sex (reference: female)	2.518*	0.91-6.97	0.015
Age	1.043	0.99- 1.1	0.010
Length	1.003	0.96-1.05	0.000
BMI	1.070*	1.00-1.14	0.018
Previous education level (Reference: Senior general secondary education)			0.002
Pre-university education & academic higher education	1.245	0.39-3.94	
Intermediate vocational education and training & in-service training & other	1.245	0.50-3.10	
Native Dutch (no/yes) (reference: Dutch)	0.901	0.26-3.08	0.00
Ethnicity (reference: Dutch background)	1.703	0.74-3.90	0.08
Living situation (with parents yes/no) (reference: with parents yes)	2.202*	0.95-5.10	0.019
Study mode in nursing education (full time or dual/part-time) (reference: fulltime)			0.007
Dual	0.639	0.23-1.77	
Part-time	1.391	0.39-4.92	
Physical work factors			
Lifting and bending	0.994	0.97-1.02	0.001
VDU work (reference: no / little VDU work)	0.563	0.24-1.34	0.009
Total time spent on VDU work	0.805*	0.63-1.02	0.022
Number of colleagues number of colleagues on-site on an average working day (0-1 vs 2 -more) (reference: 0-1)	1.072	0.42-2.75	0.000
Number of patients under care on an average working day	0.995	0.92-1.08	0.000
Current clinical placement setting (reference: hospital)			0.030
Elderly care	3.111*	0.96-10.07	
home care	2.090	0.75-5.86	
mental healthcare	0.876	0.11-7.26	
other	3.152	0.79-12.63	
Physical activity level (SQUASH-score)	1.006	0.93-1.09	0.00
Musculoskeletal complaints at baseline			
complaints of arm, neck, shoulders (CANS) (reference: no/ little CANS)	1.060	0.46-2.42	0.00
Back complaints (lower back and pelvis) (reference: no/little low back/pelvis complaints)	1.587	0.67-3.76	0.006

Complaints of the lower extremities (thighs, knees, lower legs and ankles/feet) (reference: no/little lower extremities complaints)	1.445	0.64-3.26	0.004
Consultation of healthcare providers for physical health complaints (reference: yes, seeking help)	1.367	0.58-3.25	0.003
Absence during academic year due to illness (reference: no absence)	2.176*	0.92-5.15	0.018
Psychosocial work factors			
Decision latitude	0.415*	0.16-1.05	0.018
Psychological job demands	0.630	0.28-1.42	0.007
Physical job demands	0.925	0.47-1.82	0.00
Supervisor Social support	0.713	0.39-1.32	0.006
Co-worker support	0.610	0.26-1.44	0.007
Distress (reference: distress)	0.848	0.37-1.94	0.001
Need for recovery	1.004	0.99-1.02	0.002

[†]odds ratio; [‡]confidence interval; [§]explained variance by Nagelkerke R-square test.

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Supplement 6

Multivariable associations of determinants in four domains with Intention to leave (n = 711)

Determinant	Multivariate logistic regression analysis		
	OR [†]	95% CI [‡]	R ^{2§}
Domain 1: Sociodemographic characteristics			0.043
Sex (reference: female)	1.966*	1.06-3.65	
Age	0.968	0.93-1.01	
Length	0.979	0.96-1.00	
BMI	0.994	0.96-1.03	
Highest educational level (Reference: Senior general secondary education)			
Pre-university education & academic higher education	1.144	0.71-1.85	
Intermediate vocational education and training & in-service training & other	0.881	0.58-1.33	
Native Dutch (no/yes) (reference: Dutch)	0.695	0.40-1.21	
Ethnicity (reference: Dutch background)	1.294	0.83-2.02	
Living situation (with parents yes/no) (reference: with parents yes)	1.509*	1.05-2.16	
Educational routing in nursing Education (full time or dual/part-time) (reference: fulltime)			
Dual	0.587*	0.40-0.85	
Part-time	0.892	0.43-1.85	
Domain 2: Physical work factors			0.037
Lifting and bending	0.998	0.988-1.01	
VDU work (reference: no / little VDU work)	0.609*	0.415-0.89	
Total time spent on VDU work	1.004	0.945-1.07	
Number of colleagues at work on an average working day (0-1 vs 2 -more) (reference: 0-1)	1.207	0.836-1.74	
Number of patients under care for during an average working day	0.995	0.964-1.03	
Clinical placement (reference: hospital)			
Elderly care	1.352	0.81-2.27	
home care	1.014	0.65-1.58	
mental healthcare	1.088	0.56-2.11	
other	1.606	0.86-3.00	
Physical activity level (SQUASH-score)	1.040*	1.01-1.07	
Domain 3: Musculoskeletal complaints at baseline			0.042
CANS (reference: no/little CANS)	1.339	0.96-1.88	
Complaints of low back and pelvis (reference: no/little low back/pelvis complaints)	1.358	0.97-1.90	

Complaints of lower extremities (reference: no/little lower extremities complaints)	1.367*	0.99-1.89
Consultation of healthcare providers for physical health complaints (reference: yes, seeking help)	0.876	0.61-1.25
Absence during academic year due to illness (reference: no absence)	1.434*	1.05-1.95
Domain 4: Psychosocial work factors		0.145
Decision latitude	0.579*	0.36-0.93
Psychological job demands	0.866	0.59-1.27
Physical job demands	1.062	0.78-1.45
Supervisor Social support	0.796	0.57-1.11
Co-worker support	0.693	0.46-1.06
Distress (reference: distress)	1.843*	1.29-2.63
Need for recovery	1.009*	1.00-1.02

†odds ratio; ‡confidence interval; §explained variance by Nagelkerke R-square test.

*p < 0.1

Supplement 7

Multivariable associations of determinants in four domains with dropout (n = 711)

Determinant	Multivariate logistic regression analysis		
	OR [†]	95% CI [‡]	R ^{2§}
Domain 1: Sociodemographic characteristics			0.069
Sex (reference: female)	3.30*	0.83-13.14	
Age	1.03	0.95-1.12	
Length	0.98	0.92-1.04	
BMI	1.05	0.98-1.13	
Highest educational level (Reference: Senior general secondary education)			
Pre-university education & academic higher education	0.96	0.26-3.51	
Intermediate vocational education and training & in-service training & other	0.84	0.28-2.52	
Native Dutch (no/yes) (reference: Dutch)	0.43	0.10-1.78	
Ethnicity (reference: Dutch background)	1.77	0.62-5.06	
Living situation (with parents yes/no) (reference: with parents yes)	2.11*	0.80-5.56	
Educational routing in nursing Education (full time or dual/part-time) (reference: fulltime)			
Dual	0.52	0.16-1.61	
Part-time	0.64	0.11-3.70	
Domain 2: Physical work factors			0.061
Lifting and bending	0.99	0.96-1.02	
VDU work (reference: no / little VDU work)	0.88*	0.33-2.33	
Total time spent on VDU work	0.79	0.60-1.02	
Number of colleagues at work on an average working day (0-1 vs 2 -more) (reference: 0-1)	0.92	0.35-2.46	
Number of patients under care for during an average working day	0.97	0.87-1.08 (range=1 to 80) (mean=7.65)	
Clinical placement (reference: hospital)			
Elderly care	2.76	0.79-9.66	
home care	2.65	0.75-9.33	
mental healthcare	0.84	0.09-7.93	
other	3.58	0.86-14.84	
Physical activity level (SQUASH-score)	1.02	0.93-1.11	
Domain 3: Musculoskeletal complaints at baseline			0.027
CANS (reference: no/little CANS)	0.83	0.34-2.04	
Complaints of low back and pelvis (reference: no/little low back/pelvis complaints)	1.50	0.59-3.75	

Complaints of lower extremities (reference: no/little lower extremities complaints)	1.28	0.55-3.02
Consultation of healthcare providers for physical health complaints (reference: yes, seeking help)	1.17	0.47-2.91
Absence during academic year due to illness (reference: no absence)	2.08	0.87-4.97
Domain 4: Psychosocial work factors		0.036
Decision latitude	0.47	0.15-1.49
Psychological job demands	0.54	0.21-1.35
Physical job demands	0.97	0.43-2.18
Supervisor Social support	0.86	0.38-1.94
Co-worker support	0.77	0.26-2.25
Distress (reference: distress)	0.68	0.26-1.77
Need for recovery	1.01	0.99-1.03

†odds ratio; ‡confidence interval; §explained variance by Nagelkerke R-square test.

*p < 0.1



Chapter 5

What sociodemographic and work characteristics are associated with musculoskeletal complaints in nursing students? A cross-sectional analysis of repeated measurements

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ABSTRACT

Musculoskeletal complaints (MSCs) arise during nursing education. We examined cross-sectional associations between self-reported MSCs and both sociodemographic and workplace characteristics in different clinical placement settings. We included two observations among three cohorts of third-year Dutch nursing students (total N=711) of the undergraduate nursing program of Rotterdam University of Applied Sciences. Questionnaire data on sociodemographic, physical and psychosocial work characteristics, and MSCs were used. Generalized estimating equation analysis for repeated measurements with backward elimination was used to examine associations with MSCs.

In total, 79% of students experienced MSCs. Female sex (OR 0.37, 95% CI 0.22–0.62), lifting and bending (OR 1.01, 95% CI 1.00–1.03), physical job demands (OR 2.33, 95% CI 1.68–3.22) and need for recovery (OR 1.02, 95% CI 1.01–1.03), were statistically significantly associated with overall MSCs. Models for regional complaints are also presented in this article. Nursing school and clinical placement staff should consider these factors when dealing with nursing students with MSCs.

Keywords: Musculoskeletal complaints; Nursing students; Cross-sectional analysis

INTRODUCTION

The demand for nurses is high, and the retention of nurses is a global challenge. The World Health Organisation (WHO) predicts increased global demand for health and social care staff by 2030, of which nurses comprise about half the global healthcare workforce⁽¹⁾. The decision to leave the nursing profession is the result of a complex process⁽²⁾, in which physical health characteristics might play a role. Musculoskeletal complaints affect the work ability of nurses⁽³⁾ and may contribute to leaving the profession^(4,5). Addressing this problem early and ongoing, preferably starting during nursing education, may contribute to the long-term retention of nurses.

BACKGROUND

Musculoskeletal complaints (MSCs) give rise to work disability⁽⁶⁾, absenteeism⁽⁷⁾, and dropout from the nursing profession⁽⁸⁾. Aiken's study⁽⁸⁾ among 43,000 nurses in 5 countries, reported 17% to 39% having the intention to leave their profession within the next year due to physical and psychological job demands. Fochsen et al⁽⁴⁾ showed that 26% of nurses employed in hospitals in Sweden were no longer employed in nursing care a decade later. MSCs of the neck/shoulder or knees as well as physical working conditions were among the variables that were associated with their leaving nursing care. US nurses with high physically demanding jobs more often reported an intent to leave their position⁽⁹⁾. Given the current shortage of nurses and the growing demand for nursing professionals in the coming years⁽¹⁰⁾, these findings are worrying.

Nurses are often exposed to physically demanding tasks, such as lifting, bending, working in awkward positions and repetitiveness in nursing tasks. This may result in overexertion injuries to nurses' musculoskeletal system⁽¹¹⁾. MSCs are common in the nursing profession⁽¹²⁻¹⁵⁾, with prevalence rates for low back pain of 40 - 88%⁽¹⁶⁾, and for neck-shoulder-arm pain 13 - 96%⁽¹⁷⁾. Prevalence rates of MSCs in the lower extremities range between 3.2% and 100%⁽¹⁸⁾. Different settings and clinical situations, and different instruments and scales, may partly account for the varying prevalence rates. The annual prevalence of low back pain in Nigerian nurses was 73.5%⁽¹⁹⁾ and the low back pain prevalence in Turkish nurses was 49.7%⁽²⁰⁾.

The development of MSCs starts already among nursing students during their clinical placements^(21,22). Two studies reported that MSCs were most common in the spine area (neck, upper back, and lower back) among nursing students in Sweden⁽²³⁾, with a prevalence rate of 51% for neck pain, and Turkey⁽²⁴⁾ with a 12-month prevalence rate of 33.5% for neck pain.

A high incidence of MSCs has been identified in novice nurses. 39% of nurses in the first four years of their working career reported MSCs⁽²⁵⁾. Mitchell et al.⁽²⁶⁾ indicated that MSCs were more prevalent during the last two years of nursing training and over the period from student to working nurse than at the start of the nursing education. They suggested that increased occupational exposure and more frequent and intensive physical work demands contribute to this. Effective interventions for preventing work related MSCs for nursing students and novice nurses are scarce⁽²⁷⁾. It is therefore imperative to provide appropriate support during and shortly after nursing education⁽²³⁾ to avoid increasing MSCs .

It is unclear what sociodemographic and workplace characteristics contribute to MSCs in nursing students. This study explored possible cross-sectional associations between these characteristics, and self-reported MSCs.

METHODS

Study design

A cross-sectional analysis of repeated measurements.

Setting

The Bachelor of Nursing degree program of Rotterdam University of Applied Sciences has a yearly average of 500 first-year students⁽²⁸⁾. This four-year accredited educational program includes four clinical placements of 20 weeks each (80 weeks in total): one clinical placement in year 2 (first or second semester), two clinical placements in year 3, and one clinical placement in year 4 (second semester).

Study population

All third-year nursing students of three consecutive academic years (from 2015-2016 to 2017-2018) of the undergraduate nursing program of Rotterdam University of Applied Sciences (N=995) were invited to participate. Prior to being invited to participate in the study, students received oral and written information about the study, with presentations and flyers.

Data collection

Online self-administered questionnaires were sent by e-mail in the twelfth week of the second semester of the third study year (second placement setting of year 3). One year

later, in the second semester of the fourth year, an identical follow-up questionnaire was sent, except that the first questionnaire contained questions on sociodemographic data such as gender and ethnicity. The questionnaires addressed the outcome variable, that is, MSCs during the current clinical placement, and a number of potential associated factors that were derived from the literature and the researchers’ expertise.

The students could complete the questionnaires as part of the educational program during lectures. Up to three follow-up invitations to participate in the study were sent. Participants did not receive compensation for their participation.

Outcome variable

The outcome of interest for the current study was MSCs during the students’ current clinical placement. MSCs were assessed using the Dutch Musculoskeletal Questionnaire (DMQ)⁽²⁹⁾, including questions about having musculoskeletal ache, pain, or discomfort in each of twelve body regions supported by a body map diagram (figure 1).

Figure 1

Body map diagram

Complaints of neck, back and limbs
During your current clinical placement, do you have pain, discomfort of your:

	Yes, long term	Yes, regularly	Yes, once in a while	No, never
neck	☐	☐	☐	☐
shoulders	☐	☐	☐	☐
upper back	☐	☐	☐	☐
upper arm	☐	☐	☐	☐
lower back	☐	☐	☐	☐
elbows	☐	☐	☐	☐
wrists / hands	☐	☐	☐	☐
pelvis	☐	☐	☐	☐
thighs	☐	☐	☐	☐
knees	☐	☐	☐	☐
lower legs	☐	☐	☐	☐
ankles / feet	☐	☐	☐	☐

The twelve body regions were combined into three anatomical areas according to the 'Multidisciplinary guideline non-specific Complaints Arm, Neck and/or Shoulders'⁽³⁰⁾, 'JGZ guideline Extremities, including thighs, knees, lower legs and ankles/feet'⁽³¹⁾, and 'KNGF practice guideline 'Low back pain''⁽³²⁾: 1) upper extremities (hands/wrists, elbows, upper arm, neck, shoulders and upper back); 2) lower back area (lower back and pelvis); and 3) 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').

Sociodemographic characteristics

The following sociodemographic factors were used: sex, age, body mass index (BMI), living situation, ethnicity, prior education, and study route. Living situation was modelled dichotomously: living with parents or not living with parents. Ethnicity was modelled dichotomously: Dutch or western migration background, or non-western migration background. Students were classified as having a non-western migration background, when at least one parent was born in a non-western country⁽³³⁾. Prior education was classified into three levels: 1) higher general secondary or pre-university education, 2) academic higher education or 3) vocational education and training, in-service training, or other. Study route was classified into: 1) full-time, 2) part-time, or 3) combined study-work programme.

Physical workplace characteristics

The following physical workplace factors were included: lifting and bending, physical job demands, Visual Display Unit work (VDU), the number of colleagues that the student works with on an average working day, the daily number of patients cared for, current clinical placement setting, and physical activity level. The 8-item 'lifting and bending' scale from the NEXT questionnaire⁽³⁴⁾ was used to assess exposure to lifting and bending, with a possible range from 0 to 100 (the higher the score, the higher the exposure to lifting and bending). Physical job demands were measured with subscales of the Job Content Questionnaire (JCQ)⁽³⁵⁾. Visual Display Unit work was assessed with two questions from the Dutch Questionnaire on the Experience and Evaluation of Work (VBBA)⁽³⁶⁾, on the frequency (no-little/ often-always) and duration (mean number of hours per day). The daily number of colleagues working with was modelled into '0 to 1' and '2 or more'. Current clinical placement settings

were modelled using five categories: 1) hospital care, 2) nursing home care, 3) home care, 4) mental health care, and 5) other (including care for disabled, youth healthcare, other settings).

Psychosocial workplace characteristics

We used the following subscales of the Job Content Questionnaire (JCQ)⁽³⁵⁾: decision latitude (composed of decision authority and skill discretion), psychological job demands, and supervisor and co-worker social support to assess psychosocial work characteristics. For each subscale, a sum score was calculated, ranging from 1 to 4.

Physical and mental health characteristics

The Short Questionnaire to Assess Health-enhancing Physical Activity (SQUASH) was used to assess physical activity level; providing an indication of the number of days per week with at least 30 minutes of moderate physical activity⁽³⁷⁾.

To measure distress, the generic 3-item Distress Screener⁽³⁸⁾ was used, with questions about suffering from worry or listlessness, and feeling tense during the past week. Distress was modelled dichotomously: no/yes. The 11-item need for recovery subscale (NFR) was used from the Dutch Questionnaire on the Experience and Evaluation of Work⁽³⁹⁾. A sum score was calculated, ranging from 0 to 100. Higher scores indicate a higher need for recovery.

Data Analysis

Descriptive statistical analysis were applied to describe factors and outcome variables, using mean scores, standard deviations (SD), median and interquartile Range (IQR) for continuous variables, and frequency and percentages for categorical variables.

Before running our model, (multi)collinearity was checked to detect correlations between all factors. We did a nonparametric correlation test, applying Spearman's rho (with cut-off > 0.7). For factors showing (multi)collinearity, the factor with the strongest association to the primary outcome (BMI) was selected for the model; for the current study, 'BMI' was kept over 'weight'. After removal of weight, the models were no longer subject to multicollinearity issues.

Cross-sectional associations between sociodemographic, workplace and health characteristics, and MSCs were evaluated using Generalized Estimating Equation

(GEE). GEE is an appropriate method for analyzing cross-sectional associations with repeated measures. In the current study, GEE accounts for changes in clinical placement setting and personal circumstances over time (that is, between the two observations in the third and fourth academic year) within individual students.

We constructed four models through backward elimination ($p > 0.05$ for removal), for each anatomical area (upper extremities, lower back, and lower extremities) and for total MSCs. The significance level for inclusion of a factor in our final model was set at p -value 0.05. All variables included in the model were measured at the two observations, except for sex, age, country of birth, ethnicity, first language, study route, prior education, and height. Odds ratios with 95% confidence intervals for each factor were calculated. All analyses were performed in IBM SPSS version 26.0. All analyses were performed in IBM SPSS version 26.0.

Ethical considerations

Ethical approval was obtained from the Medical Ethical Review Committee of the Erasmus University Medical Center, Rotterdam (MEC number: FMS/sl/273789). The research was carried out in accordance with the Netherlands Code of Conduct for Scientific Practice of the Netherlands Association of Universities (VSNU). All participants received oral and written information about the study and gave written informed consent.

RESULTS

Participants' characteristics

In total, 711 of 995 eligible nursing students (71.4%) participated in this study. 115 other students did not respond to the invitation and 169 did not give permission to use their data. Of about half of this group (359; 50.5%), we also received a second measurement. For three of these students, only the first of the two observations was used in the model, because of missing data (they did no clinical placement at the second observation). This left us with a total of 1067 observations.

The mean age of participants was 23.5 (SD 5.5 years). Most participants were female (90.2%). The sociodemographic and workplace characteristics (year 3) of the individuals are shown in Table 1.

Table 1*Demographic, physical and psychosocial work and health characteristics (N=711)*

	N (%) unless specified otherwise
Sample size, N	711
Sociodemographic characteristics	
Sex (% female)	641 (90.2%)
Age (years), mean $\pm$ SD (range)	23.50 $\pm$ 5.46 (19 to 55)
Median; IQR	22; 4
Height (cm), mean $\pm$ SD (range)	170.37 $\pm$ 8.26 (146 to 200)
Median; IQR	170; 10
BMI (kg/m ²), mean $\pm$ SD (range)	23.71 $\pm$ 4.18 (15.6 to 67.6)
Median; IQR	23.03; 4.45
Living situation (% with parents)	(56.3%)
Ethnicity (% Dutch or western migration background)	498 (70%)
Dutch as first language (% Dutch)	614 (86.4%)
Country of birth (% the Netherlands)	639 (89.9%)
Prior education	
• Higher 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%)
Study route	
• fulltime programme	439 (61.7%)
• work-study programme	212 (29.8%)
• part-time study programme	60 (8.4%)
Current clinical placement	
• hospital	338 (47.5%)
• elderly care	81 (11.4%)
• home care	189 (26.6%)
• mental healthcare	55 (7.7%)
• other	48 (6.8%)
Physical workplace characteristics ^a	
Lifting and bending, mean $\pm$ SD (range)	26.48 $\pm$ 18.72 (0 to 100)
Median; IQR	22.1; 25.0
Physical job demands, mean $\pm$ SD (range)	2.65 $\pm$ 0.60 (1 to 4)
Median; IQR	2.75; 0.75
Total time spent on VDU work, mean $\pm$ SD (range)	3.78 $\pm$ 2.67 (0 to 24)
Median; IQR	3.0; 3
VDU work (% often/always)	552 (77.6%)
Daily number of colleagues working with:	
• 0 or 1	169 (23.8%)
• 2 or more	542 (76.2%)

Daily number of patients cared for, mean $\pm$ SD (range)	7.65 $\pm$ 5.43 (1 to 80)
Median; IQR	6.0; 6
Psychosocial workplace characteristics ^b	
Decision latitude, mean $\pm$ SD (range)	2.95 $\pm$ 0.41 (1 to 3.92)
Median; IQR	2.92; 0.50
Psychological job demands, mean $\pm$ SD (range)	2.85 $\pm$ 0.50 (1 to 4)
Median; IQR	2.83; 0.75
Supervisor support, mean $\pm$ SD (range)	2.94 $\pm$ 0.62 (1 to 4)
Median; IQR	3.0; 0.50
Co-worker support, mean $\pm$ SD (range)	3.09 $\pm$ 0.48 (1.5 to 4)
Median; IQR	3.0; 0.50
Physical and mental health characteristics	
Distress (% moderate to high distress)	324 (45.6%)
Need for recovery (0-100), mean $\pm$ SD (range)	63.37 $\pm$ 27.07 (0 to 100)
Median; IQR	72.73; 36.36
Total activity score (SQUASH) ^c , mean $\pm$ SD (range)	7,984.5 $\pm$ 5,033.6 (0 to 39,060)
Median; IQR	6,900; 6,075
Musculoskeletal complaints during current clinical placement ^d	
Overall MSC at any body part (% regular /long-lasting)	558 (78.5%)
Complaints of the upper extremities area (% regular /long-lasting)	405 (57.0%)
Complaints of the lower back area (% regular /long-lasting)	399 (56.1%)
Complaints of lower extremities (% regular /long-lasting)	293 (41.2%)

Body mass index (BMI); Inter Quartile Range (IQR); Short QUestionnaire to ASsess Health-enhancing physical activity (SQUASH)

^a The potential range of total scores was 0-100 for lifting and bending; and 1-4 to the subscale Physical Job Demands of the Job Content Questionnaire.

^b The potential range of total scores was 1-4 to the subscales Decision Latitude, Psychological Job Demands, Supervisor Support and Collegial Support of the Job Content Questionnaire.

^c SQUASH-score: the total activity score is the product of the total time (in minutes) and the intensity of activities per week.

^d Of the 558 students having any MSC, 555 (99.5%) indicated that the MSC was partly of completely related to their clinical placement or work.

Musculoskeletal complaints

The overall prevalence of regular or long-lasting MSCs in any body part among nursing students at the first observation was high (79%). The majority (99.5%) indicated that these complaints were clinical placement related. Of the students at the first observation, 57% had regular or long-lasting MSCs of the upper extremities. For the lower back and the lower extremities, these percentages were 56% and 41%, respectively. Appendix A shows the indicated MSCs per body part at the first measurement (N=711) and at the second measurement (N=359).

Sociodemographic and workplace characteristics

Using backward elimination to improve our models, the following factors were removed from all four models: Age, height, working at a screen, average number of hours of screenwork, supervisor support, co-worker support, number of colleagues, living situation.

The full list of multivariate associations between MSCs by anatomical area and the various characteristics in the four final models is presented in appendices B, C, D and E. Based on the 1067 observations of 711 participants, we could determine three statistically significant associated factors that recurred in all anatomical areas of MSCs (male sex, physical job demands, need for recovery; see table 2). Two other associated factors (lifting and bending and study route) recurred in three anatomical areas.

Table 2*Determinants associated with MSCs in nursing students (1067 observations)^a*

Determinants	Model 1		Model 2		Model 3		Model 4	
	Overall MSC		Upper extremities		Low back		Lower extremities	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Sex (reference: female)	0.37 ***	0.22 - 0.62	0.55*	0.33 - 0.91	0.57*	0.35 - 0.93	0.28***	0.16-0.51
Need for recovery (0-100)	1.02***	1.01 - 1.03	1.01***	1.01-1.02	1.02***	1.01 - 1.02	1.01***	1.01-1.02
Physical job demands (1-4)	2.33***	1.68 - 3.22	2.49 ***	1.89 - 3.28	2.03***	1.56 - 2.64	1.69***	1.31 - 2.19
Lifting and bending (0-100)	1.01**	1.00 - 1.03			1.01*	1.00 - 1.02	1.01*	1.00-1.02
Study route: part-time (reference: full-time)			1.80*	0.95 - 3.41			0.53*	0.32 - 0.88
BMI (15-68)							1.06**	1.02-1.09
Distress (reference: no distress)			1.60***	1.21-2.11				
Decision latitude (1-4)			0.67*	0.47 - 0.95				
Prior education: secondary vocational nursing education (reference: senior general secondary education)			1.43*	1.01-2.03				
Psychological job demands (1-4)			0.71*	0.52 - 0.96				
Clinical placement setting: nursing homes and elderly care (reference: hospital)			0.60*	0.39 - 0.91				
Ethnicity (reference: non-Western background)					0.62**	0.46 - 0.84		
Daily number of patients cared for (1-80)							0.96**	0.94-0.99
First language (reference: Dutch)							2.03***	1.34 - 3.08

OR = odds ratio; CI = confidence interval

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$ ^a For categorical factors, the odds ratios are computed with respect to the specified reference category; for continuous factors, the odds ratios are computed per unit increase. Cells are left empty if that factor was not included in the final model.

DISCUSSION

Already in the third year of nursing education, we found high prevalence's of MSCs (overall 79%; neck-shoulder-upper extremity 57%; low back and pelvis 56%; lower extremities 41%) in nursing students. About four out of five nursing students of our cohort experienced regular or long-lasting MSCs (pain or discomfort). Studies of MSCs among nursing students are scarce, but high overall MSC prevalence rates were also found in Turkish nursing students (73.2%) and Swedish novice nurses (50%)^(23, 24).

Several factors in different domains were associated with MSCs. First, exposure to physical work conditions, such as lifting and bending activities and other physical job demands, were associated with higher proportions of MSCs. This is in line with existing evidence from studies among (registered) nurses⁽¹⁴⁾.

Secondly, we found an association between MSCs and several psychosocial work characteristics. Students who had few control options during clinical placements (low decision latitude) more often reported complaints in the upper extremities. Decision control was found to be associated with MSCs for shoulder pain⁽⁴⁰⁾ and complaints in the wrists/hands and the upper spine⁽⁴¹⁾, in a general working population. Decision latitude was also associated with neck, shoulder and lower back pain among female employees in human services⁽⁴²⁾. Low decision latitude may contribute to job strain, which in turn is a risk factor of musculoskeletal pain and other health complaints^(43, 44).

Thirdly, we found an association between MSCs and some physical and mental health related characteristics of the nursing students; need for recovery, distress, and BMI. Students with increased need for recovery reported more MSCs. An association between need for recovery and MSCs was also found in other studies among other professions⁽⁴⁵⁻⁴⁹⁾. It remains unclear, however, whether insufficient recovery time leads to MSCs, or whether having MSCs increases the need for recovery.

Students who experienced distress, had more overall complaints and complaints in the upper extremities. This finding is consistent with previous studies^(50, 51). In their meta-analysis on the impact of work-related psychosocial stressors on the onset of MSCs, Hauke et al.⁽⁵⁰⁾ found the largest estimate for effect size for psychological distress and the upper extremities. Amin et al.⁽⁵¹⁾ found that nurses with higher emotional distress had more MSCs, with the highest OR reported in the upper extremities.

An increasing BMI is significantly associated with MSCs of the lower extremity. This is consistent with various other studies⁽⁵²⁻⁵⁴⁾; there is a strong association between overweight/obesity and complaints of the lower extremities^(52, 54, 55).

Somewhat unexpectedly, clinical placements in the nursing home setting were negatively associated with MSCs of the upper extremities. Perhaps, this can be explained by the availability and higher use of patient handling equipment⁽⁵⁶⁾ or collegial assistance with a lift.

For some of the associated factors, we do not have a sound explanation. Intermediate vocational degree trained nursing students and part-time course route students have in common that they often have a (part-time) nursing job besides their bachelor nursing training. Perhaps these students have to support themselves or their families financially and experience more distress and/or other stressors that cause low back and upper extremities complaints.

Finally, a higher daily number of patients cared for was slightly, but negatively associated with lower limb complaints. In general, the number of patients a student must care for has little influence on the development of complaints of the lower extremities. Contrary to our finding, Larese & Fiortio⁽⁵⁷⁾ found that nurses working in wards with high patient to nurse ratios had more MSCs than those working in wards with lower ratios. Satisfactory ratios between nurses and patients could improve work efficiency and decrease injury rates⁽⁵⁷⁾.

Methodological considerations

This study examined possible cross-sectional associations between sociodemographic, workplace and health characteristics, and self-reported MSCs in nursing students, using a total of 1067 observations.

We dichotomized the outcome measure of our study, because of our specific interest in the more severe MSCs, as these, in particular, are associated with care-seeking and absenteeism. In addition, we classified the MSCs into three gross anatomical areas, in line with current guidelines⁽³⁰⁻³²⁾. Consequently, we did not obtain insight into the associated factors of MSCs in specific body parts. For a more thorough exploration of associated factors of MSCs in the specific body parts, it would be relevant to also include some more complaint-specific ergonomic risk factors.

The use of self-reported measurements of physical exposure limits the ability to draw specific conclusions. For example, it is possible that the actual incidence of MSCs

may have been over- or underestimated. Though we used validated instruments, we would have preferred more objective measures of physical exposure in the field, such as Accelerometry, Actigraph or Pedometer. This was, however, deemed impractical, time-consuming and too costly.

Included psychosocial work and health characteristics that may increase MSCs, were limited to the Job Content Questionnaire (JCQ) scales assessing decision latitude, psychological job demands, supervisor and co-worker support⁽³⁵⁾; distress⁽³⁸⁾; and NFR scale⁽³⁹⁾. The validity of these instruments has not been investigated for the group of nursing students doing a clinical placement. This offers opportunities for further research. These instruments, however, have been used in other studies among registered nurses and other student groups.

Another limitation of our study is that the results might not be fully generalized, because the students who participated in our study may have been healthier and less prone to dropout than the students who did not participate (volunteer bias). This might mean that some of the associations in our final model may have been underestimated and would have been stronger if the non-participating students could have been included in our study.

Having a second measurement for a substantial part of the students should be seen as a strength of our study. This allowed to examine the association between the factors and MSCs while taking the changes over time within individuals into account.

Recommendations for practice and future research

Because of the high prevalence of MSCs, associated factors contributing to MSCs in nursing students should be considered by nursing education providers and clinical placement providers. First, it is important that they make an effort to lower physical job demands and invest in proper training and aids that contribute to the prevention and decrease of MSCs in nursing students.

Second, stress management programs may help reducing nursing students' stress. Preferably, such programs should focus on both the individual's coping strategies and psychosocial workplace stressors⁽⁵⁸⁾.

Third, nursing students with a high BMI could benefit from weight loss. Weight loss has been shown to significantly improve knee pain and function among overweight and obese individuals⁽⁵⁹⁾.

The interplay between job stressors, need for recovery and MSCs in nursing students is complex. To understand this fully, further research is needed. Furthermore, other factors that were not included in our study may further explain MSCs in nursing students.

CONCLUSION

The prevalence of MSCs is high among nursing students. This study provided insights in sociodemographic and physical and psychosocial workplace characteristics that are associated with MSCs among these nursing students. Sociodemographic factors were being female, non-Dutch first language and non-Western ethnicity, part-time study route, increasing BMI, and prior secondary vocational nursing education. Workplace related factors were high physical job demands, lifting and bending, higher daily number of patients cared for, low decision latitude, and low psychological job demands. A clinical placement in the nursing home setting was related to a smaller odds of MSCs of the upper extremities. Relevant health variables were higher need for recovery and distress. Nursing school and clinical placement staff should consider these factors when dealing with nursing students with MSCs.

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AUTHOR CONTRIBUTIONS

PR and HM initiated and designed the 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

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A

MSCs per body part at first (T0) (N=711) and at second (T1) (N=359) measurement

T0 (N= 711): Complaints of:	Yes, long term N (%)	Yes, regularly N (%)	Yes, once in a while N (%)	No, never N (%)
Neck	75 (10.5)	183 (25.7)	230 (32.3)	223 (31.4)
Shoulders	74 (10.4)	193 (27.1)	225 (31.6)	219 (30.8)
Upper back	72 (10.1)	170 (23.9)	174 (24.5)	295 (41.5)
Upper arms	7 (1)	32 (4.5)	97 (13.6)	575 (80.9)
Elbows	1 (0.1)	17 (2.4)	39 (5.5)	654 (92.0)
Wrists/hands	23 (3.2)	70 (9.8)	126 (17.7)	492 (69.2)
Lower back	118 (16.6)	272 (38.3)	190 (26.7)	131 (18.4)
Hips	15 (2.1)	47 (6.6)	96 (13.5)	553 (77.8)
Thigh bone	5 (0.7)	28 (3.9)	47 (6.6)	631 (88.7)
Knees	41 (5.8)	110 (15.5)	165 (23.2)	395 (55.6)
Lower legs	13 (1.8)	73 (10.3)	90 (12.7)	535 (75.2)
Ankles/feet	42 (5.9)	167 (23.5)	209 (29.4)	293 (41.2)
T1 (N= 359) Complaints of:	Yes, long term N (%)	Yes, regularly N (%)	Yes, once in a while N (%)	No, never N (%)
Neck	29 (8.1)	102 (28.4)	116 (32.3)	112 (31.2)
Shoulders	32 (8.9)	93 (25.9)	123 (34.3)	111 (30.9)
Upper back	34 (9.5)	67 (18.7)	100 (27.9)	158 (44.0)
Upper arms	5 (1.4)	14 (3.9)	54 (15.0)	286 (79.7)
Elbows	2 (0.6)	6 (1.7)	17 (4.7)	334 (93.0)
Wrists/hands	13 (3.3)	32 (8.9)	78 (21.7)	237 (66.0)
Lower back	55 (15.3)	138 (38.4)	102 (28.4)	64 (17.8)
Hips	11 (3.1)	20 (5.6)	58 (16.2)	270 (75.2)
Thigh bone	0 (0.0)	10 (2.8)	23 (6.4)	326 (90.8)
Knees	16 (4.5)	63 (17.5)	78 (21.7)	202 (56.3)
Lower legs	5 (1.4)	31 (8.6)	52 (14.5)	271 (75.5)
Ankles/feet	22 (6.1)	66 (18.4)	94 (26.2)	177 (49.3)

Appendix B

Factors associated with all MSCs in nursing students (1067 observations)

Overall complaints	p	OR	95% CI
Sex (reference: female)	0.000	0.370	0.222-0.617
Lifting and bending (0 to 100)	0.021	1.013	1.002-1.025
Physical job demands (1 to 4)	0.000	2.327	1.680-3.224
Need for recovery (0 to 100)	0.000	1.018	1.012-1.025

p = p-value; OR = odds ratio; CI = confidence interval

Appendix C

Factors associated with complaints of the upper extremities in nursing students (1067 observations)

Complaints of the upper extremities	p	OR	95% CI
Sex (reference: female)	0.021	0.550	0.331-0.913
Prior education: secondary vocational nursing education (reference: senior general secondary education)	0.044	1.430	1.009-2.027
Study route (reference: full-time)	0.072	1.799	0.948-3.412
Clinical placement setting: homecare (reference: hospital)	0.017	0.595	0.338-0.913
Physical job demands (1 to 4)	0.000	2.487	1.885-3.280
Psychological job demands (1 to 4)	0.025	0.707	0.522-0.958
Distress (reference: no distress)	0.001	1.595	1.208-2.106
Decision Latitude (1 to 4)	0.026	0.673	0.474-0.954
Need for recovery (0 to 100)	0.000	1.014	1.008-1.019

p = p-value; OR = odds ratio; CI = confidence interval

Appendix D

Factors associated with low back complaints in nursing students (1067 observations)

Low back complaints	p	OR	95% CI
Sex (reference: female)	0.024	0.570	0,350-0,929
Ethnicity (reference: non-Western background)	0,002	0,620	0,456-0,842
Lifting and bending (0 to 100)	0,049	1,008	1,000-1,017
Physical job demands (1 to 4)	0,000	2,027	1,560-2,635
Need for recovery (0 to 100)	0,000	1,015	1,010-1,021

p = p-value; OR = odds ratio; CI = confidence interval

Appendix E

Factors associated with complaints of the lower extremities in nursing students (1067 observations)

Complaints of the lower extremities	p	OR	95% CI
Sex (reference: female)	0.000	0.281	0,155-0,508
Study route (reference: full-time)	0.015	0.530	0,319-0,883
BMI (15 to 68)	0.003	1.055	1,018-1,092
Lifting and bending (0 to 100)	0.030	1.010	1,001-1,018
Daily number of patients cared for (1 to 80)	0.007	0.962	0,935-0,989
Physical job demands (1 to 4)	0.000	1.694	1,309-2,192
Need for recovery (0 to 100)	0.000	1.014	1,008-1,019
Dutch as first language (reference: Dutch)	0.001	2.031	1.337-3.084

p = p-value; OR = odds ratio; CI = confidence interval



Chapter 6

Predicting late dropout from nursing education or early dropout from the profession

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ABSTRACT

Aim: To identify predictors of late academic or early career dropout, and derive a simple model for identifying nursing students and novice nurses with significant increased dropout risk.

Background: Dropout from nursing school and the nursing profession is of great concern for students, educators, as well as graduated nurses. Nurse shortages are a major problem in healthcare worldwide. Retention of nursing students and novice nurses can contribute to reducing the deficits. Little is known about the predictors of dropout among nursing students in the later years of their degree programme (late dropout) and early nurse dropout from the profession.

Design: Prospective cohort study with three years of follow-up, among 406 third-year nursing students of the Bachelor of Nursing programme of Rotterdam University of Applied Sciences in the Netherlands.

Methods: Data were collected between May 2016 and February 2019 using a self-administered questionnaire. Backward binary multiple logistic regression analyses were used to build a prediction model for dropout.

Results: Dropout from nursing education and at the start of the nursing career totalled 12%. Twelve factors, including male sex (OR 3.76, 90% CI 1.65-8.57), age (OR 1.06, 90% CI 1.01-1.11), migration background (OR 2.42, 90% CI 1.25-4.68), clinical placement setting (including mental healthcare; OR 0.18, 90% CI 0.05-0.65), musculoskeletal symptoms (OR 1.20, 90% CI 1.05-1.38) and psychosocial work characteristics (including exposure to violence; OR 3.12, 90% CI 1.45-6.74) were statistically significant predictors in our dropout model. The explained variance of the final model was 26%.

Conclusion: The study highlights the importance of taking musculoskeletal and mental health symptoms, psychosocial work characteristics, as well as sex, age and migration background into consideration as predictors for dropout among nursing students and novice nurses. This study is a first step towards a predictive model that helps identifying high-risk groups.

Keywords: Attrition, Dropout, Mental, Novice nurses, Nursing students, Physical, Prediction model, Psychosocial, Retention, Turnover.

BACKGROUND

In the near future, an increase in nursing workload and, consequently, an increase of the physical and mental burden is expected, because of the predicted shortage of nurses and the increasing number of chronically ill patients⁽¹⁻³⁾. Both are attributable to an aging population in Western industrialized countries^(1, 4, 5).

The perceived workload is associated with an increasing intention to leave the nursing profession^(3, 6). The prevalence of intention to leave among registered nurses across 10 European countries varied from 5 to 17% between countries, with the lowest rates in the Netherlands (5%) and Spain (5%) and the highest in Germany (17%)⁽⁷⁾. Physical and mental health symptoms due to the high physical and emotional demands of contemporary practice are increasingly recognized to be associated with occupational dropout in registered nurses⁽⁸⁾. The occupational dropout among registered nurses may also discourage student nurses to join the profession⁽⁹⁾.

The intention to leave the nursing profession or actual dropout from nursing is not limited to registered nurses, but occurs already among student nurses^(10, 11). Dropout reasons in student nurses are related to the high physical, psychological and emotional demands in daily practice as well. Research in various countries around the world^(10, 12-15) has shown that physical and mental health problems are already high among student nurses and may lead to their dropout.

Nursing student dropout rates have been described in various studies. The nursing student dropout rate was about 25% in Britain and Australia⁽¹⁶⁾. Harris, Rosenberg, and Grace O'Rourke⁽¹⁷⁾ and Merkle⁽¹¹⁾ found that nursing student dropout rates may rise up to 50% or 53% for enrolled students in some baccalaureate nursing programs in the United States. These dropout rates, however, probably concern students in all years of the study. In the Netherlands, the dropout rate of student nurses after the first year in university was 21% in 2018/2019⁽¹⁸⁾. Wrong study or career choice and problems with academic adjustment were among the most commonly reported reasons for leaving a nursing programme in the first year of study⁽¹⁹⁾.

We hypothesize that physical and mental health issues may also contribute to a decision to quit nursing education. According to Videman, Ojajärvi, Riihimäki, and Troup⁽²⁰⁾, the lifetime cumulative prevalence of back pain among student nurses increased from 31% on entering nursing school to 72% at the end of the

study program. A systematic review on the prevalence of self-reported depressive symptoms among student nurses suggested that student nurses have high overall pooled prevalence of depression (34.0%) worldwide⁽²¹⁾. The clinical placement is a major cause for anxiety and stress, which could lead to depression in student nurses^(10, 22-24).

Dropout of nursing students and novice nurses may be the outcome of a complex interplay of various factors, including sociodemographic characteristics, physical and psychosocial work characteristics, and musculoskeletal and mental health. To retain nursing students and novice nurses, knowledge of the dropout predictors is important for monitoring and identification of students or novice nurses eligible for early intervention.

METHODS

Aim

This study aimed to identify predictors of late dropout among nursing students and early dropout from the profession, and derive a model for identifying students and novice nurses with significant increased dropout risk.

Design

Prospective cohort study with three years of follow-up.

Sample/Participants

The Bachelor of Nursing degree programme of Rotterdam University of Applied Sciences admits 400 to 500 first-year students annually for the four-year accredited programme⁽²⁵⁾. Clinical placement training is part of the programme and includes four periods of 20 weeks: one in the second year, two in the third year, and one in the fourth year of the programme. The current study is part the research project SPRiNG that was initiated in 2016⁽²⁶⁾. For this study, we included two third-year student cohorts from two consecutive academic years (2015-2016 and 2016-2017). All students who gave their consent to participate (N = 406) were included in the study.

Data collection

Students were invited to complete one questionnaire at baseline, in the second semester of the third year of their nursing study. Students were given the opportunity to complete the questionnaire during professional development and research skills classes, to enhance the response. They were sent an identical questionnaire one year later, in the fourth year of their study, and a final follow-up questionnaire eighteen months after the anticipated graduation date. For the current study, we used data from the baseline measurement and the final follow-up measurement.

Potential predictors

Data on potential predictors were obtained from the baseline questionnaire. The potential predictors included sociodemographic characteristics, physical and psychosocial work characteristics, physical and mental health symptoms and other. These potential predictors were selected based on both subjective considerations by the research team and objective results of the survey. The total list of variables included in the analysis can be found in appendix 1. The origin of the questionnaire constructs has been described previously⁽²⁶⁾.

Outcome of interest

The outcome of interest was late dropout from nursing education or early dropout from the nursing profession. Data on dropout were collected eighteen months after the anticipated graduation date, combining data from the student administration (students who had quit nursing education before graduation) and from the final follow-up questionnaire. Non-responders were contacted by telephone. The novice nurses for whom we were unable to obtain dropout data, were considered to be still working in the profession.

Data analysis

We checked the normality of distributions for interval/ratio scales and made descriptive analyses for all predictors. For predictors that were not normally distributed, the scale was dichotomised. To avoid nearly empty categories of ordinal scales, categories were merged. For violence and gossip or slander we created three categories: (1) 'never', (2) 'occasionally (a few times)', and (3) 'frequently (every month, every week, or every day)', and bullying was dichotomised into (1) 'no' and (2) 'yes (a few times, every month, every week, or every day)'. We checked for collinearity by applying Spearman's

$\rho < 0.7$. If the variables were correlated, those with the strongest correlation with the primary outcome were kept in the model. Based on this, we removed the sub-scores of the Utrecht Work Engagement Scale (UWES), the Job Content Questionnaire (JCQ) decision authority and the sum score of physical symptoms from the model.

Manual backward stepwise logistic regression analysis ($p > 0.1$ for removal) was used. All possible predictors were included in the model and then the ones with the largest p-value were removed one by one. The significance level for inclusion of a factor in our final model was set at p-value 0.10⁽²⁷⁾. If the largest p-value belonged to one of the categories of a variable, this category was added to the reference category. Remaining predictors were combined in a final model. We calculated the odds ratios with 90% confidence intervals for each predictor that remained in the model. We used Nagelkerke R^2 to express the explained variance of the model. All analyses were performed in IBM SPSS version 26.0.

Ethical considerations

Ethical approval was obtained from the Erasmus University Medical Ethical Review Committee Rotterdam (MEC number: MEC-2016-203). The study complied with the Code of Conduct for Scientific Practice from the Netherlands Association of Universities⁽²⁸⁾.

Before inclusion, all participants received information about the study orally and in writing, and they were assured of complete confidentiality. Written informed consent was obtained from all participants prior to data collection. No identifying information is presented.

RESULTS

Participants' baseline characteristics

Table 1 shows baseline characteristics of the 406 participants. The majority were female students (89%). Mean age of participants was 24 years. A small majority (53%) lived with their parents. Most participants had either a Dutch or western migration background (77%). Average BMI was 23.4 kg/m² (SD 3.6). Fifty-two percent were doing a clinical placement in a hospital setting. Eighty-six percent had indicated having regular or long-lasting musculoskeletal symptoms at any body part. Thirty-seven percent considered to quit nursing education.

Table 1*Participants' baseline characteristics*

	N (%)	Mean (SD) (range)
Sample size, N	406	
Sex (% female)	363 (89.4%)	
Age (years)		23.7 (5.8) (19-54)
Body Mass Index (BMI) (kg/m ²)		23.4 (3.6) (15.6-41.1)
Height (cm)		170.9 (8.0) (151-199)
Living situation (% with parents)	215 (53.0%)	
Migration background (% Dutch or western migration background)	314 (77.3%)	
Country of birth (% the Netherlands)	365 (89.9%)	
Highest educational level		
• Senior general secondary education	230 (56.7%)	
• Pre-university education & academic higher education	67 (16.5%)	
• Intermediate vocational education and training & in-service training & other	109 (26.8%)	
Educational routing		
• fulltime programme	439 (61.7%)	
• work-study programme	212 (29.8%)	
• part-time study programme	60 (8.4%)	
Current clinical placement		
• hospital	210 (51.7%)	
• elderly care	50 (12.3%)	
• home care	83 (20.4%)	
• mental healthcare	37 (9.1%)	
• other	26 (6.4%)	
<i>Physical work characteristics</i>		
Lifting and bending		40.6 (28.1) (0-150)
Physical job demands		13.1 (3.1) (5-20)
Total time spent working at a screen		3.4 (2.5) (1-24)
Working at a screen (% always-often)	300 (73.9%)	
Nr of colleagues (% 2-more)	199 (49%)	
Nr of patients		7.7 (6.4) (1-80)

Psychosocial work characteristics

Decision latitude		7.7 (9.8) (38-94)
Psychological job demands		54.1 (4.4) (40-64)
Supervisor support		11.7 (2.6) (4-16)
Co-worker support		12.3 (1.9) (6-16)

Mental health symptoms

Distress (% no)	237 (58.4%)	
Need for recovery		6.8 (3.1) (0-11)

Physical health symptoms

Physical activity level (SQUASH)		7.6 (5.3) (0-27)
Any musculoskeletal symptoms at any body part (% regular / long-lasting)	350 (86.2%)	
Symptoms of the upper extremities (CANS) (% regular /long-lasting)	216 (53.2%)	
Low back pain (% regular /long-lasting)	210 (51.7%)	
Symptoms of lower extremities (% regular /long-lasting)	154 (37.9%)	

Proxies of late dropout from nursing education

Sickness absence (% yes)	116 (28.6%)	
Work engagement		4.4 (1.2) (1-7)
Considering quitting nursing education (% any consideration to quit)	151 (37.2%)	

Overall dropout from nursing education or the nursing profession

The total dropout from nursing education or the nursing profession was 12%. Our final multivariate logistic regression model included a combination of twelve significant predictors of dropout (table 2). The explained variance of the final model (R^2) was 26%.

Table 2*Final model with all significant ($p < 0.1$) predictors for dropout*

Characteristics at baseline	OR [†]	90% CI [‡]	R ^{2§}
			0.264
Male sex (reference: female)	3.758	1.648-8.569	
Age (per year increase)	1.059	1.008-1.113	
Clinical placement in elderly care (reference: hospital care)	0.272	0.101-0.734	
Clinical placement in home care (reference: hospital care)	0.363	0.148-0.889	
Clinical placement in mental healthcare (reference: hospital care)	0.179	0.049-0.651	
Migration background (reference: no migration background)	2.419	1.249-4.683	
Never or sometimes working at a screen (reference: often or always working at a screen)	2.925	1.479-5.785	
Exposure to violence (reference: no exposure to violence)	3.125	1.450-6.739	
Exposure to gossip or slander (reference: no exposure to gossip or slander)	1.885	1.015-3.501	
Regular or long term musculoskeletal symptoms (reference: no or occasional musculoskeletal symptoms)	1.201	1.047-1.379	
Work engagement (per unit increase; potential range 0-6)	0.579	0.430-0.781	
Need for recovery (per unit increase; potential range 0-100)	0.830	0.737-0.934	

†Odds ratio; ‡Confidence interval; §Explained variance by Nagelkerke R-square test.

DISCUSSION

Key results

Dropout from nursing education or at the start of the nursing career is a multidimensional biopsychosocial problem, that involves complex interactions between different factors. This study identified several sociodemographic, physical work and psychosocial work characteristics, and physical and mental health symptoms that substantially contribute to a predictive model of dropout from nursing education or the start of the nursing career. The multivariate model showed acceptable predictive ability and identified various significant prognostic factors, explaining 26% of the variance for dropout.

Only two physical work and health predictors were associated with dropout; musculoskeletal symptoms and working at a screen on the clinical placement. An association of experiencing more musculoskeletal symptoms with increased dropout was reported in a previous study, especially neck or shoulder complaints or

knee complaints⁽²⁹⁾. In the present study, never or sometimes working at a screen on the clinical placement was found to be a predictive factor for dropout. Possibly, some students had insufficient time for nursing reporting activities within their working hours due to time constraints. The problem of untimely documentation has been recognized in previous research among physicians and registered nurses⁽³⁰⁾. A Korean study showed that more than 20% of nurse documentation had to be completed outside working hours, and that years of experience was one of the factors influencing timely documentation⁽³¹⁾.

Violence, gossip or slander, work engagement, and need for recovery were also associated with dropout. Violence and gossip or slander, including bullying are well-known phenomena in nursing⁽³²⁾. They affect nursing students physically, mentally and emotionally and have a negative impact on their learning experiences⁽³³⁾. Reports of bullying and violence are increasing, leading to dropout from nursing education⁽³⁴⁾. In a qualitative study, gossip, slander and bullying have explicitly been mentioned by former novice nurses as reasons for leaving the nursing profession⁽³⁵⁾. This is consistent with current findings. The impact of violence and gossip or slander can be damaging for students and novice nurses, the nursing profession and patient care, with students and novice nurses choosing to leave at a time when there is an increased shortage of qualified staff⁽³⁶⁾.

Work engagement is characterised by work-related vigour and dedication and is related to a positive sense of fulfilment⁽³⁷⁾. Work engagement of nursing students comprises dedication of time spend on educational activities, as well as dedication towards clinical placements. Work engagement contributes as a predictor of student success⁽³⁸⁾. In our study, work engagement was found to be a statistically significant predictor for late dropout.

Most nursing students have a high workload and must deal with clinical placement requirements as well as with theoretical study requirements⁽³⁹⁾. The requirements to obtain a Bachelor degree in nursing are high. Some students have insufficient possibilities for recuperation, resulting in a residual need for recovery the next working day⁽⁴⁰⁾. We found in our study, however, that a greater need for recovery was protective for dropout, which was unexpected and contradictory to the findings of Rella et al.⁽³⁹⁾ who described that poor recovery experiences combined with serious fatigue within their study sample among second- and third-year students, were higher when the combined course and placement demands were greatest. We have no sound explanation as to why a greater need for recovery predicts less dropout in our study.

The likelihood of dropping out from nursing education or the nursing profession, was associated with being a male student, older age and having a non-western migration background. Approximately 10% of the nursing students in our cohort were male. This represents the average number of male nurses in the healthcare sector worldwide⁽⁴¹⁾. Male sex and dropout from nursing education has been described earlier^(29, 41-44). Reasons for male students to leave nursing education were isolation, the nursing role, and traditional gender roles⁽⁴⁵⁾. Although sex is an unmodifiable factor, one could consider to pay special attention to barriers that are experienced by male nursing students and professionals.

Older age has previously been identified among Spanish nursing students as a relevant significant predicting factor for dropout intention⁽⁴⁶⁾. Variables such as family demands and other work-life conflict issues such as combining studying and a job may contribute to this tendency⁽⁴⁶⁾.

Our finding that being a student with a non-western migration background is a statistically significant predictor for late dropout is consistent with other studies. In a previous study, having a non-western migration background was associated with an increased risk of dropping out from nursing education⁽⁴⁴⁾. Other studies have shown that these students can be subjected to discrimination and racism by teachers, tutors, peers, hospital staff and patients, leading to dropout⁽⁴⁷⁻⁴⁹⁾.

The clinical placement setting is another predictor of dropout. Two systematic reviews identified unsatisfactory placement experiences and poor support during placements as reasons for nursing students to leave nursing school^(11, 45). They did not, however, report on specific clinical placements. In our study, we found that nursing students who had their third-year clinical placement in either elderly care, home care or mental health care, were less prone to late dropout. In the Netherlands, because of the broad nursing outflow profile, nursing students ideally do their clinical placements in various health care settings as much as possible; they can only choose a setting to a very limited extent. Possibly, most students who opt for a clinical placement in elderly care, home care or mental health care, do so more deliberately.

For students experiencing problems with mental or physical workload during their clinical placement, a more supportive attitude of placement staff towards the students could be beneficial, especially when these students are exposed to unpleasant placement experiences⁽⁴⁵⁾.

The explained variance in our model was 26.4%. This means that 73.6% could not be explained by the variables in our model and that there are still other variables that contribute to the prediction of dropout.

Nursing school staff could commit themselves to increase the physical and psychosocial resilience of all nursing students in the nursing school curriculum, addressing –at least- the potential predictors found in this study. For individual nursing students who consider quitting nursing education, schools should offer support in which the student’s motives for the intention to quit are explored, and, dependent of the individual circumstances, tailored solutions should be sought in order to retain the student. To reduce the risk of student dropout, clinical placement settings should strive for a healthy and safe working climate and ensure that students are enabled to work physically and mentally safe. As some novice nurses decide to stop working in the nursing profession within two years after graduation, investing in proper transition programmes is also justified.

Strengths and limitations

A strength of our study was that we used a prospective study design, an advantage when assessing individual change over time. The prediction model has been established on a cohort consisting of over 400 third-year student nurses from two academic years.

The outcome measure of our study comprised late academic dropout or early career dropout. This involved students who passed the first years of nursing education and have taken their first steps in nursing, but for some reason decided not to work as a nurse, before or just after graduation. The motives for late dropout and early career dropout are largely comparable^(35, 50); in essence, both groups no longer aspire working as a nurse.

At baseline, the response rate was 74%. Twenty-six percent (N=141) of the invited students declined to participate. The overall dropout rate from nursing education in our cohort was 8.2%. Among the respondents, the proportion of late dropout from nursing education (post-graduation dropout excluded) was 3.7%. This suggests that the non-respondents had a higher risk of dropout. We may, therefore, have missed potential predictors.

Another limitation is that the prediction model has been established on one population. Therefore, the model is probably overfit. Results should be validated in future cohorts.

The dropout data from nursing education were obtained from the student administration and are considered reliable. Data on dropout rates after graduation were based on self-report, either through a self-completed questionnaire distributed 18 months after graduation or through follow-up by phone for non-responders. Graduated students who could not be contacted at follow-up, were considered as working in the profession. The overall dropout rate, therefore, could have been underestimated.

Data on the potential predictors rely on self-reported questionnaires. Despite the use of validated instruments⁽²⁶⁾, the use of self-report may have been affected by social desirability. There were, however, no advantages or disadvantages to participating in this study and, thus, social desirability will not have had a major impact. Recall bias may have led to some overreporting of unfavourable circumstances in students with dropout.

It needs to be noted that this study was conducted among student nurses from a single specific university of Applied Sciences. Caution should therefore be exercised when generalizing the results to other nursing schools in the Netherlands, or elsewhere. The factors that predict dropout may differ between student nurses from different universities.

For future research, it is recommended to include more cohorts and more schools of nursing, in other settings and countries. This will both increase the power and help to determine whether the predictors included in this study actually continue to contribute to the outcomes of the study. Such research should be implemented throughout the whole nursing course, starting as early as possible in the programme, preferably at the beginning of the first year.

CONCLUSION

In conclusion, this study provides a first set of predictors of dropout of nursing students. The current evidence can help to identify nursing students and novice nurses at risk for dropping out. The model, however, must be (externally) validated and the predictive performance be verified. Dropout is complex; multiple factors, including musculoskeletal and mental health symptoms, are significantly associated with predicting dropout from nursing education and the profession. Additional research should be done on potential predictors not yet included in this model.

CONFLICT OF INTEREST STATEMENT

No conflict of interest has been declared by the authors.

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Appendix 1

List of potential predictors included in the analysis

Sociodemographic characteristics	Measurement level, instrument and source
Sex	One single question: 'What is your sex?'; male or female
Age	One single question: 'What is your age?'
BMI	Calculated from the student's self-reported height (in centimeters) and weight (in kilograms); $BMI = \text{weight}/\text{height}^2$
Living situation	One single question: 'What is your living situation?'
Migration background	Classification based on Three questions: 'Where are you born?', 'In which country was your mother born?', 'In which country was your father born?'; students with a migration background were born in another country, or had at least one parent who was born in another country.
First language	One single question: 'Is Dutch your first language?'; yes or no
Highest educational level	One single question: 'What is your highest (completed) education?'
Educational routing	One single question: 'Which educational route are you following?'; Fulltime, Dual or Parttime
Current clinical placement	One single question: 'In which health care sector are you currently doing your clinical placement or are you working?'
Physical work characteristics	
Lifting and bending	Lifting and bending scale, NEXT Study-Group (Kümmerling & Hasselhorn, 2003) ¹
Physical job demands	Job Content Questionnaire (JCQ), (Karasek, Brisson, 1998) ²
Working at a screen Total time spent working at a screen	Dutch Questionnaire on the Experience and Evaluation of Work (VBBA), (Van Veldhoven & Meijman, 1994) ³
Number of colleagues on-site	One single question: 'How many colleagues do you work with in a day during your clinical placement/work?'
Number of patients	One single question: 'How many patients do you care for on average on a weekday during a day shift?'
Help from care provider for physical symptoms	One single question: 'Have you sought help from a health care provider for physical complaints in the current clinical placement/work period?'
Physical health symptoms	
Any musculoskeletal symptoms at any body part <i>Symptoms of the upper extremities (CANS)</i> <i>Low back pain</i> <i>Symptoms of the lower extremities</i>	Dutch Musculoskeletal Questionnaire (DMQ) (Hildebrandt, 2001) ⁴

Psychosocial work characteristics

Sickness Absenteeism due to work stress	Sickness Absenteeism, NEA, (Hoofman, Mars, 2015) ⁵
Sickness Absenteeism due to work stress for more than 4 weeks	
Malfunctioning due to work stress	Dutch Questionnaire on the Experience and Evaluation of Work (VBBA), (Van Veldhoven & Meijman, 1994) ³
Malfunctioning due to work stress for more than 4 weeks	
Loss of work pleasure due to work stress	
Seriously considered changing clinical placement/education	
Help from care provider for social problems	
Bullying	COPSOQ II, (Pejtersen, Kristensen, 2010) ⁶
Violence	
Gossip or slander	
Decision latitude	Job Content Questionnaire (JCQ), (Karasek, Brisson, 1998) ²
Psychological job demands	
Supervisor social support	
Co-worker social support	
Coping; expression of emotions	Utrechtse Coping Lijst UCL, (Schreurs, & Van de Willige, 1993) ⁷
Coping; active handling	
Coping; Palliative reaction	
Coping; Social support	
Work family conflict (WFC)	WFC scale and FWC scale, (Netemeyer, Boles, 1996) ⁸
Family work conflict (FWC)	
Occupational self-efficacy	Occupational Self-Efficacy Scale short version, (Rigotti, Schyns, 2008) ⁹

Mental health symptoms

Distress	Distress Screener, (Braam, van Oostrom, 2009) ¹⁰
Need for recovery (NFR)	NFR scale, (Van Veldhoven & Broersen, 2003) ¹¹

Other determinants

Physical activity level	Short QUEStionnaire to ASses Health enhancing physical activity (SQUASH), (Wendel-Vos & Schuit, 2003) ¹²
Work engagement	Utrechtse Bevlogenheidsschaal (UBES-S), (Schaufeli & Bakker, 2003) ¹³
Sick leave during academic year	One single question: 'Have you ever been absent this academic year?'; yes / no
Not absent, but sick	One single question: 'Did it happen in the current clinical placement/work period that you started an placement/work while you knew that you should have reported sick?'; No / yes, sometimes / yes, regularly
Considering quitting nursing education	One single question: 'I am considering quitting my studies.'; 10 point likert scale: by no means (1).....(10) certainly

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PART III

Effectiveness and feasibility of preventive
interventions with regard to physical
resilience



Chapter 7

Effective interventions for preventing work related physical health complaints in nursing students and novice nurses: A Systematic Review

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ABSTRACT

From the start of their career, nursing students and novice nurses are at risk of developing physical health problems due to high physical workload, which may lead to early exit from nursing. To provide an overview of interventions preventing physical health problems in early career, a systematic review was performed. A comprehensive search of the literature was conducted up to December 2017. Primary outcome of interest was education/work dropout. Secondary outcomes were musculoskeletal symptoms. Independent authors selected studies, appraised quality and extracted data. After screening 7,111 titles and abstracts, eleven studies were included. Seven studies evaluated interventions for moving/handling training. Four evaluated other interventions. None focused on our primary outcome education/work dropout. All studies reported on physical complaints among student nurses only. Overall, risk of bias was high and clinical heterogeneity prohibited pooling of data. Intervention effects were small and inconsistent. In conclusion, evidence for the effectiveness of interventions in the nursing curricula for the prevention/treatment of physical complaints is scarce and where available conflicting. We recommend high quality research on dropout due to physical health problems, as well as on the prevention/treatment of physical complaints.

Keywords: dropout; moving/handling training; musculoskeletal problems; novice nurses; student nurses.

BACKGROUND

Nurses, as well as many other health professionals, frequently have to deal with a high physical workload, including lifting while transferring a patient, awkward working postures during patient care, and pushing/pulling while repositioning a patient or manoeuvring equipment, often leading to complaints of the neck, shoulder and back⁽¹⁻⁵⁾.

Apart from graduated nurses being at risk to develop musculoskeletal problems, musculoskeletal problems are also prevalent in the nursing student population^(6, 7). Smith and Leggat (6), for example, investigated the prevalence of musculoskeletal problems among rural Australian student nurses and found that 80% of students reported musculoskeletal problems at some body site, with low back pain as the most common condition (59.2%). Lövgren, Gustavsson⁽⁸⁾ examined neck/shoulder and back pain in newly graduated nurses and reported an increasing trend towards and after graduation. Monitoring research in nursing homes, homes for elderly and home care services sectors in the Netherlands, showed that especially young employees, including students, have greater risk. Compared to older employees, they have up to 10% more musculoskeletal complaints⁽⁹⁾.

Musculoskeletal symptoms lead to productivity loss at work, sick leave, or even turnover from health care, from the nursing profession⁽¹⁰⁻¹⁴⁾, or from nursing education^(6, 8).

Many preventive and therapeutic interventions for musculoskeletal conditions in experienced registered nurses are available. Examples of a wide range of preventive measures in the workplace, such as preferred patient handling techniques and the use of lifting devices, were described in various studies^(11, 12, 15, 16). Koppelaar, Knibbe⁽³⁾ and Koppelaar⁽¹⁶⁾ presented an overview of primary preventive interventions to reduce the exposure to manual patient handling, e.g. lifting techniques, ergonomic devices, rapid self-appraisal methods to evaluate mechanical load, and the introduction of so-called 'ergocoaches'. Nevertheless, such interventions are under-utilised in daily practice^(11, 12, 15-17). Potentially, the implementation of effective preventive and curative interventions may (partly) decrease the occurrence of back complaints.

Concurrently, it would be effective to implement preventive strategies during nursing education to reduce the high prevalence of pain in this population, and enable them to continue nursing work after graduation⁽⁸⁾; the authors, however, also state

that strategies for managing these conditions should be developed and provided at the same time, suggesting that effective preventive strategies may not be available yet. In addition, nursing schools do not seem to prioritize (ergonomic) measures to prevent dropout and/or the onset of physical health problems resulting from high physical working demands⁽⁹⁾; implementation of these interventions seems difficult to achieve. Interventions aimed at the prevention of musculoskeletal problems in student and novice nurses, however, may contribute to the physical resilience and retention of these groups.

To our knowledge, there is no systematic evidence supporting the effectiveness of interventions focused on dropout from nursing education or the nursing profession due to musculoskeletal problems. Moreover, it seems justified and equally important to identify interventions that are effective in preserving physical health in student and novice nurses, since musculoskeletal problems may contribute as early indicators of dropout.

Therefore, this review examined interventions implemented in nursing schools aimed at physical health problems among student or novice nurses. The implementation of effective interventions in nursing schools may result in a decrease of physical health problems and can contribute to the retention of student nurses in nursing education and novice nurses in the nursing profession.

This review aimed 1) to provide an overview of interventions available for student or novice nurses with a focus on their physical health and wellbeing and the effect of these interventions on the prevention of dropout and 2) to provide an overview of the effect of these interventions on physical health problems.

METHODS

Design

With this systematic review we systematically and comprehensively searched, appraised and synthesised research evidence⁽¹⁸⁾ for interventions aiming at the prevention of dropout of student or novice nurses from nursing education or the nursing profession, respectively, due to physical health problems. We used the Cochrane handbook⁽¹⁹⁾, the recommendations by the Editorial Board of the Cochrane Collaboration Back Review Group⁽²⁰⁾ and followed the PRISMA 2015 guideline^(21, 22) to ensure consistency and rigorousness.

Outcomes

The primary outcome of interest was dropout from nursing education, or from the nursing profession in the first two years after graduation, due to musculoskeletal symptoms or discomfort. Data on dropout could be self-reported or registry based.

The secondary outcome was the prevalence of musculoskeletal symptoms or discomfort in students and/or novice nurses, whether self-reported or clinically diagnosed by a physician.

We included studies describing interventions in the educational setting for student nurses and/or healthcare setting for novice nurses.

Types of studies

All studies with a quantitative research design were included, e.g. randomised controlled trials, clinical controlled trials, pre-post intervention studies, and observational studies. We also included studies with a mixed-method design and articles published in any language. For languages of the original articles other than English, Dutch, German or French, Google translate was used for the first translation of these studies⁽²³⁾. If necessary, a professional translator was consulted.

Participants and types of interventions

Participants were student and/or novice nurses, less than two years after graduation. We were open to any type of intervention as long as the intervention focused on; i) dropout from nursing education or the nursing profession within two years after graduation and ii) musculoskeletal problems.

Literature search and selection

The CINAHL, EMBASE, ERIC, MEDLINE, the Cochrane Library, Web of Science, and Google scholar databases were searched from inception up to 18 December 2017⁽²⁴⁾:

To identify possible studies for this review, detailed search strategies were developed for each database by an information specialist of Erasmus University Medical Center Rotterdam. The database-specific search strategies used are available in the online appendix.

A three-step search strategy was built, using 1) relevant terms and synonyms related to the target population (e.g. student nurse, novice nurse), 2) the primary outcome

measure (such as dropout, early exit, or turnover), and 3) the type of interventions. Comparable search strategies were used with secondary outcome measure terms. In addition, the reference lists of the included publications and six additional reviews were scrutinised to identify potentially relevant studies that might have been missed. Because a first orientation in the literature suggested that relevant publications might be scarce, we set no limit to the publication date.

Two authors (JK, EB) independently screened all titles and abstracts using Covidence software⁽²⁵⁾. For all potentially relevant studies, full-text copies were retrieved and assessed. Any disagreements were resolved by consensus, or a third author (PR) was consulted if disagreement persisted.

Studies were included if the primary outcome was reported or could be calculated as the number of dropped out student/novice nurses per year, or reported a secondary outcome (e.g. musculoskeletal symptoms).

Quality appraisal, data extraction and data syntheses

The methodological quality of the included articles was individually assessed by three reviewers (JK, PR and JR) using the Cochrane Risk of Bias tool (modified) for quality assessment of RCTs⁽¹⁹⁾. The results of these three independent reviewers were compared and consensus on risk of bias was reached in a joint discussion.

We retrieved the following data: 1) characteristics of the included studies, e.g. country, number of participants, design, evaluation method, results, outcomes, 2) characteristics of the interventions, e.g. duration, target group characteristics (age, sex, year of study, work experience, ethnic group), components, professionals involved, and 3) outcome measures.

Clinical and statistical heterogeneity were assessed for all included studies that reported similar outcomes. The trials were assessed based on setting, participants, and intervention. If trials were clinically heterogeneous, data were not pooled. Statistical heterogeneity was assessed with the Chi-square test and I-square statistics. If I-square values were $\geq 50\%$, substantial heterogeneity was deemed present⁽¹⁹⁾.

It was planned to use funnel plots to investigate reporting bias if at least four trials were included in a specific comparison. Where appropriate, it was planned to pool the results of comparable studies and report the pooled estimates,

together with the 95% confidence interval (CI). However, due to practical/clinical and methodological heterogeneity of the included studies, statistical pooling was not feasible. Therefore, results are described from the qualitative data synthesis (clinically comparable studies).

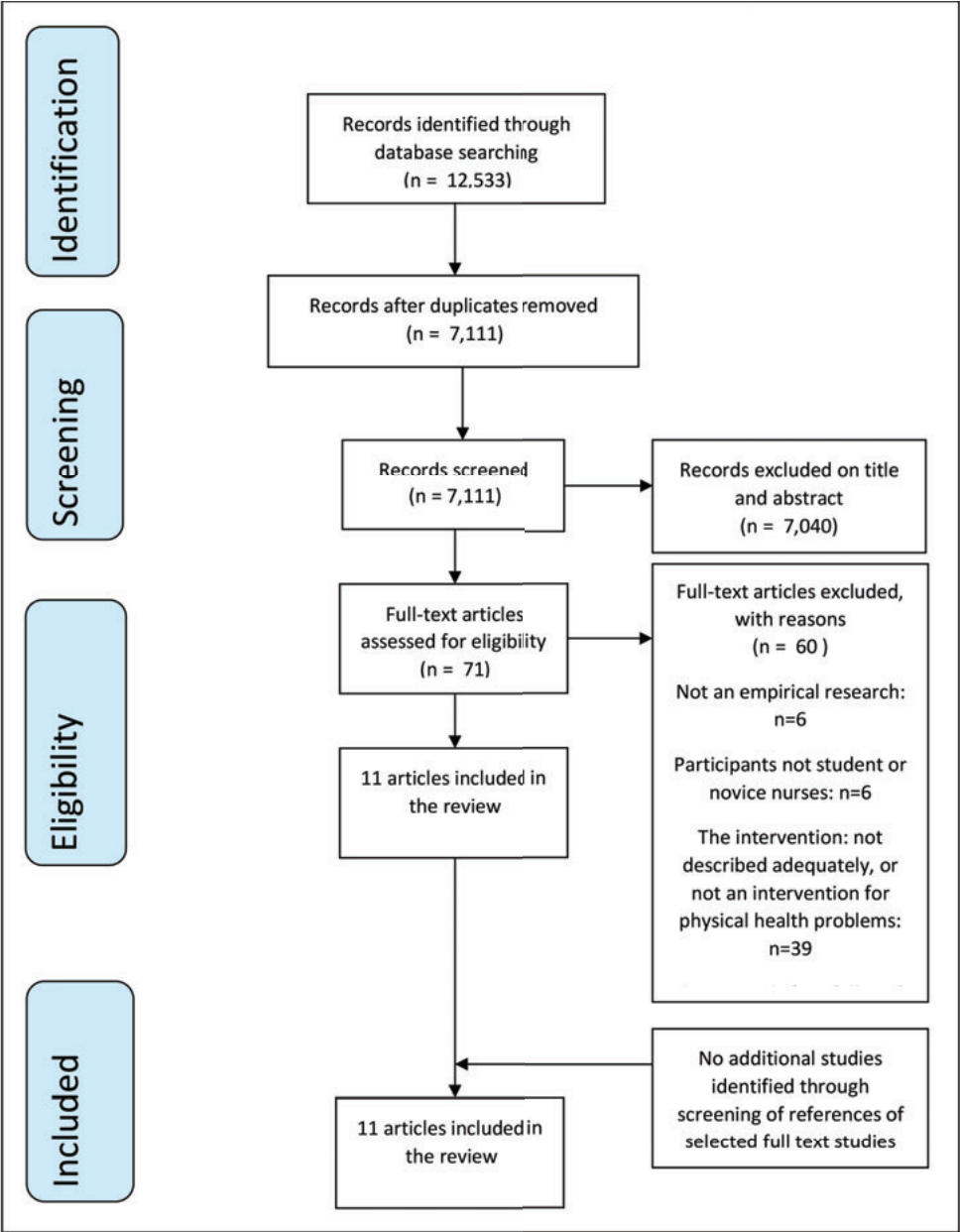
FINDINGS

Search results

The electronic searches for this review identified 12,533 references. After removing duplicates, 7,111 records remained for screening. Based on the title and abstract, 7,040 records were excluded, leaving 71 potentially relevant abstracts. For these, the full-text articles were retrieved. Of these 71 studies, 60 were excluded because they did not fulfil the inclusion criteria. Figure 1 presents an overview of the inclusion/exclusion process (with reasons for exclusion). Scrutinising the reference lists of six reviews⁽²⁶⁻³¹⁾, and of all the included articles did not yield any additional studies. Finally, 11 studies matched the inclusion criteria and were included in this review. These 11 articles described 12 interventions.

Figure 1

Flow diagram of the inclusion and exclusion of articles for interventions on physical health problems in student and novice nurses



Characteristics included studies

Of the 11 studies, three were RCTs⁽³²⁻³⁴⁾; one had a quasi-randomised controlled design⁽³⁵⁾; one described two interventions (one with a non-randomised controlled design and one with an observational design)⁽³⁶⁾; another study had an observational design⁽³⁷⁾; and the remaining five studies were non-randomised controlled studies⁽³⁸⁻⁴²⁾. Of all studies, 10 concerned 'nursing students' and one⁽³³⁾ focused on 'assistant nursing students'; this latter study was included since this group was considered to be similar to 'nursing students'. We found no studies reporting on novice nurses.

The sample size of the individual studies ranged from 2 to 668 participants. A total of 1,634 participants were included in 10 studies, and one study did not report the number of participants⁽³⁷⁾.

All studies were conducted in nursing schools. The studies were conducted in the UK^(36, 38), Sweden⁽³⁹⁾, Belgium⁽⁴⁰⁾, Denmark⁽³³⁾, Finland^(41, 42), Portugal⁽³⁷⁾, Korea⁽³²⁾, USA⁽³⁴⁾, and Iran⁽³⁵⁾. Table 1 summarises the characteristics and main results of the primary and secondary outcomes of the included studies.

Table 1

Characteristics of the included studies

First author (year), (language), Country	Study design	Population: Student nurses*	Intervention	Comparison	Outcome of interest	Results**
Studies with focus on moving/handling training						
Gladman (1993) ⁽³⁸⁾ , (English), UK	Non-randomised controlled study	n=87; Control group (n=46), Intervention group (n=41)	Research based patient-handling training	Traditional patient-handling training	Back pain	Intervention group experienced more back pain (92%) than control group (73%) (p = 0.05)
Helsing et al. (1993) ⁽³⁹⁾ , (English), Sweden	Non-randomised controlled study	n=52; Control group (n=33), intervention group (n=19)	Ergonomic training package with behavioural training, and extra education on patient handling, besides the regular programme	Regular programme	Back pain frequency and intensity	In the intervention and control groups, low back pain score decreased during the 2-year study and returned to pre-test levels in both groups in the third year. The decrease in lower back pain frequency (p = 0.0352) was statistically significant in the control group during the study. No other statistically significant differences between the groups.
Moens et al. (2002) ⁽⁴⁰⁾ , (English), Belgium	Non-randomised controlled study	n=552; Control group (n=261), intervention group (n=291)	Training of lifting and transfer techniques	Regular programme without training	Back pain incidence and sick leave	No statistically significant difference in back pain incidence after 1 year (p > 0.05) and no statistically significant difference in sick leave between the groups (p > 0.05).

Stubbs et al. (1983) ⁽³⁶⁾ A), (English), UK	Observational study	n=8 cross-sectional	Examination of four 2-person techniques for moving a patient up a hospital bed	Not applicable	Back pain prevalence and intra-abdominal pressure	No relation between the time spent training and subsequent prevalence of back pain. Usage of shoulder lift produced statistically significant ($p < 0.01$) lower intra-abdominal pressure than the other three lifts. Increased intra-abdominal pressure in intervention nurse during turning procedure and use of axillary lift, which reduced during more complex manoeuvres (e.g. transfer of patient from bed to chair). These trends were not observed in the control nurse (not tested).
Stubbs et al. (1983) ⁽³⁶⁾ B), (English), UK	Non-randomised controlled study	n=2; Control group (n=1), intervention group (n=1)	Practical patient handling training by an experienced teacher during 5 sessions	Training by an experienced teacher given in session 4 only	Intra-abdominal pressure	Prevalence of low back pain increased in intervention (50%) and control group (53%), but no statistically significant differences. Sickness absence increased in both groups but was statistically significant lower ($p < 0.05$) in intervention group than in control group.
Svensson et al. (2009) ⁽³³⁾ , (English), Denmark	Randomised controlled study	n=668 student nursing assistants*; Control group (n=279), intervention group (n=389)	Low back pain prevention programme only	Regular programme	Sickness absence and low back pain	

Troup and Rauhalala (1987) ⁽⁴¹⁾ , (English), Finland	Non-randomised controlled study	n=199; Control group (n=93), Intervention group (n=106)	Additional theory and practical ergonomics and biomechanics patient handling training, besides the regular programme	Traditional patient-handling training	Working posture, patient handling and back pain	No statistically significant difference in prevalence or incidence of back pain after intervention.
		n= 200; Control group (n=113), intervention group (n=87)	Theoretic and practical ergonomics and biomechanics patient handling training	Regular programme	Back pain incidence, severity, injury, disability and patient handling	No statistically significant differences in prevalence or incidence of back pain after intervention ($p < 0.001$).
Studies with focus on other interventions						
Costa et al. (2011) ⁽³⁷⁾ , (Portuguese), Portugal	Observational study	Data not provided	Ergonomic changes to the physical space and furniture of the cafeteria	Not applicable	Working posture, musculoskeletal disorders	Positive correlation between ergonomic changes and working posture, regarding movement, alignment, posture (musculoskeletal disorders).
		n=56; Control group (n=28), intervention group (n=28)	Exercise programme	No exercise programme	Body composition and physical fitness	Statistically significant improvement of back strength ($p=0.015$), muscle endurance ($p=0.007$), flexibility ($p=0.000$), and balance ($p=0.018$), in intervention group compared with control group.
Kim and Park (2006) ⁽³²⁾ , (Korean), Korea	Randomised controlled study					

Tooms et al. (1987) ⁽³⁴⁾ , (<i>English</i>), USA	Randomised controlled study	n=100; Control group (n=49), intervention group (n=51)	Viscoelastic insoles	No insoles	Low back pain and pain in lower extremities post work	Statistically significant peripheral shift in pain location from low back pain to pain in lower extremity (p=0.02) and significant changes in duration of post-work pain (p=0.04) and frequency of pain during the workday (p=0.02) in intervention group compared to controls.
Yazdani et al. (2014) ⁽³⁵⁾ , (<i>English</i>), Iran	Quasi-randomised controlled study	n=38; Control group (n=19), intervention group (n=19)	Laughter Yoga	No laughter Yoga	General health and physical disorders	statistically significant positive effect of intervention on general health in intervention group (p=0.01), but no statistically significant difference in the control group (p=0.33).

* Population: 'student nurses' unless stated otherwise, ** When available, p-values are given from the original study

Interventions included in studies

Seven studies investigated interventions aimed at ergonomic training and included: a course on lifting and moving patients⁽³⁸⁾; ergonomic and behavioural training⁽³⁹⁾; lifting and transfer techniques⁽⁴⁰⁾; moving patients up a hospital bed⁽³⁶⁾; multidimensional low back pain prevention programme⁽³³⁾; additional patient handling training⁽⁴¹⁾; and biomechanics and ergonomics training⁽⁴²⁾.

Four studies focused on other intervention types: applying changes in the cafeteria space, verifying the substitution of elements of furniture, pavement and luminosity⁽³⁷⁾; exercise program⁽³²⁾; effect of viscoelastic shoe inserts⁽³⁴⁾; and laughter Yoga⁽³⁵⁾.

Reported outcomes

None of the included studies reported on dropout related outcomes, our primary outcome of interest. Nine studies reported on back pain, with only two studies focussing on back pain at work alone^(38, 39). Other studies examined back pain as reason for sick leave^(33, 40), intra-abdominal pressure⁽³⁶⁾, patient handling^(41, 42), working posture^(37, 41), and post work pain⁽³⁴⁾. One examined body composition and physical fitness⁽³²⁾. Another explored general health and physical disorders⁽³⁵⁾.

Quality appraisal and methodological considerations

The methodological quality of the 11 studies is presented in Figure 2 and a summary of the 'risk of bias' assessment of each item across trials is provided in Figure 3. All studies were considered to have a high risk of bias.

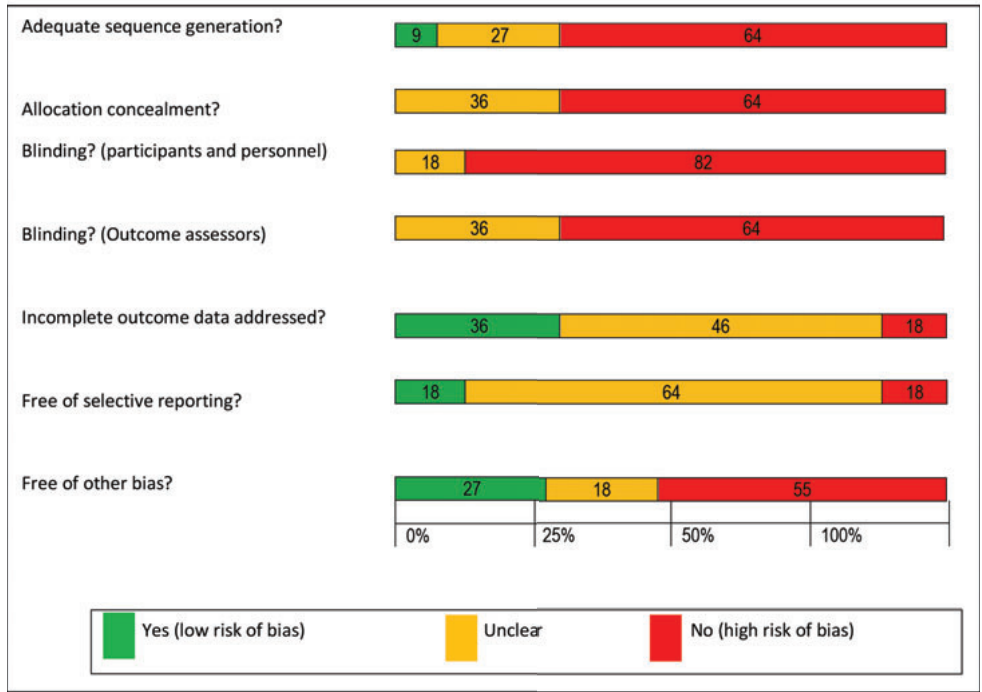
Figure 2*Assessment of the methodological quality of each study*

First author (ref. no.)		Random sequence generation	Allocation concealment	Blinding of participants and	Blinding of outcome assessment	Incomplete outcome data	Selective outcome reporting	Other sources of bias	Conclusion
Costa et al. (2011) ⁽³⁷⁾	O	?	?	-	-	?	?	-	High RoB
Gladman (1993) ⁽³⁸⁾	NCT	-	-	?	?	+	-	-	High RoB
Hellsing et al. (1993) ⁽³⁹⁾	NCT	?	?	-	?	?	?	-	High RoB
Kim and Park (2006) ⁽³²⁾	RCT	-	-	-	-	-	?	+	High RoB
Moens et al. (2002) ⁽⁴⁰⁾	NCT	-	-	-	-	+	?	?	High RoB
Stubbs et al. (1983) A) ⁽³⁶⁾	O	-	-	-	-	+	-	-	High RoB
Stubbs et al. (1983) B) ⁽³⁶⁾	NCT	-	-	-	-	+	-	-	High RoB
Svensson et al. (2009) ⁽³³⁾	RCT	?	?	-	?	+	+	+	High RoB
Tooms et al. (1987) ⁽³⁴⁾	RCT	+	?	-	-	?	?	+	High RoB
Troup and Rauhala (1987) ⁽⁴¹⁾	NCT	-	-	-	-	?	?	?	High RoB
Videman et al. (1989) ⁽⁴²⁾	NCT	-	-	?	-	-	+	-	High RoB
Yazdani et al. (2014) ⁽³⁵⁾	QCT	-	-	-	?	?	?	-	High RoB

Key	
RoB	Risk of bias
+	Low risk of bias
-	High risk of bias
?	Unclear risk of bias
NCT	Non-randomised controlled study
RCT	Randomised controlled study
QCT	Quasi-randomised controlled study
O	Observational study

Figure 3

Assessment of the methodological quality of each item: presented as percentages across all included studies



The variety in methods used was high. The data of the 11 studies could not be pooled, because of the heterogeneity of the interventions, the different comparators and the differences in timing of measurements. Rationales for chosen design were poorly described and discussed.

Studies were non-blinded to the participants nor to the providers of the interventions, and all outcomes were self-reported. Because most studies did not adequately describe the randomisation procedure, it was not possible to determine whether adequate procedures were used. The study populations ranged from 2 to 668 (mean=178, median=87) participants; the small sample size of some studies resulted in a lack of statistical power to detect relevant effects of these interventions.

Effectiveness of patient handling interventions

Six studies^(33, 38-42) evaluated an curriculum-based training for safe patient handling in nursing schools to reduce musculoskeletal symptoms. Although patient-handling

techniques improved significantly in the intervention groups in three of the studies⁽⁴⁰⁻⁴²⁾, no decrease in musculoskeletal symptoms (back pain) was found. Svensson, Strøyer⁽³³⁾ did not report on improvements in patient-handling techniques, nor on a decrease in musculoskeletal symptoms. Two studies found a statistically significant difference in the prevalence of back pain in favour of the control group^(38, 39).

Stubbs, Buckle⁽³⁶⁾ found no relationship between the time spent training in patient transferring techniques and prevalence of back pain. Moens, Johannik⁽⁴⁰⁾ studied the incidence of back pain as reason for sick leave, but found no statistically significant effect between the intervention and control groups.

Table 2 presents the results of a descriptive comparison between studies with a similar ergonomic intervention that reported the effects on the prevalence of back pain (trials did differ on pain measurement scales and time points). Table 2 shows that, based on the change in baseline prevalence, three of five studies^(38, 40, 42) had an outcome which favoured the intervention. Two studies favoured the control group^(33, 39). Clinical/-practical heterogeneity prohibited further pooling of data.

Table 2

Change in prevalence of back pain before and after an intervention

First author (ref. no.)	Experimental group				Control group			
	Total no. of students	No. with back pain before intervention (%)	No. with back pain after intervention (%)	Change in prevalence of back pain	Total no. of students	No. with back pain before intervention (%)	No. with back pain after intervention (%)	Change in prevalence of back pain
Gladman (1993) ⁽³⁸⁾	36	19 (53%)	13* (36%)	-17%	44	12 (27%)	20* (46%)	+19%
			* After 1.5 years				* After 2 years	
Hellsing et al. (1993) ⁽³⁹⁾	19	10 (55%)	9* (50%)	-5%	33	22 (59%)	16* (45%)	-14%
			* After 1 year				* After 1 year	
Moens et al. (2002) ⁽⁴⁰⁾	100	59 (59%)	67* (67%)	+8%	124	69 (56%)	90* (73%)	+17%
			* After 1 year				* After 1 year	
Svensson et al. (2009) ⁽³³⁾	372	148 (39%)	n/a* (50%)	+11%	266	119 (44%)	n/a* (53%)	+9%
			* After 1 year				* After 1 year	
Videman et al. (1989) ⁽⁴²⁾	87	57 (64%)	45* (56%)	-8%	113	50 (47%)	61* (58%)	+11%
			* After 1 year				* After 1 year	

Effectiveness of other interventions

Despite that Costa, Grilo⁽³⁷⁾ found a positive relation between the ergonomic modifications of the nursing school cafeteria and the adoption of more appropriate postures among the users (student nurses) of the cafeteria, they concluded that other conditions that constitute risk factors for musculoskeletal disorders need to be considered.

Tooms, Griffin⁽³⁴⁾ described a statistically significant decrease of back pain/pain in the lower extremity and a shift in pain from back to the lower extremity, only in the intervention group (using viscoelastic shoe inserts).

DISCUSSION

This review aimed 1) to provide an overview of interventions available for student or novice nurses with a focus on their physical health and wellbeing and the effect of these interventions on the prevention of dropout and 2) to provide an overview of the effect of these interventions on physical health problems. A review focusing on these two groups was considered necessary due to the unique nature of these particular target groups. Compared with the older, more experienced nursing population, these groups have greater risk to develop physical health complaints⁽⁹⁾. Moreover, (intention to) dropout from nursing education or from the nursing profession within two years after graduation is an increasing problem. Worldwide more nurses are needed than are graduating^(43, 44). Surprisingly, none of the studies included dropout related outcomes and no study focused on musculoskeletal problems in novice nurses. This shows that there is lack of attention for this important issue and stresses the urgency for more research in this important field.

Interventions to improve the physical health

For this review, only 11 studies could be identified. The majority of the included studies focused on intervention programmes related to ergonomic training, aimed at reducing musculoskeletal disorders in student nurses. Overall, there was conflicting evidence for the effects of such curriculum-based training on musculoskeletal symptoms, while positive, negative and no effects were reported in the eligible studies (Table 1). Comparison of the studies reporting on the outcome “back pain” (Table 2) showed that three out of five studies^(38, 40, 42) had an outcome in favour of the intervention, whereas two studies favoured the control group^(33, 39). In two

studies^(33, 40), the prevalence of back pain increased in both the intervention and control group, with the increase in the study by Moens, Johannik⁽⁴⁰⁾ being 9% larger in the control group. In the study by Svensson, Strøyer⁽³³⁾ however, the increase was larger in the intervention group, but the difference was minimal at 2%. Studies did differ on the obtained pain measurement scales and time points. Therefore, the evidence for the effect of curriculum-based training on back pain is limited. Interventions with regard to safe patient handling (e.g. the use of proper ergonomic techniques) have been in the nursing curriculum for many years. It is surprising that there are so few intervention studies that support the rationale for this form of education for student nurses. In contrast, interventions aimed at reducing musculoskeletal disorders in registered nurses with multiple years of experience are numerous^(3, 45-49). This indicates that additional research is needed in the field of intervention studies focusing on student and novice nurses.

Comparison with other studies

Next to the lack of eligible studies on dropout from the nursing profession or intervention studies among novice nurses, this review found no evidence for the effect of interventions in the educational setting on musculoskeletal symptoms among student nurses. This concurs with results from reviews looking at the effect of education in the primary prevention of musculoskeletal symptoms among other target populations. A review including 5,525 workers in various workplace settings (including hospital/healthcare workers), found no effect of education in the primary prevention of low back pain⁽⁵⁰⁾. In a total of 18,492 workers in various workplace settings (including 1,169 nurses), no evidence for the effectiveness of training with or without lifting equipment in the prevention of back pain or consequent disability was found⁽⁵¹⁾. In their systematic review, Richardson, McNoe⁽⁵²⁾ found limited evidence for interventions, like patient lift systems, patient handling training, and multi-component interventions, to prevent musculoskeletal injuries in nurses. Finally, a review that included 2,194 nurses in various health care settings concluded that training and education alone is not sufficient for a decrease in musculoskeletal symptoms, but training and education in combination with an ergonomic intervention (i.e. use of additional mechanical or other aids) seemed to be effective⁽¹¹⁾. This indicates that training and education alone might not necessary influence the behaviour of students in practice. Possible solutions could be found in a combination of ergonomic training and education on one hand and practical/-behavioural interventions at the workplace on the other hand. This is in line with

one of the included studies⁽³⁸⁾ that acknowledged that nursing training plays an important role in the skills of nurses to lift/move patients, but noted that education on lifting/moving patients should not end in the classroom. Gladman⁽³⁸⁾ (p.50) also stated that *“Students require skilled, up-to-date supervision by qualified nurses”*, but some students receive limited supervision and the attitudes of the qualified staff do little to promote safe practice.

Risk of bias in included studies

Current review did not identify any high quality studies. Furthermore, the eligible studies were quite old. The most recent was published in 2014, but most were published before 2000, indicating that this area has lacked attention in recent years.

The methodological quality of the studies compromises the evidence provided. Most included studies had small numbers of participants and the risk of bias was overall high (Figure 2). Similar conclusions were drawn by Richardson, McNoe⁽⁵²⁾, in their review on interventions to prevent and reduce the impact of musculoskeletal injuries among registered nurses. It is therefore justified to encourage better quality (RCT) studies with sufficient numbers of participants, increased length of study duration and appropriate (cluster) randomisation, that provide evidence in the nursing student and novice nurses population.

We understand that aspects of an RCT, considered as the gold standard for studying effectiveness, can be unfeasible in an educational setting. The rationales for chosen designs other than RCTs, however, were not addressed in the included studies.

To increase the likelihood of success in a RCT, a feasibility or pilot study may be an essential stage in the project^(53, 54). It may also be justified to consider alternative designs, such as a pragmatic stepped wedge cluster randomised design or a multiple baseline design⁽⁵⁵⁾.

Strengths and limitations of this review

The strengths of this review include a comprehensive electronic literature search, systematic review methods including double extraction of papers, and contact with authors to clarify data. The main concerns for the review arise from: firstly, the fact that the studies were not all RCTs and our choice to assess the methodological quality of the included studies using the Cochrane Risk of Bias (RoB) tool (modified) for quality assessment of RCTs. Since we were looking for the effect of interventions rather than

associations, we decided to continue to use the Cochrane RoB tool for assessing RCT, despite the fact that the majority of included studies in this review were not RCT. The second concern was the decision to apply 'no language restrictions'; of the 11 studies, 9 were published in English, one was published in Portuguese⁽³⁷⁾ and another in Korean⁽³²⁾. These latter studies were translated by means of Google translate. This may have had consequences as such translations are not always accurate. In order to improve accuracy, we translated the studies sentence by sentence in English and double checked it with another language (Dutch). Balk, Chung⁽²³⁾ formally evaluated the accuracy of Google Translate for the purpose of data extraction of non-English language articles. Data extraction was studied from ten RCTs in eight languages (including Portuguese and Korean). Balk, Chung⁽²³⁾ concluded that accurate extraction was possible for some articles in all languages, except for Chinese. The Portuguese translation yielded the most accurate extractions⁽²³⁾. Finally, in some studies it was difficult to retrieve the appropriate data due to poor presentation of the results. In these cases we had to recalculate the results to obtain accurate data for Table 2. Contacting the authors did not provide the required information as only one author responded (but with incorrect information).

CONCLUSIONS

This review indicates that there is little and inconsistent evidence for effective interventions to reduce dropout from the nursing profession/education nor the prevention of musculoskeletal symptoms among student or novice nurses. Further high-quality research is required to ascertain the development, evaluation and sustainability of such interventions and to determine the long-term benefits of these interventions with regard to dropout/retention and the reduction of musculoskeletal complaints in this population. Such research should contain sufficiently large samples and adequate follow-up periods. To evaluate the relation between musculoskeletal problems and dropout from nursing education or the nursing profession within two years after graduation, it is important that these outcomes are reported as well in future studies.

Disclaimer

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ETHICAL APPROVAL

Not applicable.

CREDIT AUTHORSHIP CONTRIBUTION STATEMENT

Jos H.A.M. Kox: Conceptualization, Formal analysis, Methodology, Writing - original draft, Writing - review & editing. **Ellen J.M. Bakker:** Formal analysis, Writing - review & editing. **Sita Bierma-Zeinsträ:** Writing - original draft, Writing - review & editing. **Jos Runhaar:** Supervision, Writing - review & editing. **Harald S. Miedema:** Writing - original draft, Writing - review & editing. **Pepijn D.D.M. Roelofs:** Conceptualization, Supervision, Funding acquisition, Project administration, Writing - review & editing.

7

DECLARATION OF COMPETING INTEREST

All authors declare that they have no competing interests.

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APPENDIX A. SUPPLEMENTARY DATA

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Chapter 8

Teaching ergonomic and haptonomic patient handling; the feasibility of an on-site course in clinical practice for nursing students

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ABSTRACT

This study aims to evaluate the feasibility (e.g., acceptability, demand, implementation, integration, and efficacy) of an ergonomic patient handling training based on the principles of haptonomy for nursing students. We conducted a mixed-method feasibility study; quantitative and qualitative methods were used to explore the feasibility. A total of 32 vocational and Bachelor student nurses working at two learning units participated in the study. Students at one learning unit (n=21) received the training, the other students did not. Most students found the training inspiring, motivating and a feasible approach for use and integration in a nursing curriculum. The mean rating for the training on a scale from 1 to 10 was 7.7 (range 5–10). A small reduction of musculoskeletal symptoms among students in the intervention group is promising regarding the effectiveness of the training.

Keywords: Ergonomics; Feasibility study; Haptonomy; Musculoskeletal symptoms; Nursing students

BACKGROUND

Lifting, transferring, repositioning, and mobilizing patients as well as frequent and prolonged work in uncomfortable positions, contribute significantly to the high incidence of musculoskeletal symptoms (such as low back pain) in nurses⁽¹⁻⁶⁾. These physical health symptoms already occur during nursing training⁽⁷⁻¹⁰⁾. Videman, Ojajärvi, Riihimäki, and Troup⁽¹¹⁾ showed in their study among 174 Finnish female nursing students that the incidence of low back pain sharply increased by the end of the nursing education and after graduation. These findings underscore the importance of early implementation of activities for the prevention of musculoskeletal symptoms and their sustainable application throughout working life.

Various intervention strategies are used to prevent the occurrence of musculoskeletal symptoms in nurses. The most common approach to prevent musculoskeletal symptoms among health care staff is teaching patient transfer techniques^(12, 13). Such interventions have shown to have little effect on the nurses' way of working or on the occurrence of symptoms⁽¹⁴⁻¹⁹⁾. This may be partly due to an underuse of preventive measures in daily practice⁽¹⁴⁻¹⁸⁾. In addition, the effect of an ergonomic training has been shown to recede after six months⁽²⁰⁾.

A systematic review on preventive interventions for physical health complaints in nursing students and early career nurses, showed that evidence for the effectiveness of such interventions is scarce and often conflicting⁽²¹⁾. Of twelve interventions included in the review, eight involved training in patient handling, which in some studies was combined with theoretical knowledge. However, the effect on musculoskeletal symptoms was disappointing and contradictory. Studies with sufficiently long follow-up and appropriate outcome measures are scarce. In nursing education, skills training in patient transfer techniques is often limited to only a few hours school-based training⁽²²⁾.

At Rotterdam University of Applied Sciences, we studied how the nursing curriculum could be improved to enable nursing students to better cope with the physical and mental demands they face in nursing practice. An expert panel, consisting of registered nurses, nursing students, nursing lecturers (intermediate vocational and bachelor level), experts and researchers in the field of ergonomics and work & health, considered a training in ergonomic patient handling, based upon the principles of haptonomy, a promising intervention to improve patient transfer techniques in nursing students.

Static and postural stresses are major causes of back pain^(4, 23). Static overload often occurs during activities such as washing, bathing or showering of patients. Nursing

students are prone to activities both in in-hospital care and outside the hospital (e.g., studying at home), which makes them more vulnerable to muscle overloading, due to static and non-ergonomic postures⁽⁹⁾. Reduction of static overloading is central to the guidelines of the Dutch working environment covenants⁽²⁴⁾. The conscious use of ergonomic principles, including the use of aids for moving, lifting and handling, in combination with haptonomic principles may contribute to a reduced risk of musculoskeletal symptoms due to patient handling tasks. Further information on the principles of haptonomy can be found in box 1.

In addition to the haptonomic component, the ergonomic patient handling training consisted of longer and more training sessions than the standard training, and can be delivered both at nursing school and in practice.

Box 1*Principles of haptonomy in patient care*

Haptonomy is derived from the Greek words hapsis (touching, feeling) and nomos (patterns, laws, rules)⁽²⁵⁾. Haptonomy is still a relatively young field of study, mainly known in the Netherlands and in France⁽²⁶⁾. It has yielded good practical results in healthcare practice^(27, 28), but is not scientifically substantiated.

Patient transfer techniques integrating the principles of ergonomics and of haptonomy rely on the use of partial physical prompts to encourage the patient to perform the intended movement, thereby reducing the need for the nurse to use force. It needs a profound realization that the patient is not just a body to be moved, but an animated living being⁽²⁷⁾. Relocations (transfers) thus become technically easier to perform.

An example of a haptonomic, non-verbal instruction is to indicate a direction of movement by placing a hand on that part of the body that the caregiver wants the patient to move. A soft touch followed by slow pressure must be applied without pushing or pulling, because very little force is needed to activate the basal neuromuscular sensors and to achieve the desired movement. Too much force can lead to resistance⁽²⁹⁾.

Working according to haptonomic principles also involves an awareness of the interpersonal space between patient and caregiver. Too much space can lead to uncertainty, discomfort and anxiety in the patient. Too little space can encourage the patient to start leaning on the caregiver. If the caregiver then gives more support, the passive response of the patient will further increase.

Individual patients differ greatly in how and why they move, so caregivers must adjust the haptonomic approach accordingly⁽³⁰⁾.

In this explorative study, we want to evaluate to what extent: (1) a training based on ergonomic patient handling with haptonomic principles is suitable, satisfying, attractive and instructive for nursing students (acceptability and demand); (2) the

ergonomic patient handling training is feasible for use and integration in a nursing curriculum, and the training can be successfully delivered (implementation and integration); (3) students acquire the intended knowledge, skills and attitudes, so that targeted outcomes occur (efficacy).

METHODS

Design

A mixed-method feasibility study was conducted to determine the feasibility of the ergonomic patient handling training based on haptic principles. To assess the feasibility (acceptability, demand, implementation, integration, and efficacy), we used an evaluation model based on Bowen's feasibility study framework⁽³¹⁾, which we combined with Kirkpatrick's training evaluation model⁽³²⁾ (Table 1).

Participants and setting

This feasibility study was conducted in Erasmus University Medical Center in Rotterdam, The Netherlands. The training was offered to nursing students (at both vocational and Bachelor level) who did a clinical placement in the clinical learning unit of trauma surgery, orthopaedics and plastic surgery. Participation in the research was facilitated by the clinical learning unit by integration of the training in the clinical placement activities. Nursing students from the clinical learning unit of urology and gynaecology acted as a control group. These students received only the questionnaires, but not the training.

Description of the intervention

The ergonomic patient handling training was a tailored version of the basic training 'Physically safe & respectful working in care', developed by Hake⁽³³⁾. This training is based on three pillars⁽³⁴⁾:

1. a good working posture.
2. working according to health and safety standards
3. taking care that the client cooperates according to the best of their ability ('haptic working')

Table 1

Evaluation model based on Bowen, et al⁽³¹⁾, and Kirkpatrick and Kirkpatrick⁽³²⁾

Area of focus ^{a)}	Research questions ^{a)}	Outcomes of interest ^{a)}	Research instruments	Research population	Level of training evaluation ^{b)}
Acceptability	To what extent is the ergonomic patient handling training judged as suitable, satisfying, or attractive to students?	1. Satisfaction 2. Perceived appropriateness	Post-training survey	Students, trainer and education manager and nursing skills course holder	Level 1: Reaction
Demand	To what extent is the ergonomic patient handling training likely to be used or applied by students?	1. Actual use 2. Expressed interest or intention to use	Post-training survey; reflection on training	Students	Level 3: Impact
Implementation	To what extent can the ergonomic patient handling training be successfully delivered to intended participants in some defined, but not fully controlled, context?	1. Degree of execution 2. Success or failure of execution	Post-training survey; attendance list	Students, trainer and education manager and nursing skills course holder	Not applicable
Integration	To what extent can the ergonomic patient handling training be integrated within the existing educational system or clinical placement setting?	1. Perceived fit with infrastructure 2. Perceived sustainability	Post-training survey	Students, education manager and nursing skills course holder	Not applicable
Efficacy	To what degree students acquire the intended knowledge, skills and attitudes based on their participation in the ergonomic patient handling training?	1. Perceived knowledge 2. Perceived skills 3. Perceived attitudes	Post-training survey	Students	Level 2: Learning
	To what degree do targeted outcomes occur as a result of the ergonomic patient handling training?	4. Effects of the training on musculoskeletal symptoms	Pretest-posttest survey measuring: musculoskeletal symptoms	Students	Level 4: Result

^{a)}(Bowen, et al. ⁽³¹⁾); ^{b)} (Kirkpatrick & Kirkpatrick⁽³²⁾)

The training consisted of two 3-hour sessions, with a theoretical and practical component (table 2).

Training materials - Students were provided with a handout, and had access to the book 'Basic book transfer techniques for health care professionals'⁽³⁴⁾ and the online e-learning programme consisting of ten modules, including, 'Lifting from and in bed', 'Rise and sit' and 'Donning and doffing compression stockings'.

Trainer - The training was developed and provided by an experienced physiotherapist, haptonomist and trainer in patient transfer techniques on a haptonomic basis⁽³⁴⁾.

Procedure - Students in the intervention group were split into three training groups to limit the group size (the maximum was set at ten). Each group was scheduled for two training sessions with a 2-4 week interval between the sessions (February and March 2020).

Table 2

Training content transfer techniques and caring

Session, duration	Theoretical content (basic principles) ⁽³⁴⁾	Practical content (Parts of the training)
Session 1; 3 hours	- Relevant health and safety standards and how to work with them. - Work posture in general (in various settings). - Working posture at the bedside. - What is haptonomic work and how to apply it? - Cooperation of the patient to the best of his ability. - Alternatives for squatting and kneeling. - Dealing with clients who do not understand words properly, such as clients with dementia, aphasia and/or mental disability.	- Transfer from seat (bed edge / chair) to position and back. - Assistance in and out of bed. - Experiencing how patient transfers can be done differently (on a haptonomic basis) and why.
Session 2; 3 hours	- Summary of previous session. - Handling of compression stockings from pressure class two onwards. - Schedule for tilting and use of sliding tarpaulin. - Lifting, pushing & pulling (manoeuvring the wheelchair).	- Bed: tilt on the side - Bed: moving within the boundaries of the bed / working with sliding sheets - Experiencing how patient transfers can be done differently (on a haptonomic basis) and why.

Data collection

The data collection for this study started in February 2020 and follow-up was concluded 10 weeks after, in April 2020.

The feasibility aspects (acceptability, demand, implementation, integration) were investigated quantitatively and qualitatively using:

1. a post-training survey, containing self-formulated closed and open-ended questions on all feasibility aspects, completed by students who followed the training.
2. semi-structured interviews, one with the trainer and one with both the education manager and the nursing skills course holder (Table 1). The interviews took place after the follow-up measurements. A topic list was used, addressing a selection of the feasibility aspects (Table 1).
3. In addition, an attendance list was kept for registration of participation (implementation).

To explore efficacy, we did a pretest-posttest survey containing validated instruments and self-formulated questions, completed by all participating students (table 3). Questions included sociodemographic characteristics (sex, age, height, weight, first language and study route), musculoskeletal symptoms, physical work exposure (lifting and bending), and sick leave and absence. The potential score range for lifting and bending is 0-100; a score between 50 and 80 indicates a substantial physical exposure of between 50 and 80 major physical tasks per workday⁽³⁵⁾.

Three self-formulated questions were used to find out the knowledge and application of the national guidelines on healthy and safe working as documented in the Health and Safety Catalogue. We included various self-formulated questions, to obtain information on the number of colleagues and number of patients the students worked with. A detailed description of the validated questionnaires that are mentioned in table 3 can be found in the SPRiNG cohort study protocol⁽³⁶⁾.

Table 3

Overview of the study outcome measures and scales for the evaluation of the efficacy (pre- posttest measurement, all students)

Outcome measure	Questionnaire	Measuring moments
	Musculoskeletal symptoms, physical workplace characteristics	
Physical health symptoms	Musculoskeletal symptoms; neck, back, limbs (DMQ) ⁽³⁷⁾	• Prior to training • 10 weeks after starting the clinical placement
Physical work exposure	Lifting and bending (NEXT) ⁽³⁵⁾	• 10 weeks after starting the clinical placement
Physical work exposure	Monitor work (VBBA) ⁽³⁸⁾	• 10 weeks after starting the clinical placement
sick leave / absence	‘Gezond werken in de zorg’ [Healthy Working in Healthcare] questionnaire ⁽³⁹⁾ Nationale Enquête Arbeidsomstandigheden (NEA) [National Labour Survey] ⁽⁴⁰⁾	• Prior to training • 10 weeks after starting the clinical placement
Absence and support for physical symptoms during the clinical placement/ working period	Use of support for physical health symptoms ‘Gezond werken in de zorg’ [Healthy Working in Healthcare] Questionnaire ⁽³⁹⁾	• Prior to training • 10 weeks after starting the clinical placement
Number of colleagues during a dayshift	self-formulated	• 10 weeks after starting the clinical placement
Average number of patients during a dayshift	self-formulated	• 10 weeks after starting the clinical placement
	National guidelines on healthy and safe working	
Healthy and safe working in health care	self-formulated	• 10 weeks after starting the clinical placement



Statistical Analysis

Quantitative survey data were analysed using SPSS version 26 (SPSS, Inc., Chicago, IL, USA) for Windows. Descriptive statistics were used to analyse background characteristics and all outcomes at baseline and follow-up. We checked the normality of distributions for all characteristics. Answers on the open questions in the survey as well as the interview transcripts were analysed qualitatively and descriptively, using codes derived from the learning objectives and feasibility aspects from Bowen et al⁽³¹⁾, and Kirkpatrick and Kirkpatrick⁽³²⁾. Power was deemed inadequate to demonstrate significant changes in musculoskeletal symptoms.

Ethical considerations

Ethical approval was obtained from the Medical Ethical Review Committee of the Erasmus University Medical Center Rotterdam (MEC-2019-0638). The research was carried out in accordance with the Netherlands Code of Conduct for Research Integrity⁽⁴¹⁾. Before being approached for participation, all participants received oral and written information about the study. All participants gave written informed consent. This research was conducted according to the requirements of the Helsinki Declaration (2008).

RESULTS

Characteristics of the study population

In total, 33 students participated in this study, 21 in the intervention group and 12 in the control group. All 33 students took part in the pre-test survey and 32 students in the post-test survey; the one student lost to follow-up participated in the control group and had to terminate her clinical placement prematurely for unknown reasons.

The mean age of the students in the intervention group was 20 years (range 16-28, SD 2.69). Three students in this group were male. The mean age of the students in the control group was also 20 years (range 18-25, SD 2.06). In this group, all students were female. Most students in both intervention and control group were in their third or fourth year of nursing education (18 students in the intervention group, and 11 in the control group). Eleven students in the intervention group and four students in the control group did the intermediate vocational degree nursing training. In the intervention group, a majority of 15 students studied fulltime; in the control group, all students studied full time (table 4).

Table 4*Background characteristics of participants*

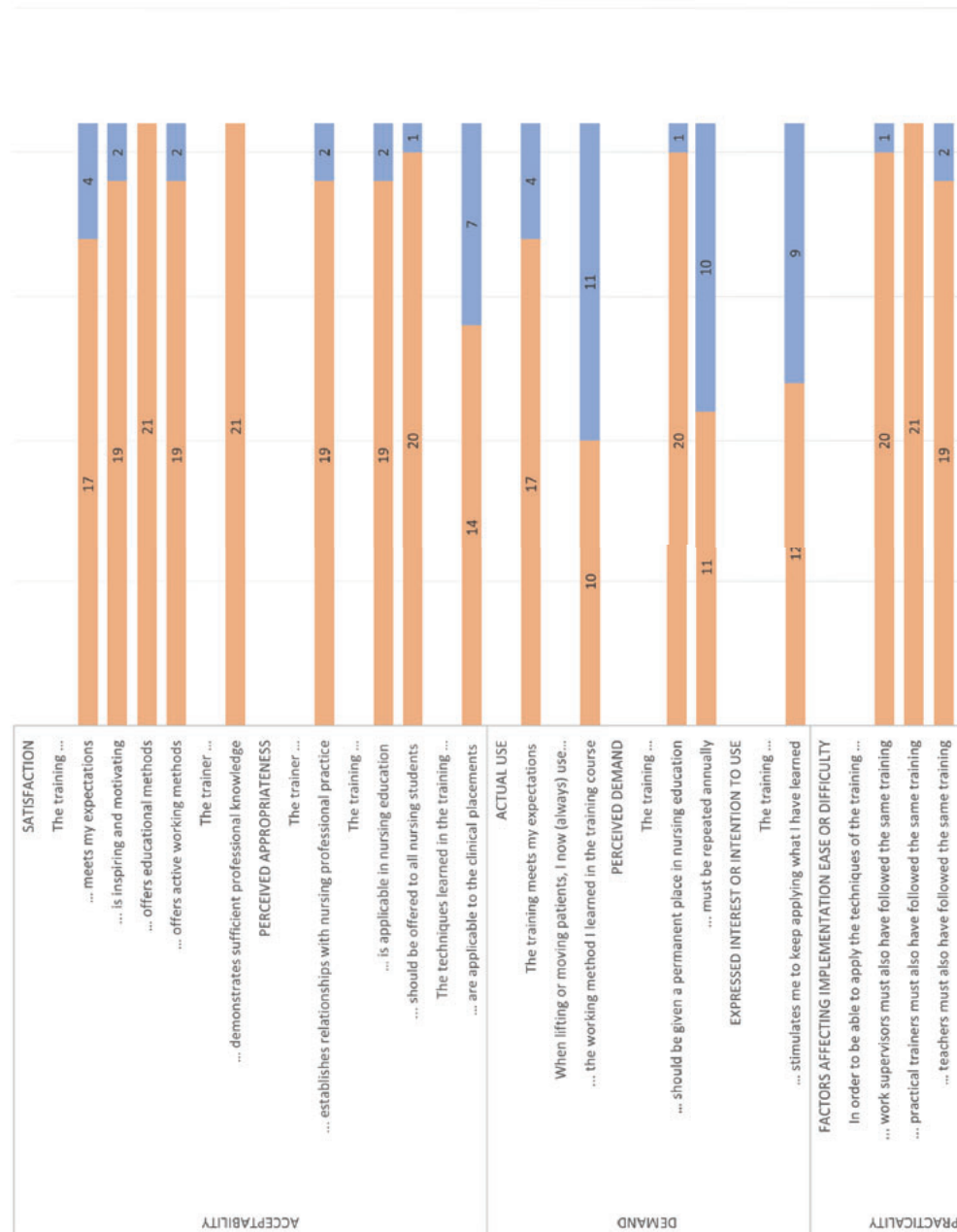
Pre-measurement	Total N (%) unless specified otherwise	Intervention N (%) unless specified otherwise	Control N (%) unless specified otherwise
Sample size, N	33	21	12
Sex (% female)	30 (90.9%)	18 (85.7%)	12 (100%)
Age (years), mean $\pm$ SD (range)	20.4 $\pm$ 2.5 (16-28)	20.4 $\pm$ 2.7 (16-28)	20.3 $\pm$ 2.1 (18-25)
BMI (kg/m ²), mean $\pm$ SD (range)	23.7 $\pm$ 4.2 (16.7-32.2)	24.7 $\pm$ 4.4 (17.5-32.2)	22.1 $\pm$ 3.5 (16.7-31.0)
Height (cm), mean $\pm$ SD (range)	170.4 $\pm$ 7.0 (158-190)	171.4 $\pm$ 7.6 (158-190)	168.8 $\pm$ 5.6 (161-177)
Weight (kg), mean $\pm$ SD (range)	69.2 $\pm$ 14.6 (50-102)	72.6 $\pm$ 15.0 (50-102)	63.2 $\pm$ 12.3 51-95
Current nursing education			
% intermediate vocational degree training	15 (45.5%)	11 (52.4%)	4 (33.3%)
% bachelor degree training	18 (54.5%)	10 (47.6%)	8 (66.7%)
Current study year			
% year 1	2 (6.1%)	2 (9.5%)	
% year 2	2 (6.1%)	1 (4.8%)	1 (8.3%)
% year 3	20 (60.6%)	11 (52.4%)	9 (75%)
% year 4	9 (27.3%)	7 (33.3%)	2 (16.7%)
Educational route			
% fulltime programme	27 (81.8%)	15 (71.4%)	12 (100%)
% work-study programme	6 (18.2%)	6 (28.6%)	
% Dutch as a first language (% yes)	30 (90.9%)	19 (90.5%)	11 (91.7%)

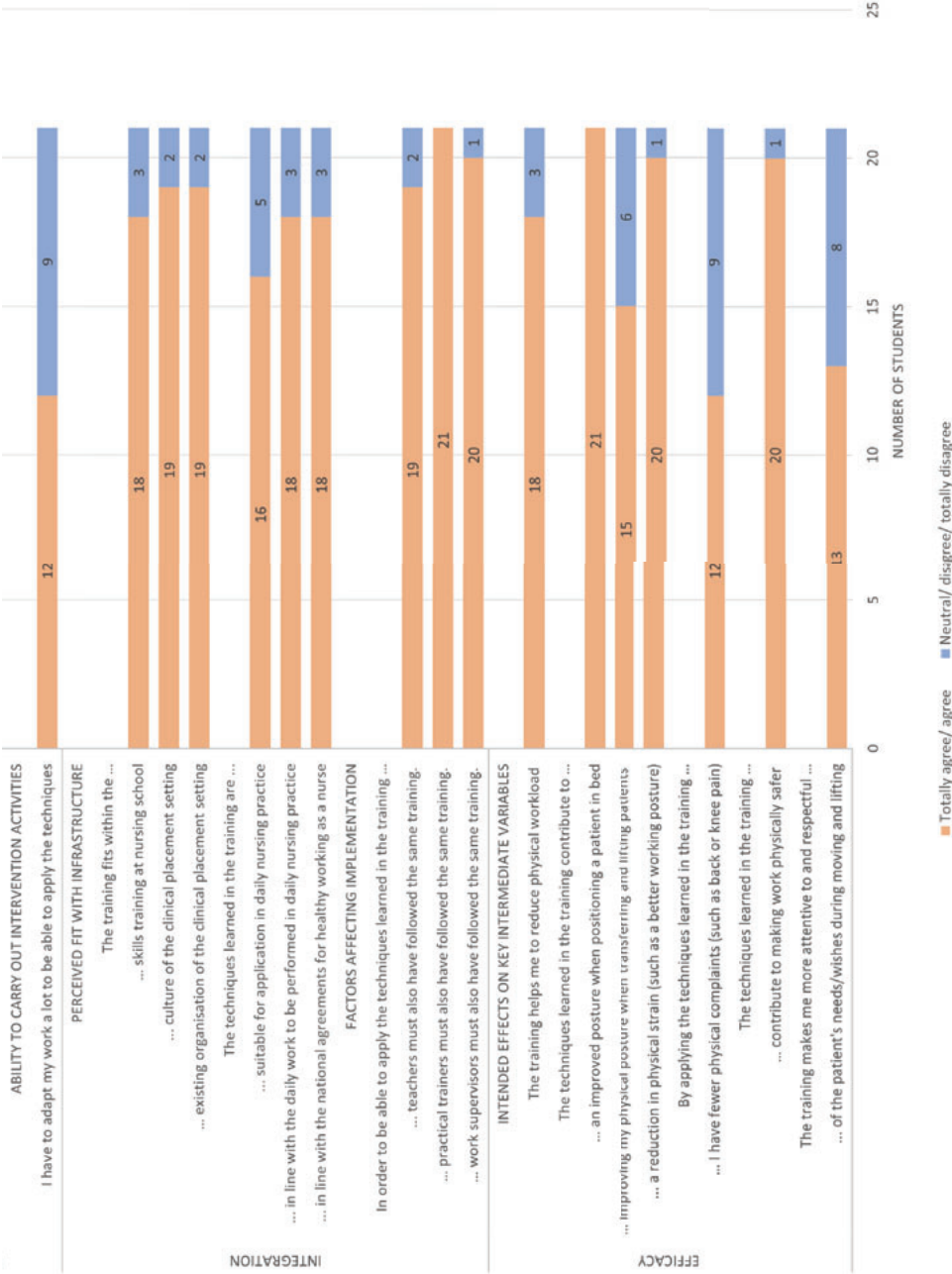
Evaluation of the training***Acceptability***

The post-training survey (figure 1) showed that most of the 21 students were satisfied with the training. The mean overall rating for the content and delivery of the training was 7.7 (SD 1.19) on a scale from 1-10. All students found that the trainer demonstrated sufficient professional knowledge, and the majority considered the content of the training as educating, activating, inspiring and motivating.

About two thirds of the students considered the techniques learned in the training to be appropriate to apply in their clinical placement and a majority of students

Figure 1
Evaluation of the intervention (N=21)





confirmed that the training is suitable for application in daily nursing practice. All but one student thought that the training should be offered to all nursing students.

According to the trainer, the students were eager to participate in the training. She had not experienced any reluctance, though sometimes was confronted with disbelief, with students asking questions like: “Is this [the haptonomic approach] really applicable in practice? It is nice what we practice on each other here, but what if it is with a real client?”.

Most students considered the training to be suitable, satisfying, favourable, and relevant to apply, both at nursing school and at clinical placement. This corresponds to a positive learning outcome on Kirkpatrick’s level 1: reaction.

Demand

Actual use

About half of the students in the intervention group stated that they applied the techniques they learned during the training when lifting or moving patients.

Perceived demand

Most students stated that the training should be given a permanent place in nursing education and just over half of the students (totally) agreed that training must be repeated annually.

The education manager and the nursing skills course holder agreed that nursing students need proper skills to prevent or reduce physical symptoms. Students should be made aware of and realise the importance of moving patients correctly, with attention to their own posture, to prevent or reduce physical symptoms. Both manager and course holder thought that it might be valuable to provide a refresher training to third-year students who are in the early stages of their clinical placement. It still needs to be discussed, however, whether this refresher training should be optional (voluntary) or mandatory.

Intent to continue use

About half of the students stated that the training stimulated them to continue to apply what they had learned. However, they had also a major comment about the training. It must also be offered to graduate nursing staff at the clinical placements, if it is to work properly.

“It is difficult to integrate it into my work because colleagues have not had the training. Because of this, I notice that sometimes you still help someone up under the armpits because a colleague is used to that and it has to be done quickly. It would be great if everyone followed the training so that a single line can be drawn.” (Female student, 20 years, fourth year, Bachelor level)

When learning about techniques that require tools, the tools must be available in the clinical placement.

“Sometimes this [applying the proper technique] is still difficult because the materials are not fully available, such as a sliding sheet.” (Female student, 20 years, fourth year, Bachelor level)

These findings correspond to a moderately positive outcome in behavioural change in Kirkpatrick’s learning level 3; The acquired knowledge can only be applied in the participant’s (working) environment if the preconditions are also met.

Practicality

Most students in the intervention group attended both training sessions. Three students attended only the first session and one student only the second one. Reasons for not attending one of the sessions were nightshifts and days off. Twelve students had used the book and three students had used the e-learning programme. Reasons for not using the book were lack of time, forgotten and overlooked (1 student each). Reasons for not using the e-learning programme were forgotten (8 students), lack of time (4 students), not interested or no need for it (3 students), and could not access the site (3 students). The interviewed trainer mentioned that the training duration had been too short to pay attention to the book and the e-learning.

The students made some suggestions for improvement of the training regarding: (1) delivery of the training in the context of real practice, and with real patients; (2) expansion of the training to graduated nurses; (3) availability of aids in daily practice; (4) the number of training sessions.

“Give the training on the ward in the presence of patients. Apply directly to a patient.” (Female student, 22 years, third year, Bachelor level)

The education manager and nursing skills course holder were positive towards the training concept, but also expressed their hesitancy to introduce it into nursing education due to the already overloaded curriculum.

“We are in the process of a curriculum review, which of course offers possibilities to investigate or to discuss with each other where it can be embedded in the curriculum. But again, our curriculum is really very full.” (education manager)

According to the education manager and nursing skills course holder, it is preferable to adapt the current training by integrating some of the principles of haptonomy, to gain a quick win for further implementation of the new approach within the current curriculum.

“To introduce the training into nursing education on a large scale, it is first necessary to look at what and how it is done now and to see if there are any quick wins to fully integrate it within the whole professional teaching team.” (education manager)

The trainer emphasised that students and healthcare professionals need to realize that it takes time and practice to master the techniques of the ergonomic patient handling training.

Integration

The majority of students had the opinion that the training should be given a permanent place in the nursing curriculum and 11 of 21 students thought that the training should be repeated once a year.

Both the education manager and nursing skills course holder acknowledged that there is room for improvement. Currently, training in patient transfer techniques is offered only once in the first year of the nursing curriculum. They both believe that the timing of the training within the curriculum is essential and that the training preferably should be offered shortly before students go on placement. According to them regular refreshment of what has been learned in training is equally important. Moreover, the proper integration of the principles of haptonomy in the lessons should be watched over continuously, and the teachers involved should be skilled. A train-the-trainer course may be useful. Cooperation with clinical placement settings in this matter is essential, but difficult.

“The biggest challenge remains, and will remain for a long time to come, that the clinical placement settings must then also adopt it. [...] I think that because of the delusions of the day, it is just enormously complicated to make time for this as a nurse, to get time for it.” (education manager)

The opinion of the trainer in this matter was clear; the training should be given in all nursing schools for nursing students, with regular refresher training, but also in practice for all graduated nurses, so that students and graduates use the same techniques.

Efficacy

All students agreed with the proposition that the methodologies in the training course contribute to an improved posture when moving patients in bed, and 18 students agreed that the training contributes to reduce physical workload (figure 1).

Twelve students mentioned that by applying the techniques from the training, they experienced fewer musculoskeletal symptoms (such as backache or knee pain). Also, 20 students indicated that the training techniques contribute to making work physically safer, and 13 students had the opinion that the training made them more attentive to and respectful of the patient's needs/wishes during moving and lifting activities.

Students in the intervention group had post-intervention more small positive changes in the occurrence of musculoskeletal symptoms, compared to students in the control group who had not received the intervention. (figure 2).

In answer to the open-ended question on the most important added value of the 'Ergonomic patient handling training', students mentioned an increased understanding of a correct posture and of haptonomic principles, and the experienced benefits of applying the newly learned techniques in moving and transferring patients.

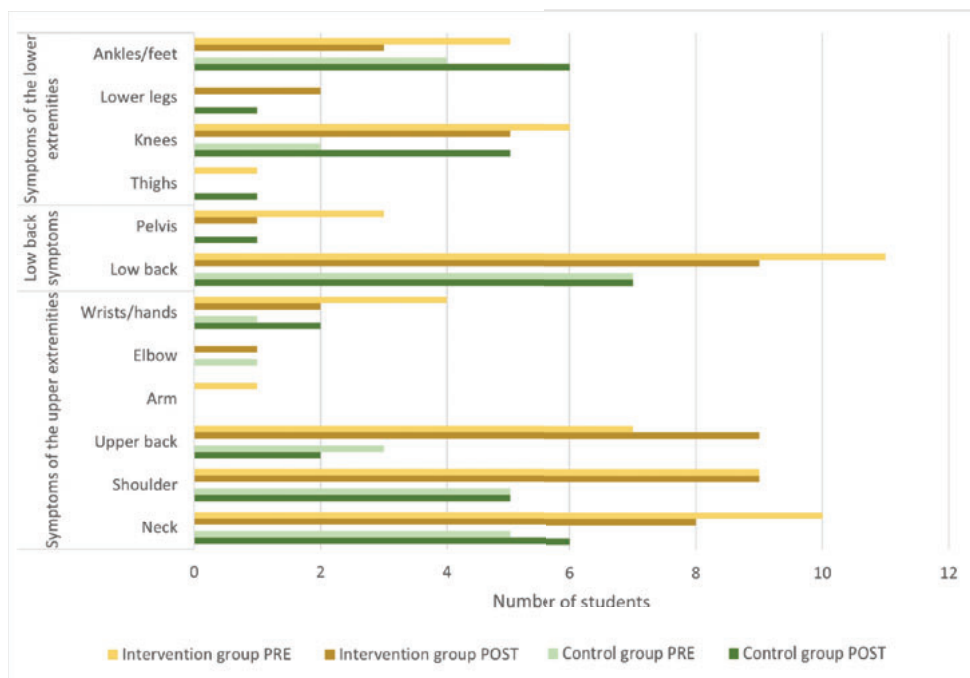
"The awareness that posture and small changes can make a big difference. That all work in healthcare does NOT have to be physically demanding. A statement of which I was astonished, but now I believe in it." (Female student, 21 years, third year, Bachelor level)

"Through this training I became aware that your posture has a lot of influence on your body and that you have to pay attention to that to avoid physical symptoms." (Female student, 20 years, third year, Bachelor level)

In the intervention group, there was a decrease in prevalence of symptoms of the neck (two students less) and of the low back (two students less), whereas in the control group there was an increase of neck symptoms (one student more), and no change was seen in the low back symptoms.

Figure 2

Musculoskeletal symptoms before and 10 weeks after the intervention between groups



In the intervention group, there was a decrease in prevalence of symptoms of the ankle/foot (two students less), whereas in the control group two students had an increase of ankle/foot symptoms (figure 2). In both groups, there was a slight increase of visits to a care provider for musculoskeletal symptoms (one student more in the intervention group, and two students more in the control group). Both groups had to perform lifting and bending activities; students in the intervention group had higher scores for lifting and bending (mean $\pm$ SD; 29.05 ± 13.98) compared to students in the control group (mean $\pm$ SD; 18.86 ± 8.88). For both groups the lifting and bending scores remained well below 50. A score between 50 and 80 indicates a substantial physical exposure of between 50 and 80 major physical tasks per workday.

The education manager and nursing skills course holder expressed their concern about the high prevalence of musculoskeletal symptoms among nursing students. The figures evoked recognition. They were, however, somewhat pessimistic about the adherence to safe patient handling techniques in clinical practice, especially

when there is a gap between learned skills and practical reality. Thus, the occurrence of musculoskeletal symptoms seems almost inevitable.

“The longer people [i.e., nurses] work in the field, the more they make their own way in whatever they do. The work protocol is gradually abandoned and more and more they find their own way that works, sort of, for that person.” (nursing skills course holder).

DISCUSSION

This study explored the feasibility of a training based on ergonomic patient handling techniques.

As for the acceptability of the training, the students were largely positive about the theoretical and practical content, the clarity of the goals, the expertise of the trainer, the educational material and the training’s practicality. Students believe that the training should be offered to all nursing students. There are, however, a number of challenges concerning the integration of the current training in the nursing curriculum. We believe that offering the training at the clinical placement site may have the advantage that not only nurse students, but also registered nurses and other direct patient care staff can participate. First, it is important that all care professionals have knowledge of, accept the principles of, and work conform the ergonomic conventions, maintaining a correct posture and using haptonomy to invite patients to move with you. Only then, registered nurses can function as role models. Second, patient-handling training may be more meaningful in the clinical placement setting, as the learned techniques can be directly put into practice. Dehghani, Ghanavati, Soltan, Aghakhani, and Haghpanah⁽⁴²⁾ found that nursing students who obtained clinical competency at the clinical placement demonstrated a better communication and cooperation with their instructor and with each other. They were more confident and had better understanding, and the amount of learning in practical skills was enhanced.

Drawbacks of on-site training are the large number of clinical placements in varying settings. As a consequence, delivery of the training to all students cannot be ensured. For some settings, in particular mental health care, a training of patient handling techniques may be less important. Moreover, it may not be efficient to organise the two-session training in a setting with only a small number of nursing students placed.

In the end, broad management support and cooperation between nursing education and clinical placement settings is essential for a profound implementation of such training. ErgoCoaches, trained ward nurses who are specialised in applying ergonomic principles, should ensure that the right actions are actually taken^(43, 44). The heavy workload in clinical practice contributes to the lack of attention to ergonomic work among both students and qualified nurses. It is also important that when ergonomic interventions are taught to students at school, they should also be embraced and incorporated in practice⁽⁴⁵⁾. This will have a positive effect on the impact of the intervention.

We also found that for some of the students in our study, it was not possible to apply the learned techniques in clinical practice. First, they were confronted with the unavailability of materials needed to apply the principles of ergonomic patient handling, such as a ReadySlide, a thin and foldable sliding sheet to ease various types of transfers, an Easy-Slide and a SlideX, additional tools for donning and doffing elastic stockings by caregivers. Second, students mentioned that the colleagues they worked with were not familiar with these techniques. As mentioned-above, this warrants training of both students and clinical supervisors, trainers and other nurses at the clinical placement site. A systematic review by Koppelaar et al⁽⁴⁶⁾ showed that several barriers and facilitators may influence the implementation of preventive interventions on patient handling in health care, including individual factors (e.g., motivation and ability), and environmental factors (e.g., social support, wide appeal, or patient-related factors). All such factors should be considered for successful implementation of ergonomic patient handling. Olinski and Norton⁽⁴⁷⁾ in detail describe the efforts to implement a safe patient-handling programme over a period of eight years. They indicated that the challenge lies in the sustainability of the initial benefits of the program and creating a culture change within the organisation.

We did not aim to assess the effectiveness of the techniques of ergonomic patient handling, but the comparison of the presence of musculoskeletal symptoms in the intervention or control group at baseline and the end of our study showed a tendency in favour of the training for symptoms of the lower extremities in particular.

In addition to a decrease in musculoskeletal symptoms in the intervention group, the principles of haptonomy could also have contributed to better patient outcomes. These principles are based on touch^(29, 30). Touching patients in nursing

is very common. Nurses touch patients regularly in various activities, such as giving instructions, bathing, and patient transfers. It is a valued aspect of providing care. Touch calms, reassures, shares warmth and provides stimulation⁽⁴⁸⁾. The effect of expressive physical touch with verbalisation on anxiety and dysfunctional behaviour in clients with dementia was investigated by Kim and Buschmann⁽⁴⁹⁾. They found that anxiety is lower immediately following expressive physical touch with verbalization and that expressive physical touch with verbalization causes decreasing episodes of dysfunctional behaviour⁽⁴⁹⁾. The use of haptic principles during patient transfer activities contributes to a better mutual understanding between nurse and patient.

Students in our study showed an increased awareness of the potential value of integrating ergonomic and haptic principles in patient transfer techniques. Some of them had experienced positive effects. It is important that when subjects such as an ergonomic patient handling training are taught to nursing students at school, this has to be embraced by the clinical placements as well. Further research into the effectiveness of an ergonomic patient handling training is needed.

Strengths and limitations

To our knowledge, our study is the first to study the feasibility of an ergonomic patient-handling training that is based on the principles of haptics. A strength of our study is the use of the feasibility framework of Bowen⁽³¹⁾ combined with the four levels of Kirkpatrick's evaluation model⁽³²⁾, as well as the use of a pre-post design, with an intervention and control group. Another strength was that the questionnaire used had been tested for face validity.

A limitation could be that the obtained data was measured on self-reported and not on observed behaviour. Self-reporting may contain social desirability bias. To address social desirability bias, we maintained subject anonymity and assured confidentiality⁽⁵⁰⁾. In addition, the results of our study should be interpreted with caution, because this study is limited in scale, scope and sample size, as is inherent to most feasibility studies. In addition, the study groups and the clinical placement settings were not fully comparable, and, therefore, the tentatively positive results concerning the effectiveness of the training should be considered with extra caution.

The COVID-19 pandemic may have influenced the findings, as various students were relocated to other clinical placement settings after finishing the training. They were unable to put the learned activities into practice at their original clinical placement

setting, but they could apply it in a different placement setting. In this study, we did not assess the areas Adaptation, Practicality and Expansion of Bowen's framework; thus, it is not known to what extent the training is feasible with regard to these aspects.

Implications for research and practice

The feasibility including efficacy and effectiveness of the training should be further explored. The current study results can serve as a basis for further research on the effectiveness of the ergonomic patient handling techniques, using a randomised controlled-trial design.

For students to be able to work according to the principles of safe and respectful patient handling, support from management in practice and at the clinical placement, as well as training of faculty staff, clinical supervisors and mentors is necessary.

CONCLUSION

Overall, we can conclude that students regarded the training based on ergonomic patient handling techniques including the principles of haptonomy as suitable, satisfying, attractive, and instructive. They also considered it feasible for use and integration in a nursing curriculum, and that it should be offered to all students. At management level, concerns were raised for integration of the training, including the already overloaded curriculum. Regular repetition of the training is necessary to ensure that what has been learned is retained. To properly implement such training within the nursing curriculum, support from the education manager and clinical placement settings is indispensable. The training increased the students' awareness of proper patient handling; small changes in the occurrence of musculoskeletal symptoms are promising for the training effectiveness.

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Chapter 9

General discussion

Introduction and objectives

This thesis contributes to the knowledge of determinants and predictors of musculoskeletal complaints and dropout among nursing students from the training programme and novice nurses from the nursing profession. Current evidence emphasises the need for preventive strategies in nursing education to retain nursing students and prevention of developing physical symptoms. This thesis evolves around the relationship between dropout from education and physical health symptoms in nursing students, the role of this relationship in prevention and the translation of this concept to educational and clinical practice.

The central aim of this thesis was to explore 1) the determinants of physical health and late dropout from nursing education and 2) available interventions aimed at improving physical health of nursing students or novice nurses to prevent dropout. This was elaborated in three parts. The first part mapped out the motives and determinants that contribute to dropout among student and novice nurses. In the second part determinants and predictors were identified for a) The intention to leave and actual dropout and b) Musculoskeletal complaints (MSCs) and physical work factors among nursing students and novice nurses. Lastly, part three described the feasibility and effectiveness of preventive interventions with regard to physical resilience. The current chapter intends to discuss on the main findings of this thesis. A number of methodological issues will be critically reflected upon. This chapter concludes with a presentation of practical implications for education and practice, and provides implications for future research.

Main results in perspective

Nursing student dropout and novice nurse turnover

This thesis showed that various determinants are associated with nursing students' intention to leave nursing education, students' actual dropout from nursing education, and novice nurses' turnover from the nursing profession. The specific focus of this thesis was students' and novice nurses' dropout due to physical health complaints, and more specifically MSCs. To prevent students from leaving nursing education and novice nurses from leaving the profession, it is crucial to understand the aspects that are associated to this turnover.

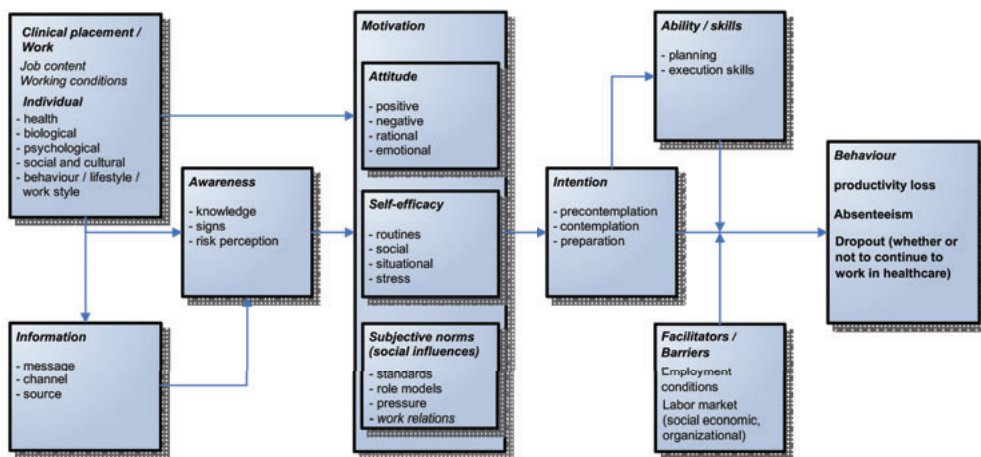
The findings of this thesis showed that various factors derived from clinical placement and work experiences have impact on nursing students' and novice

nurses' emotional state and commitment to become a professional nurse, or to stay committed to the nursing profession. In this discussion, we will discuss some of these factors in more detail and place them in a broader context.

In the introduction the integrated explanatory model for behavioural change as a framework for determinant research (figure 1) was introduced⁽¹⁾.

Figure 1

Integrated explanatory model for behavioural change as a framework for determinant research. Based on de Vries, Dijkstra⁽¹⁾.



This model shows that the clinical placement/work and the obtained information with regard to the working conditions and job content have influence on the students awareness and motivation. Job content as well as working conditions have impact on the individual student or novice nurse. They become aware of their own physical and psychological health, including their own behaviour, lifestyle and workstyle. This awareness influences their attitude, self-efficacy and subjective norms (social influences)⁽¹⁾. Positive placement or work experiences, will contribute to a positive attitude and more motivated individuals. Not surprisingly, in our study we showed that negative placement or work experiences, have the opposite effect, and may lead to dropout (**chapter 6**). This is influenced by the rational and emotional aspects of the individual. The situational and social context of the placement or work contributes to the individuals' self-efficacy, as well as routine tasks and stress related factors⁽¹⁾. Especially the social context of the clinical placement or work

setting, i.e. the feeling of belonging and being accepted in the team, is important for both nursing students and novice nurses (**chapter 3**). Especially in the transition process from student to novice nurse, the feeling of belonging to and acceptance in the team are crucial.

For novice nurses, the transition from nursing student to novice nurse can be very difficult. Newly graduated nurses are seen as accomplished competent nurses, but do not always feel that way. Our qualitative study (**chapter 3**) has shown that they often feel that they are insufficiently competent, when they are expected to be. This affects their self-efficacy and motivation. Work pressure and heavy workload contribute to increased job dissatisfaction, the inability to deliver high-quality care and a work-life imbalance (**chapter 3**). The increased responsibilities of novice nurses after graduation attribute to this. Social influences such as role models, working relationships, and a supportive work environment are important aspects for students and novice nurses to stay motivated and satisfied. These factors influence the motivation of novice nurses whether or not to stay in the profession. We will elaborate on these topics in more detail. To facilitate the transition process, various tailored new graduate nurse transition-to-practice programmes have been developed. Such programmes aim to support novice nurses to work competently and confidently, to facilitate their professional transition, and to encourage their commitment to a career in nursing. In this discussion chapter we will have a closer look at some of these programmes such as those in the United States, the United Kingdom and the Netherlands.

Our study showed that male nursing students have a higher risk to dropout (**chapters 4 and 6**). Male nursing students and male novice nurses are in the minority and have fewer role models. This may contribute to their lower motivation. Keeping men in nursing can help solve the nursing shortage. That is why we will discuss this issue more closely.

The main focus of this thesis was dropout from nursing education and the nursing profession because of physical (musculoskeletal) health complaints. The prevalence rates of MSCs in nursing students are high, but do not directly lead to dropout (**chapter 5**). MSCs, however, do contribute as predictors for dropout (**chapter 6**). Therefore, we will discuss this in more detail.

The above mentioned topics all contribute to dropout or dropout prevention. Addressing this requires a change in behaviour (figure 1). Motivation is a prerequisite

for change; the behavioural change may apply to the student or novice nurse, but may also apply to colleagues or the institution or department. It is important to approach change from a person-centred perspective⁽²⁾. To retain novice nurses for example, tailored transition-to-practice programmes may be required. This, however, must be facilitated by employers or employers' associations and may require governmental support. Before discussing the above mentioned topics in more detail, I would like to highlight briefly my personal experiences and perspective as a male nurse (box 1).

Box 1

Personal perspective⁽³⁻⁶⁾

Personal perspective

Being a registered male nurse and nursing educator myself, the wellbeing of nursing students and novice nurses have my profound interest. Although it has been 36 years since I graduated, certain experiences as a student and as a new graduate remain vivid. I can still recall the feeling of pride when I started working as an eighteen year old nursing student in my first clinical placement, wearing a uniform for the first time. Soon, however, I also realised that not all professional nurses were willing to work with me and teach me the tricks of the trade. Some nursing colleagues found students a nuisance and a burden. For me, this meant that at times I was reluctant to go to my clinical placement, because I was afraid of having to work with certain colleagues. These colleagues did not give me that essential feeling of belonging, contrary their attitude contributed to my feelings of insecurity, stress and frustration. Other colleagues, on the other hand, were very welcoming and open to mentoring students. Automatically, I started to focus more on the colleagues who enjoyed working with students and wanted to share their knowledge and experiences. These colleagues helped to ensure that I did not dropout of the training prematurely. Fortunately, the other colleagues were in the minority, but their impact was considerable. It required resilience to deal with this in a proper manner, but the positive influences and behaviours of motivated mentors helped me to do so. This helped me to use my experiences to make the experiences of others better than my own. First as a graduated nurse, later as a nursing educator. Various studies⁽³⁻⁶⁾, including our qualitative study (**chapter 3**) show that such practices still occur, and I would like to advocate that colleagues in the field pay more attention to this.

When I started nursing school, I was probably quite naive about the gender gap in nursing. For me, the overriding aim was to be able to provide proper nursing care. In my class, starting with approximately 20 nursing students, there were five male nursing students. Two of them dropped out during the training. Nine students (including the three remaining men) graduated within the regular training time. One male colleague decided not to work as a nurse after his graduation and continued to study for another profession. My interest in the experiences of male nurses has developed primarily during this PhD research. It struck me that the results of our study showed that being male is both a determinant and a predictor of dropping out of nursing education. I became eager to learn more about the reasons why men enter nursing school, and the reasons why being a man is a determinant as well as a predictor of dropout. This offers opportunities for future research.

Musculoskeletal complaints in nursing students

We cannot ignore the fact that musculoskeletal complaints among nursing students are already very high. In our study (**chapter 5**) we found that the overall regular or long-lasting MSCs in participating nursing students was 78.6%. These MSCs occurred in either one or more parts of the body. Most students (99.5%) indicated that these complaints were clinical placement related. High overall MSC or low back prevalence rates in nursing students are reported in various countries around the world, with yearly rates varying between 36.9% and 83%; Australia 80.0%⁽⁷⁾, Brazil, 73.8%⁽⁸⁾, Ghana, 70.1%⁽⁹⁾, India, 81%⁽¹⁰⁾, Italy, 80%⁽¹¹⁾, Japan, 36.9%⁽¹²⁾, Korea, 73.3%⁽¹³⁾, Saudi Arabia, 71.1%⁽¹⁴⁾, South Africa, 83%⁽¹⁵⁾, Sweden, 67%⁽¹⁶⁾, Turkey, 73.2%⁽¹⁷⁾, and the USA, 53.8%⁽¹⁸⁾. These figures indicate that the problem of MSCs is not a regional one. The high prevalence rates of MSCs in nursing students indicate that low back problems in nursing staff develop already during the period of nursing school training, rather than after nurses enter the workforce⁽¹⁹⁾. This is worrying, as several studies show that MSCs do eventually lead to dropout⁽²⁰⁻²²⁾. Nursing student populations should, therefore, be a target group for MSC preventative strategies, and nursing schools and clinical placement settings should respond accordingly⁽²³⁾. We found that lifting and bending activities contributed to the experienced MSCs (**chapter 5**). Good posture and not exerting force during patient transfers contribute to the prevention of musculoskeletal complaints. Our systematic review (**chapter 7**) showed that proper effective interventions to prevent work related MSCs in nursing students and novice nurses are lacking, and the described intervention effects were small and inconsistent. In **chapter 8** we described a feasibility study based on physically safe and respectful patient transfer techniques, including the applied principles of ergonomics and haptonomy. These techniques comply with the National occupational health and safety regulations⁽²⁴⁾, and may contribute to proper and safe patient transfer techniques including lifting and bending activities. It should be considered that the techniques for transferring patients learned in nursing school are not always applied in the clinical placement⁽²⁵⁾. Swain, Pufahl⁽²⁵⁾ showed that nursing students indicated that they were frequently unable to use recommended techniques in practice, mostly because of the influence of other nurses. The differences between various clinical placement settings with regard to implementation of patient transfer techniques are sometimes very large with regard to availability of manual handling aids, time constraints and patient needs⁽²⁵⁾. The ability of nursing students to provide high quality patient care depends in part on their capability to maintain their own health and well-being⁽¹⁹⁾.

In our study that investigated the (sociodemographic and workplace) determinants which are significantly associated with experienced MSCs (**chapter 5**), we found that female students are at greater risk of developing MSC than male students. Various studies, in the general population as well as in the nursing population, show that the MSC prevalence rates are systematically higher in women than in men^(11, 26-29). A combination of biological, psychosocial, and cultural differences between men and women, such as the role of hormones, differential anatomy, muscle strength and joint stability, may contribute to the sex differences in MSC prevalence^(30, 31). Sex differences should be considered in the prevention of MSCs among nursing students. This will contribute to the development of better strategies for preventing MSCs in both male and female nursing students. In all cases, the National occupational health and safety at work regulations and guidelines must be observed⁽²⁴⁾. In the Netherlands ErgoCoaches are appointed to facilitate the implementation of these guidelines in clinical practice. An ErgoCoach is a nurse who works on the ward like the other nurses, but is trained and specialised in ergonomic principles⁽³²⁾. Yearly surveys among ErgoCoaches, however, point to a lack of training expertise, and time for ErgoCoaches to perform the activities expected from them⁽³³⁾. There is hardly any attention for ErgoCoaching in nursing education, and ErgoCoaching is not a first priority for students in practice either⁽³⁴⁾. The heavy workload in clinical practice contributes to the lack of attention to ergonomic work among both students and qualified nurses. A mixed methods study among 42 registered nurses in the US showed that the heavy workload often impedes their ability to use proper body mechanics, ask for help from colleagues, or use equipment that could reduce injury risk. The time required to access equipment and the location of the equipment sometimes resulted in nurses deciding not to retrieve equipment that could reduce the risk of injury when lifting patients⁽³⁵⁾. We hear similar reports among health care staff and nursing students in the Netherlands⁽³⁶⁾. This indicates that attention to ergonomic work remains important in nursing education as well as in practice and that attention to patient transfer techniques alone is not sufficient to bring about behavioural change in ergonomic work.

The clinical placement setting

The clinical placement setting can be both protective and risky for nursing students regarding MSCs and dropout. In our study where we looked at determinants that were associated with MSCs (**chapter 5**) we found that a clinical placement in home care, contributed to increased complaints of the low back in nursing students. Our

prediction model (**chapter 6**) on the other hand showed that a third year clinical placement in either elderly care, home care or home care proved to be statistically significant protective predictors for late dropout.

The clinical placement setting plays an important role when describing reasons for (late) drop-out of nursing students⁽³⁷⁾. Most nursing students are required to do internships in various clinical placement settings. Clinical professional experiences are essential to any nursing programme; students generate vivid practical experiences, they learn from the experiences of professionals in the workplace, and they are able to make the link between theory and practice⁽³⁸⁾. Many schools of nursing, however are struggling to find adequate clinical placements for their students⁽³⁹⁾. Reasons for the shortfall include increasing numbers of nursing students that enrol in nursing education programmes and expected shortages of registered nurses in the near future⁽⁴⁰⁾. The shortage of clinical placements and the lack of proper supervision and role models due to nursing staff shortages may contribute to an increase in drop-out from nursing school⁽³⁷⁾. In the Netherlands, in 2018, Universities of Applied Sciences felt compelled to impose a capacity limitation due to the shortage of clinical placements for nursing students. Without this capacity limitation, the universities of applied sciences could not guarantee the quality of new graduates⁽⁴¹⁾. As a reaction, the Dutch government launched the “Working in Care” action programme, to deal with staff shortages and to create sufficient clinical placement settings for nursing students⁽⁴²⁾. This programme helped to ensure that most universities of applied sciences no longer had a *numerus fixus* as of 2019⁽⁴¹⁾. The report “Bijlage Monitor Actieprogramma Werken in de Zorg” shows a slight increase of clinical placement settings in 2018-2019⁽⁴³⁾. Data on the number of clinical placements realised in 2019-2020 are not available yet. This number however is even more interesting because of the impact of the COVID-19 pandemic. Due to COVID there was less time to train or supervise students at the clinical placement, with the result that clinical placements were postponed. In order to resolve the problem of shortage of clinical placements in the short term, it remains important for nursing schools to consult with training partners, clinical placement settings and other care institutions to coordinate possible scenarios.

The results of our qualitative study among dropped out novice nurses (**chapter 3**) showed that a feeling of belonging at the workplace is important and contributes to the retention. A positive placement setting and a feeling of belonging are equally important for retaining nursing students. A good clinical placement setting that

contributes to a positive placement experience needs a structural relationship between the student and a supportive mentor. To ensure effective student mentoring, an individual, mutual, supportive relationship is important⁽⁴⁴⁾, and the mentor should have human qualities and pedagogical skills^(45, 46). A perceived lack of emotional and practical support from mentors and team during clinical placements contributes to the reasons for nursing students to dropout⁽⁴⁷⁾. In Ten Hooft's study participating students expressed feelings of not being welcomed as part of the team, and had concerns about lacking the knowledge to deliver good care⁽⁴⁷⁾. The mentor and team's involvement in learning and competence acquisition of the student during clinical placements are necessary conditions for good placement management and contribute to a sense of security and belonging⁽⁴⁸⁾. Negative and unsatisfactory experiences of clinical placements influence students' decision to leave the programme^(44, 49, 50). Clinical placement settings may benefit from more support and a more general supportive attitude of placement staff towards the students, especially when these students are exposed to unpleasant placement experiences⁽⁴⁹⁾.

From student to novice nurse; a process of transition

In **chapter 3** we outlined the turnover motives of former novice nurses. Here we will elaborate more specifically on three of these motives. These motives are related to factors affecting the transition from student to novice nurse. Novice nurses going through a smooth transition have a positive feeling of belonging within the team, have a healthy sense of competence, and are satisfied with their work despite the potential workload. Often, however, this transition does not go smoothly.

A feeling of belonging

A supportive environment in the workplace is crucial for novice nurses to stay in the profession. The support is not only necessary to make the transition process easier, but also contributes to a feeling of belonging (**chapter 3**). A feeling of belonging, also described as relatedness, refers to the desire to feel connected and attached to others⁽³⁾. The feeling of belonging to a team and of being accepted as part of this team has proved crucial to the professional identification process and commitment of both students and novice nurses⁽⁴⁾. When novice nurses are not supported by their team, this will affect their self-confidence, teamwork and patient care^(5, 6). Besides the team support, it is also important for novice nurses to receive support from patients, physicians and supervisors⁽⁵¹⁾. However, novice

nurses are often confronted with negative experiences by patients and doctors⁽⁵²⁾. Negative experiences with patients or patients' family include aggressive behaviour, feelings of not being respected and even sexual harassment. Negative experiences with doctors include feeling ignored and belittled, bullying, and not being treated as a professional⁽⁵¹⁾. A lack of support from colleagues, patients, physicians and supervisors contributed to 29.5% of novice nurses considering leaving the nursing profession in the study of Vogelpohl, Rice⁽⁵²⁾, among 135 novice nurses. 11.3% of them reported that they were ignored or secluded by colleagues⁽⁵²⁾. Respect and compliments from doctors on the other hand boosted the self-confidence of novice nurses, and contributed to their job satisfaction^(51, 53, 54). For novice nurses, to feel confident in their performance in the first year after graduation, a supportive and empathetic relationship with colleagues is important. According to Duchscher⁽⁵⁵⁾ during the first 12 months after graduation, novice nurses need a stable working environment that is supportive and encouraging, that provides regular and frequent feedback and offers opportunities to exchange work experiences with colleagues. Encouraging support from colleagues contributes to an increased sense of belonging, and thus to a better transition. A sense of belonging is important for all new graduated nurses⁽⁵⁶⁾. A sense of belonging is equally important for nursing students during their clinical placements, and also deserves due consideration from nursing schools and clinical placement settings alike⁽⁵⁷⁾.

Perceived competence

Novice nurses are qualified, but do not always feel competent. Novice nurses sometimes have doubts whether they have mastered the required competences well enough, to fulfil their role as an entry-level nurse professional (**chapter 3**). In the Netherlands the nursing professional profile is based on a classification of seven roles and areas of competence, based on the systematics of CanMeds (Canadian Medical Education Directions for Specialists)⁽⁵⁸⁾. The starting professional is described in the professional profile of nurses. In it, each area of competence (CanMeds role) is described separately. Each competence area has been elaborated in a number of competences and key concepts. They provide a basis for the elaboration of competences within Bachelor of Nursing education. The core of professional practice is the nurse as care provider. All other roles touch on this central role. The role of care provider gives direction to the other CanMEDS roles. (figure 2).

Figure 2

Areas of competence (CanMeds roles) in the professional profile of nurses ⁽⁵⁸⁾



The competencies are not only expected at novice nurse level; ultimately all registered nurses are accountable to meet these competencies throughout their careers relative to their specific context and/or patient population⁽⁵⁹⁾. During their nursing training and clinical placements nursing students are guided in their learning process. Often they have to perform single and individual tasks^(60, 61). In this way, they develop the necessary competencies to be able to work well as staff nurses after graduation. In the transition period from student to staff nurses, however, they are often considered as full registered nurses; they are fully employed, and have to deal with multitasking and more complex nursing tasks. They are expected to be competent and work without direct supervision⁽⁶¹⁾. They experience new challenges, increased responsibilities and high demanding work requirements, that they did not experience before graduation. They also come to realise that their experiences in clinical placements during nursing training do not always match the reality of daily practice as a registered nurse. Some novice nurses do not feel certain, confident and competent in this new role. They feel that they are not up to the challenge, and face a 'reality shock'⁽⁵⁵⁾. They also feel that the responsibility of the work is not in proportion to their competence⁽⁶²⁾. Novice nurses have greater risk for errors than experienced nurses; the primary types of errors committed by novice nurses appear to be medication errors, errors

that result in patient falls and errors in delay of treatment⁽⁶³⁾. They lack the guidance and ability to fall back on an experienced colleague, resulting in increasing stress, anxiety, dissatisfaction, and ultimately turnover. This phenomenon has also been described by Higgins, Spencer⁽⁶⁴⁾ and Teoh, Pua⁽⁶⁵⁾. The transition from nursing student into newly graduated nurse should receive more attention, already during nursing education. To become competent as an expert nurse, a novice nurse passes through five stages: novice, advanced beginner, competent, proficient and expert⁽⁶⁶⁾. Novice nurses develop their professional competence by learning from clinical practice and reflecting on the experiences they gain during the course of their profession. Support and empowerment of experienced colleagues is indispensable in this process. Novice nurses should therefore receive more support and empowerment into their new role as a registered nurse. Currently, there is still a gap between what is expected of nursing students and what is expected of novice nurses. A qualitative study by Clark and Holmes⁽⁶¹⁾ with focus groups and individual interviews, revealed that a majority of newly graduated nurses were not ready for independent practice. Other qualitative studies showed that novice nurses perceived the transition period as stressful and anxious^(6, 60, 67, 68). Especially having to comply with the new managerial role with increased responsibilities and accountability was a main source of stress and pressure⁽⁶⁹⁻⁷¹⁾. Attention for this not only increases the confidence and competence of novice nurses, but will also contribute to better patient care. A supportive environment can contribute to an easier transition process, and thus to the retention of novice nurses.

Job satisfaction versus heavy workload

After graduation the responsibilities of novice nurses increase. We have already seen that they have to deal with multitasking and more complex nursing tasks. Besides the fact that some of them do not feel competent nor confident, this adds up to the already perceived heavy workload in the nursing profession. The perception of a heavy workload and increased responsibilities among novice nurses may contribute to physical and mental exhaustion and a sense of loss of control over patient care⁽⁷²⁾. Eventually this leads to the inability to deliver high-quality care and a work-life imbalance; novice nurses get more and more dissatisfied with their jobs, leading to turnover (**chapter 3**).

Various studies have shown the relation between workload, job satisfaction and work engagement in nurses. MacPhee, Dahinten⁽⁷³⁾ showed that when professional

care standards are not met and tasks are left undone, this affects the negative relationship between heavy workload and job satisfaction. In their mixed method study, Van Bogaert, Peremans⁽⁷⁴⁾ found that high and prolonged workload was related to decreased adequacy and efficacy of nurses, which negatively affected their satisfaction and engagement. Tomic and Tomic⁽⁷⁵⁾ found in their cross-sectional survey that nurses experiencing heavy workload, had lower scores on their work engagement. Heavy workload contributed to burnout in novice nurses⁽⁷⁶⁾, and was a predictor for burnout in novice nurses⁽⁷⁷⁾. A supportive work environment predicted work engagement, contributing to lower turnover intentions⁽⁷⁷⁾.

Tailored new graduate nurse transition-to-practice programmes

In order to retain novice nurses for the nursing profession, it is important to tackle the previous described issues of relatedness, perceived competence, heavy workload and job satisfaction, already during the transition process from student to novice nurse. In this regard various transition programmes have been developed facilitating the transition from student to new graduate nurses. Transition-to-practice programs share three primary goals: (1) to develop competent and confident registered nurses; (2) to facilitate professional adjustment; and (3) to develop a commitment to a career in nursing⁽⁷⁸⁾. Transition-to-practice programs include residencies, internships, mentorships, extended preceptorships, and generic programs⁽⁷⁹⁾. Most programmes were broad with different components, outcomes, and varieties in length, type of training and support among programmes. The presence of a transition-to-practice programme contribute to the retention of novice nurses and improved cost benefits⁽⁷⁹⁾. However, National initiatives to set up transition programmes are generally lacking.

In the United States, Magnet hospital features have been associated with lower nurse turnover and higher levels of job satisfaction⁽⁸⁰⁾. Magnet hospitals have also better supportive work environments. A supportive work environment contributes to a lower number of nurses reporting that they intend to leave the hospital⁽⁸¹⁾. Strategies such as creating environments that allows for nurses' autonomy in decision-making, participation in the governance of the unit and the hospital, and participative management can be valuable to retain nurses in the hospital setting⁽⁸¹⁾. Not only novice nurses will benefit from such strategies, but also nursing students. Rodríguez-García, Márquez-Hernández⁽⁸²⁾ found that the nursing students' perception of greater Magnet-like features at the clinical placement was associated with a better and more satisfactory clinical learning environment and learning process.

In the United Kingdom a Theory into Practice (TiP) educational programme was developed, to bridge the theory-practice gap for student children's nurses⁽⁸³⁾. A need to support the transition from nursing student to new graduate nurse was identified, to retain these nurses and help them become confident practitioners as quickly as possible. The TiP programme helps nursing students to acquire clinical competences, which contributes to a smoother transition into clinical practice. TiP gives nursing students a greater understanding of how the theory they learn applies to the care they provide⁽⁸³⁾. Investing in nursing students before they are qualified can help bridging the gap between theory and practice. This contributes to prepare them for their transition process.

In the Netherlands, more and more regional initiatives are employed to set up transition programmes for novice nurses. DeRotterdamseZorg is the partnership of 32 care and education organisations working together in the Rotterdam Rijnmond region to create a healthy labour market in care and welfare. DeRotterdamseZorg developed various programmes to retain (novice) nurses, including the 'Onboarding' toolbox. This toolbox aims to attract and retain new healthcare professionals to such an extent that the outflow percentage in the first two years after entering the health service moves towards the target of 7.5% and new professionals are more quickly integrated into the organisation⁽⁸⁴⁾. In the North Brabant region, too, there are initiatives to retain novice nurses. Transvorm is the partnership of employers in the care and welfare sector in North Brabant. More than 240 care and welfare organisations are affiliated to Transvorm. Transform also developed a 'Onboarding' toolkit, as well as the 'mentoring in care' toolkit. Both toolkits contain an integrated plan for finding, attracting and retaining care workers⁽⁸⁵⁾.

These transition programmes all contribute to the retention of novice nurses, but it would be good if there were more uniformity in these types of programmes. Attention for the transition process in nursing should, however, not only start after graduation, but should already have a place in the nursing curriculum.

Being male in nursing

Nursing is still seen as a predominately female oriented profession⁽⁸⁶⁾. The status of the nursing profession is considered low. The low status deters men from choosing nursing as a career⁽⁸⁷⁾. Recently, economics, career development, and job variety contributed to the resurgence of men back into nursing^(88, 89). The nursing profession becomes more attractive for men due to the variety in specialties and the scope for

career advancement; new nursing positions such as nurse practitioner and nurse consultant contribute to the increase of men in the profession⁽⁹⁰⁻⁹³⁾. Most common reasons for male nursing students to enter a nursing programme were job security, demand for nurses, career mobility and opportunities, nurse role models, and the wish to help others⁽⁹⁴⁾.

Despite men's increasing interest in becoming nurses, they are still at risk for dropping out. In our study male sex was statistically significant associated with both intention to leave and actual dropout from nursing education (**chapter 4**), and male sex was a predictor for dropout (**chapter 6**). This finding is in line with previous studies^(95, 96), who also found that being a male nursing student increases the risk of withdrawal from nursing education. Male nursing students are still limited in number. In our study only 9.8% were male. Similar male student sex rates have been reported; United Kingdom: 8.9%⁽⁹⁷⁾, Scotland: 8–10%⁽⁹⁸⁾, United States: 7-9%⁽⁹⁹⁾. Belonging to a minority contributes to gender stereotyping and a lack of role models. This contributes to gender-related barriers and feeling isolated both at the clinical placement as well as in the classroom⁽¹⁰⁰⁻¹⁰³⁾. Nursing education in general is still too much focused on the female approach to care. Nursing education could be more proactive in promoting an appropriate learning environment for male students⁽⁹⁴⁾. The role that men can and do play in care provision is often ignored^(104, 105). Moreover, the stereotype that men in the nursing profession are often seen as homosexual, feminine, or a sexual predator still exists⁽¹⁰⁶⁻¹⁰⁸⁾. Stereotypical influences are important when men choose to become nurses; but the gender role burden and difficulties in education seem to deter men from specifically contemplating a career in nursing⁽¹⁰⁹⁻¹¹¹⁾. In their mixed-method review, Younas, Sundus⁽¹¹²⁾ described various challenges male nursing students face during their education; students indicated that feminism in nursing education was evident from the start of their nursing program. In nursing education, courses were taught without taking into consideration that there were male students in the class and the learning needs of male students were often neglected. The summarised findings with regard to appropriate work settings, indicated that male students were in a constant state of confusion about which work environments are better suited for them. Educational and clinical policies contributed to the preferred female over male nurses in clinical placements and male nursing students experienced various clinical challenges such as rejection of being a male nurse, rejection from female patients, feelings of being accused of sexual harassment from female patients, discrimination from hospital staff and clinical educators, and lack of patient cooperation⁽¹¹²⁾.

In order to attract more men into nursing, gender equality within nursing education and the nursing profession is needed. The challenges faced by male nursing students during their nursing education and at clinical placements should be addressed in joint collaboration by nursing institutions and teaching institutions. This will eventually contribute to a more diversified nursing workforce, the retention of male nursing students and the attraction of more men to the nursing profession. This can help alleviating the shortage of nurses.

Methodological considerations / Strengths and limitations

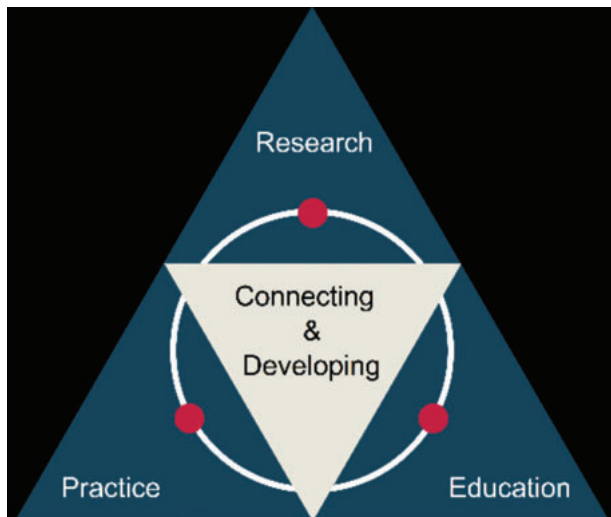
A few overarching strengths and limitations of the studies in this thesis should be mentioned. A strength of this thesis is the use of a longitudinal design. We followed participants over a 3-year period including the transition from student to novice nurse. A longitudinal study is the most valid and effective design to study determinants of an event later in time, but is also time consuming. In addition to this prospective cohort design we applied several other research designs to gain insight in the variety of topics of interest in the six studies that are described in this thesis. Throughout the studies, we aimed to overcome each successive study's limitations in a subsequent study with different designs. We started exploring our topics of interest with a study protocol in which we explained the construction of the questionnaire used for the cohort study; the obtained data eventually led to two studies exploring the determinants for dropout and musculoskeletal complaints, and a prediction model for dropout. The focus of the systematic literature review, identifying interventions to prevent physical health problems and dropout in nursing students and novice nurses yielded interesting information. We found that intervention effects were small and inconsistent and none of the included studies focussed on dropout, nor on novice nurses. We were able to perform a qualitative research design with 17 former novice nurses who left the profession within two years after graduation, to gain inside information about additional determinants for leaving. We organised 2 expert meetings with representatives from education, practice and research to reach consensus on possible interventions to test for feasibility for educational practice. This led to our feasibility study in which the "Lower-intensity patient handling" training, based on the principles of haptonomy was implemented and evaluated for feasibility and for possible barriers and facilitators.

This thesis contributes to all dimensions of practice-oriented research (figure 3); research, practice and education. The quality of these dimensions are supported

by three pillars: 1. practically relevant, contributing to sustainable development of practice in nursing and education; 2. methodically thorough, in the various designs, we made use of the state-of-the-art analysis techniques; and 3. ethically justified⁽¹¹³⁾. Where necessary, ethical approval was obtained from the Medical Ethical Review Committee of Erasmus MC. For all included studies the ethical procedures were followed with respect to informed consent, and researchers adhere to the five general principles of conduct for applied research in higher professional education⁽¹¹⁴⁾.

Figure 3

Connection between research, practice and education



We also encountered some limitations. In all our studies, we used self-reported data. Self-reported measures have the advantage that they are relatively easy to obtain. However, it is possible that the participating students had intentional (sociably desirable bias) or unintentional (recall bias) information biases that would negatively affect internal validity⁽¹¹⁵⁾. We cannot be sure that participants did not give sociably desirable answers; however, we have tried to overcome this by ensuring anonymity in the questionnaires and interviews in all studies. With regard to self-reported musculoskeletal complaints, it is possible that participants might over- or under-estimate the complaints. There was no incentive, however, to provide any inaccurate responses. The study could have been improved if an

objective measure of musculoskeletal complaints such as physical examination, was used. However, this was not feasible at this moment due to a lack of logistical and financial resources.

The total study group of our cohort study consisted of 711 third year students. The response rate at baseline was 71% of the total study population. Two hundred eighty four students (29%) did not complete the questionnaires or did not give their consent to the use of their data. The selection process may have influenced the results. The students who completed all the questionnaires in full and gave their consent to the use of the data dropped out less often, while the other students dropped out more often. In this regard we may have suffered from the ‘healthy survivor effect’. The ‘healthy survivor effect’ refers to a selection process whereby the participants in the study (i.e. survivors) tend to be healthier than those who declined to participate⁽¹¹⁶⁾. High-risk students were probably already more demotivated and delayed, which increased their reluctance to consent to participation. This may have led to an underestimation of the effects in our study. If we had been able to monitor these students earlier, it might have had a positive impact on their willingness to make their data available, leading to more power. This pleads for monitoring students earlier in the nursing programme, starting in year 1. Reasons for dropping out will be different in year 1 than in year 3 or 4. More students dropout in the first year of study due to wrong study choice or being unable to adapt to university^(117, 118). Monitoring students from year 1 onwards will contribute to an annual continuous monitoring system throughout the entire nursing education programme. It would be good to use digital questionnaires that provide immediate feedback per individual student; a system that is already applied at the research group Performing Arts Medicine of Codarts. The aim is to prevent health complaints and improve performance through practice-oriented research into the physical and mental health of dancers, musicians, circus artists, and athletes⁽¹¹⁹⁾. In this system every student (preferably from the first year on) gets an account within the system and will have access to personal data. After completing the questionnaire the student will be able to see, where possible, a comparison with norm or reference scores, along with a (previously developed) interpretation. Student scores can be followed over time. This gives students insight into their own physical and mental health scores, which they can share and discuss with their mentors if they wish. The data obtained will also provide relevant insights for nursing schools and clinical placement settings which can be used to retain nursing students.

For the feasibility study (**chapter 8**) we used an intervention and control group from two learning units. These learning units are quite different. The learning unit where the training was implemented was specialized in trauma surgery, orthopaedics and plastic surgery, and included 21 students, while the control unit was specialized in urology and gynaecology, and included 12 students. This may have affected the effectiveness results. However, as is inherent in all feasibility studies, the effects are limited in any case.

The data obtained were limited to nursing students from one university of applied sciences in Rotterdam, The Netherlands. The Netherlands has 17 universities of applied sciences that offer nursing courses at Bachelor degree level, and 43 regional education centres that offer nursing courses at intermediate vocational degree level. Therefore the transferability of the findings is a major limitation in our research. However, transferability was enhanced by targeted dissemination of the research results at various National and International symposia, meetings with representatives of the field and a closing project webinar, with participants from education, practice and research.

Implications for education and practice

This thesis provides useful insights regarding dropout and physical determinants and dropout predictors for education, practice and science. With the growing shortage of and increasing needs for nurses, these insights are valuable for educational- and nurse managers, policy makers and researchers.

From this thesis it became clear that nursing students already have many musculoskeletal complaints, mainly caused by physical clinical placement activities. At school nursing students are educated in patient transfer techniques. Often these techniques learned at school differ from the techniques which are applied in practice. Collaboration between nursing education and practice are essential to come to achieve alignment. This should not be restricted to training students only, but registered nurses should be trained as well. Ergo-coaches at the clinical placement, skills teachers and institutional teachers could play an essential role here. Appropriate implementation of interventions is often hindered by practical barriers. Such barriers should be addressed appropriately, for the sake of the physical health of nursing students and registered nurses. Nurse educators should keep in mind that the skills training lessons for patient transfer techniques at

nursing education are limited and these lessons alone cannot stop the onset of musculoskeletal complaints in nursing students.

To prevent musculoskeletal symptoms in nursing students it is fundamental that proper intervention programmes are developed. **Chapter 8** has shown that from the perspective of nursing students a training based on the principles of ergonomics and haptonomy could be feasible. Applying principles of ergonomics and haptonomy in patient transfer techniques, contributes to prevent physical overload among nurses. However, since this was only a feasibility study, it is recommended that more research be conducted to examine the effects of the training in a larger context in terms of scale, scope and sample. Prevention of musculoskeletal complaints in nursing students can contribute to the retention of nurses. In all cases, the National occupational health and safety at work regulations must be observed. To get a better understanding of nursing students with musculoskeletal complaints, study coaches should be more consequent in discussing physical health problems with students, and reporting of these problems in the student tracking system (Osiris).

In order to prevent students from dropping out of nursing school, it is important for nurse educators, clinical supervisors and health care organisations to invest in nursing students. Clinical supervisors and workplace colleagues can be seen as role models⁽¹²⁰⁾. A role model serves as an example to students and new nurses alike. They can assist students and new nurses in their professional development, competence and confidence in the workplace.

Special emphasis should be placed on men in nursing training. The nursing profession is still predominantly female⁽⁸⁶⁾. The lessons at school and the clinical placement settings are geared to this. For some men, this is a barrier to starting nursing training, for others it is a reason for leaving^(87, 96). In the development of the nursing curriculum nurse educators should be aware that men's health issues are important to be addressed and included. For male nursing students, it can be important to experience, be exposed to and receive support from male nursing role models. This would contribute to more equality and inclusiveness of men in the nursing profession, and eventually to less male nurse dropout. In addition, it might be interesting to look at the effectiveness of student groups in which more men are represented. This could also contribute to the further inclusiveness of men in nursing education and in the profession. Nursing schools could benefit from experiences in primary education. In primary education a successful campaign was launched to draw attention to more men in primary education. The

number of male teachers in primary education increased from 20% to 33%⁽¹²¹⁾. A similar campaign could be helpful to draw attention to more men in nursing.

In order to gain nursing experiences, it is essential for nursing students to do clinical placements. Clinical placements are required to gain practical experiences, but they also contribute to how the nursing profession is perceived by the student. Although, for various reasons, schools of nursing are struggling to find adequate clinical placements for their students, it remains important to invest in them. The shortage of clinical placements should, at all costs, not be at the expense of the quality of the supervision of the student. Nursing schools, health care institutions, and governments must do everything in their power to create sufficient clinical placements and ensure quality supervision for nursing students.

Future research

The studies presented in this thesis have provided a number of interesting suggestions for future research. To begin with it would be important to further explore the role of MSCs. It would be interesting to see what triggers the onset of MSCs in nursing students. Therefore, such research should start already at the beginning of nursing training. Research on MSCs should not be limited to self-reported questionnaires, but should preferably be investigated with objective measuring instruments such as a physical examination or a physical fitness test, as well.

It would be interesting to further explore the reasons why men choose for a nursing career, their experiences during nursing education and their reasons for either continuing or discontinuing a career in nursing. Insight in these aspects may contribute to the recruitment and retaining men in nursing.

The positive evaluation of the feasibility study indicates a promising follow up of the “Working in a physically safe and respectful manner” intervention, based on the principles of ergonomics and haptonomy. Interventions such as these contribute to increasing students’ awareness of their own working posture as well as the patient’s posture while lifting and moving patients. Additional research could be done by conducting a large-scale randomised controlled trial, involving more students and clinical placements. It would be recommended to explore this further.

More research should be done to investigate the transition-to-practice and onboarding programmes. Such programmes intend to retain novice nurses within

the profession. However, there is no or limited uniformity in these programmes. It would be good to investigate what these programmes entail, to gain a better understanding of their effects and to see if there can be more consistency in these programmes. Attention for the transition process in nursing should, however, not only start after graduation, but should already have a place in the nursing curriculum.

It will be important to see how we can get around the “healthy survival effect”. Quite a large number of students did not give their consent for the use of their data. It seems that especially these students dropped out more often. This group of students is therefore more interesting to follow, so we may be able to prevent them from dropping out by means of targeted interventions. This can be tackled by using different recruitment strategies, and by monitoring nursing students already at the start of their education.

GENERAL CONCLUSION

In this thesis, we have learned that dropout rates among students in the final years of nursing education are small. However, musculoskeletal complaints among the same population are high, with most complaints being related to the clinical placement. This may lead to future turnover. To keep nurses in the profession now and in the future, it is therefore inevitable that nursing schools and placement institutions should pay attention to this. There needs to be better coordination between what students learn at school about correct lifting and bending activities and proper patient transfer techniques, taking into account their own attitude as well as the patient’s perception, and how this is dealt with in practice during clinical placements. Besides, it occurs regularly that students, but also graduates, ignore the National occupational health and safety arrangements for correct patient transfers, due to heavy workload. This deserves attention during both training at school and during clinical placements. Moreover, the positive evaluation of the feasibility study indicates a promising follow up of this study through a large randomized controlled trial. Still, future studies should investigate the impact of musculoskeletal complaints in nursing students in relation to turnover from the nursing profession early in the career. All in all, the implications that we have discussed on the basis of our findings can be summarised by five key messages that could help us are in adequate prevention of nursing student dropout and novice nurse turnover: 1. continuous collaboration between nursing schools and clinical placement settings,

to ensure sufficient clinical placements and proper supervision of students, 2. attention to the high rate of MSCs among nursing students and compliance with national occupational health and safety regulations on lifting and moving patients, 3. continuing monitoring the nursing student population, starting in year 1, 4. more recruitment and attention to men in nursing, and 5. more attention to the transition process from student to registered nurse, starting within the nursing education program.

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Summary

Shortages in the nursing workforce are of growing concern worldwide. Various factors contribute to these shortages; an aging workforce that is retiring, an aging patient population with comorbid complex conditions including physical and mental problems, that require more nursing care, and a declining number of new workforce entrants. Student and novice nurse attrition are of growing concern. It is therefore important to retain nursing students within education, and novice nurses within the nursing profession as much as possible. In order to retain student nurses, it is imperative to understand the determinants and predictors that contribute to their potential dropout. Both physical and mental health problems contribute to nursing student dropout rates. In **chapter 1**, the general introduction, we described the background of this thesis. The focus of this thesis is on the physical resilience of nursing students and novice nurses in order to contribute to the retention of this particular group of (student) nurses.

Chapter 1 concludes with providing the research questions and an outline of the thesis. This thesis is divided into three parts.

PART I

Mapping the motives and determinants that contribute to the intention to drop out and the actual drop-out rate among student and novice nurses

Chapter 2 describes the protocol of the protocol of the SPRiNG cohort study. Three cohorts of third-year nursing students are followed for 2.5 years. Students enrolled from the Bachelor of Nursing program of the Rotterdam University of Applied Sciences. At baseline, students received a self-administered questionnaire. Primary outcome was dropout from nursing education and dropout from the nursing profession. Data on dropout from nursing education were retrieved from the student administration on an annual basis. Dropout from the nursing profession was measured one year after graduation, using the self-reported questionnaire. Secondary outcomes were presenteeism and sick leave (during internship/work). Besides student characteristics, the questionnaire also asked about physical and mental clinical placement/work characteristics, personal and behavioral factors, and experienced physical and mental burden. Main aims of this study were to determine: 1) the prevalence and incidence rates of dropout, 2) the protective and risk factors, and early indicators of dropout, and 3) the interaction between these factors and the indicators. When the SPRiNG protocol article was published, the

data analysis was in progress. Findings from this study were used as input for the dropout and physical complaint determinant articles (chapters 4 and 5) and the prediction model article (chapter 6).

To find out what motives Dutch novice nurses' have for leaving the profession within two years after graduation, we carried out a qualitative research. **Chapter 3** describes the outcomes of individual semi-structured interviews with seventeen former novice nurses. The aim of this study was to unravel Dutch former novice nurses' reasons, experiences and the circumstances (possible unknown determinants) that contributed to their professional turnover from bedside nursing. Data was collected and analysed following the principles of Thematic Analysis, leading to six themes; 1) Lack of challenge; ambitious to progress further in management or research roles. 2) Lack of passion; no feeling of passion for patient care. 3) Lack of perceived competence; not feeling "up to the challenge". 4) Lack of job satisfaction due to heavy workload; work-life imbalance and inability to deliver high-quality care. 5) Lack of work capacity due to non-work-related health conditions; unmet requirements for job or work environment adjustment. 6) Lack of feeling of belonging; suffering from a negative attitude of colleagues to one another. The motives for leaving were both intrapersonal and work-related and were intertwined. Based on our findings, we recommend capacity building for student and novice nurses, including provision of mentors and enhancement of the individual's self-esteem. Novice nurses with further professional, personal and intellectual ambitions should be given the opportunity to develop further in order to keep them motivated. Supervisor support and the development of a tailored personal development plan are essential for this. To make novice nurses feel safe and reassured transition and onboarding programmes, with the support from colleagues and supervisors are important.

PART II

Determinants and predictors of intention to leave, actual dropout and musculoskeletal complaints in nursing students and novice nurses

Chapter 4 studied the association between physical work factors and MSCs and intention to leave as well as actual dropout from nursing education among students at a Dutch University of Applied Sciences. The questionnaire described in chapter 2 was used. Baseline data from three third-year nursing student cohorts (N=711) were used between May 2016 and May 2018 on four domains. Dropout data was

obtained from the university's student administration. Backward binary multiple logistic regression was used to examine the relationship with intention to leave and late dropout. Multivariable analysis was used to test for different determinants for intention to leave and actual dropout. Reported intention to leave at baseline was 39.9%. Actual dropout was 3.4%. At baseline 79% reported regular MSCs. 99.5% was clinical placement related. The following seven determinants were statistically significantly associated with the intention to leave nursing education: male sex (OR 2.04; CI 1.186-3.49), Visual Display Unit (VDU)-work (OR 0.67; CI 0.46-0.98), physical activity (OR 1.03; CI 1.00-1.06), decision latitude (OR 0.55; CI 0.35-0.88), co-worker support (OR 0.61; CI 0.41-0.91), distress (OR 1.88; CI 1.32-2.68) and need for recovery (OR 1.01; CI 1.00-1.02) were associated to the intention to leave.

Living situation (not living with parents) (OR=2.26; CI 0.97-5.28), male sex (OR=3.10; CI 1.10-9.80) sick leave (OR 2.17; CI 0.91-5.18) and decision latitude (OR 0.39; CI 0.15-1.00) were significantly associated to actual dropout.

Of all students 40% intended to leave at baseline, but the number of actual dropout students was low (3.4%). This study showed that MSCs were not associated with intention to leave and actual dropout and of the physical work factors only VDU work was associated with intention to leave. Although we didn't find an association between MSC and intention to leave and actual dropout, we found that the prevalence of MSCs among our students is surprisingly high. Early detection of MSCs and proper physical workload training remain therefore important.

Because the MSCs were high (79%), we examined possible cross-sectional associations between sociodemographic and workplace characteristics in different clinical placement settings, and self-reported MSCs at two timepoints in nursing students. The results of this study were described in **Chapter 5**. Questionnaire data on sociodemographic, physical and psychosocial work characteristics, and MSCs were used (chapter 2). Generalized estimating equation analysis with backward binary multiple logistic regression was used to examine possible cross-sectional associations with experienced MSCs. Four determinants; i.e., sex (i.e. female), lifting and bending, physical job demands, and need for recovery, were found to be statistically significantly associated to MSCs in all three anatomical areas. Clinical placement setting and study route in nursing education were significantly associated to MSCs in two anatomical areas. Psychosocial determinants were associated with experienced MSCs in the upper extremities area, and BMI with MSCs in the

lower extremities. Monitoring of these determinants with early intervening during education might prevent musculoskeletal complaints in nursing students.

To understand what factors contributed to the prediction of late dropout in student and novice nurses, we identified in **chapter 6** physical, mental or other predictors and derived a simple model for identifying students with significant increased dropout risk. A total of 406 respondents from 2 student cohorts completed all three questionnaires over a three year period (2016-2018). Physical and psychosocial work characteristics were included in the questionnaire. Backward binary multiple logistic regression analyses were used to build a prediction model. Data on dropout from nursing education were obtained from the university's student administration. Data on early dropout from the profession were obtained from the completed questionnaires at the third measurement and telephone follow-up.

Dropout from nursing education and at the start of the nursing career totalled 12%. Twelve factors, including male sex (OR 3.76, 90% CI 1.65-8.57), age (OR 1.06, 90% CI 1.01-1.11), migration background (OR 2.42, 90% CI 1.25-4.68), clinical placement setting (including mental healthcare; OR 0.18, 90% CI 0.05-0.65), musculoskeletal symptoms (OR 1.20, 90% CI 1.05-1.38) and psychosocial work characteristics (including exposure to violence; OR 3.12, 90% CI 1.45-6.74) were statistically significant predictors in our dropout model. The explained variance of the final model was 26%. The study highlights the importance of taking musculoskeletal and mental health symptoms, psychosocial work characteristics, as well as sex, age and migration background into consideration as predictors for dropout among nursing students and novice nurses. This study is a first step towards a predictive model that helps identifying high-risk groups.

PART III

Effectiveness and feasibility of preventive interventions with regard to physical resilience

The review in **chapter 7** provided an overview of interventions implemented in nursing schools aimed at preventing physical health problems among student or novice nurses. The implementation of effective interventions in nursing schools may result in a decrease of physical health problems and can contribute to the retention of student nurses in nursing education and novice nurses in the nursing profession.

The CINAHL, EMBASE, ERIC, MEDLINE, the Cochrane Library, Web of Science, and Google scholar databases were systematically reviewed for articles providing data on education/work dropout and musculoskeletal symptoms. After screening 7111 titles and abstracts, eleven studies were included, with a total of 1634 participants. Seven studies evaluated interventions for moving/handling training. Four evaluated other interventions. None focused on our primary outcome education/work dropout. All studies reported on physical complaints among student nurses only. Overall, risk of bias was high and clinical heterogeneity prohibited pooling of data. Intervention effects were small and inconsistent. In conclusion, evidence for the effectiveness of interventions in the nursing curricula for the prevention/treatment of physical complaints is scarce and where available conflicting. We recommend high quality research on dropout due to physical health problems, as well as on the prevention/treatment of physical complaints.

Chapter 8 shows that an ergonomic patient handling training, based on the principles of haptonomy can be a feasible approach for use and integration in a nursing curriculum. In a pilot, the training was delivered to 21 nursing students who were doing their clinical placement in a learning work unit at Erasmus MC. Twelve students from another learning work unit formed the control group. For this study, quantitative and qualitative methods were combined and four elements of Bowen's feasibility model (acceptability, need, implementation, and integration) were assessed through attendance lists, evaluation surveys among the nursing students who participated in the training, and interviews with the trainer, the education manager and the technical skills course holder. Most students felt that the methodologies in the training course contribute to an improved posture when moving patients in bed. They found the training inspiring and motivating and found that the training helps to reduce physical strain. The mean rating for the training on a scale from 1 to 10 was 7.7 (range 5–10). The pre-training and post-training questionnaires showed a decrease of musculoskeletal symptoms in the low back and lower extremities in the intervention group. Therefore small changes in the occurrence of musculoskeletal symptoms are promising for the training effectiveness. Broad management support and cooperation between nursing education and clinical placement settings remain essential for a successful implementation of the training.

Finally, in **chapter 9**, the general discussion, some of the key findings of the studies in this thesis are further discussed, followed by some methodological considerations. To conclude, recommendations for practice and future research were presented.



Samenvatting

Het tekort aan verpleegkundig personeel is wereldwijd een groeiend probleem. Verschillende factoren dragen bij aan deze tekorten: vergrijzende personeelsleden die met pensioen gaan, een vergrijzende patiëntenpopulatie met co-morbide complexe aandoeningen, waaronder fysieke en mentale problemen, voor wie meer verpleegkundige zorg nodig is, en een afnemend aantal nieuwkomers op de arbeidsmarkt. Het verloop onder studenten en beginnende verpleegkundigen is een groeiende bron van zorg. Het is daarom belangrijk om verpleegkundestudenten zoveel mogelijk binnen het onderwijs en beginnende verpleegkundigen zo veel mogelijk binnen het verpleegkundig beroep te houden. Om verpleegkundestudenten te behouden, is het noodzakelijk de determinanten en voorspellers te begrijpen die bijdragen aan hun mogelijke uitval. Zowel fysieke als mentale gezondheidsproblemen dragen bij tot het uitvallen van studenten verpleegkunde. In **hoofdstuk 1**, de algemene inleiding, hebben wij de achtergrond van dit proefschrift beschreven. Dit proefschrift richt zich op de fysieke weerbaarheid van studenten verpleegkunde en van beginnende verpleegkundigen om zo bij te dragen aan het behoud van deze specifieke groep (student-)verpleegkundigen.

Hoofdstuk 1 sluit af met de onderzoeksvragen en een schets van het proefschrift. Dit proefschrift is onderverdeeld in drie delen.

DEEL I

In kaart brengen van de motieven en determinanten die bijdragen aan de intentie tot uitval en de daadwerkelijke uitval onder studenten en beginnende verpleegkundigen

Hoofdstuk 2 beschrijft het protocol van de SPRiNG-cohortstudie. Voor dit onderzoek werden drie cohorten derdejaars studenten verpleegkunde van Hogeschool Rotterdam 2,5 jaar gevolgd. De studenten kregen op drie momenten een vragenlijst, op baseline (in het derde jaar van hun opleiding), een jaar later (in hun vierde studiejaar), en tweeënhalf jaar later (ruim een jaar na hun geplande diplomering). Primaire uitkomst was uitval uit de verpleegkundige opleiding en uitval uit het verpleegkundig beroep. Gegevens over uitval uit de verpleegkundeopleiding werden jaarlijks opgevraagd bij de studentenadministratie. De uitval uit het beroep werd één jaar na het afstuderen gemeten, met behulp van de derde vragenlijst. Secundaire uitkomsten waren presentisme (blijven werken ondanks gezondheidsproblemen) en ziekteverzuim (van stage of werk). De vragenlijst bevatte vragen naar demografische kenmerken van de studenten, hun

fysieke en mentale gezondheid, en de fysieke en mentale belasting van hun stage- of werkplek. De belangrijkste doelstellingen van deze studie waren het bepalen van: 1) de prevalentie en incidentie van uitval, 2) de beschermende en risicofactoren, en vroege indicatoren van uitval, en 3) de interactie tussen deze factoren en de indicatoren. Bevindingen uit het protocolartikel zijn gebruikt als input voor de artikelen over uitval en fysieke klachten (hoofdstukken 4 en 5) en het artikel over het predictiemodel (hoofdstuk 6).

Om te achterhalen wat de motieven van Nederlandse beginnende verpleegkundigen zijn om binnen twee jaar na afstuderen het beroep te verlaten, hebben we een kwalitatief onderzoek uitgevoerd. **Hoofdstuk 3** beschrijft de uitkomsten van dit onderzoek, gebaseerd op individuele semi-gestructureerde interviews met zeventien jonge ex-verpleegkundigen. Het doel van dit onderzoek was het ontrafelen van de redenen, ervaringen en omstandigheden (mogelijke onbekende determinanten) van Nederlandse beginnende verpleegkundigen die hebben bijgedragen aan hun besluit het beroep te verlaten. De gegevens werden verzameld en geanalyseerd volgens de principes van Thematische Analyse, wat leidde tot zes thema's; 1) Gebrek aan uitdaging; ambitie om verder te komen in management- of onderzoeksfuncties. 2) Gebrek aan passie; geen gevoel van passie voor patiëntenzorg. 3) Gebrek aan ervaren competentiegevoel; niet het gevoel hebben "de uitdaging aan te kunnen". 4) Gebrek aan arbeidsvreugde als gevolg van een hoge werkdruk; disbalans tussen werk en privéleven en ervaren onvermogen om zorg van hoge kwaliteit te leveren. 5) Gebrek aan arbeidsvermogen als gevolg van niet-werk gerelateerde gezondheidsproblemen; onvoldoende aanpassing van het werk of de werkomgeving. 6) Gebrek aan saamhorigheidsgevoel; lijden onder een negatieve houding van collega's ten opzichte van elkaar. De motieven om het beroep te verlaten waren zowel interpersoonlijk als werk gerelateerd en waren met elkaar verweven. Op basis van onze bevindingen bevelen wij versteviging aan van de capaciteitsopbouw voor verpleegkundestudenten en beginnende verpleegkundigen, waarbij mentoren moeten worden aangeboden en het individuele gevoel van eigenwaarde moet worden vergroot. Beginnende verpleegkundigen met verdere professionele, persoonlijke en intellectuele ambities moeten de kans krijgen om zich verder te ontwikkelen, zodat zij gemotiveerd blijven. De steun van een supervisor en de ontwikkeling van een op maat gesneden persoonlijk ontwikkelingsplan zijn hiervoor essentieel. Om ervoor te zorgen dat beginnende verpleegkundigen zich veilig en zelfverzekerd voelen, zijn transitie- en onboarding-programma's, en de steun van collega's en leidinggevend, belangrijk.

DEEL II

Determinanten en voorspellers voor de intentie tot uitval, daadwerkelijke uitval en klachten van het bewegingsapparaat bij studenten verpleegkunde en beginnende verpleegkundigen

Hoofdstuk 4 onderzocht het verband tussen fysieke werkfactoren en klachten aan het bewegingsapparaat en de intentie om de opleiding tot verpleegkundige te verlaten, alsmede de feitelijke uitval uit de opleiding. Baseline gegevens van drie opeenvolgende derdejaars cohorten verpleegkundestudenten (N=711) in de schooljaren 2015/2016 tot en met 2017/2018 werden gebruikt. Uitvalgegevens werden verkregen van de studentenadministratie van de hogeschool. Backward binary multiple logistische regressie analyse werd gebruikt om de relatie met de intentie om te stoppen met de opleiding en late uitval te onderzoeken. Multivariabele analyse werd gebruikt om de associatie te testen van verschillende determinanten op intentie om te vertrekken en de feitelijke uitval. De gerapporteerde intentie om te vertrekken op baseline was 39,9%. De feitelijke uitval was 3,4%. Op baseline gaf 79% aan regelmatig klachten aan het bewegingsapparaat te ervaren. Daarvan was 99,5% stage gerelateerd. De volgende zeven determinanten waren statistisch significant geassocieerd met de intentie om de opleiding verpleegkunde te verlaten: mannelijk geslacht (OR 2,04; CI 1,186-3,49), beeldschermwerk (OR 0,67; CI 0,46-0,98), fysieke activiteit (OR 1,03; CI 1,00-1,06), beslissingsruimte (OR 0,55; CI 0,35-0,88), steun van collega's (OR 0,61; CI 0,41-0,91), distress (OR 1,88; CI 1,32-2,68) en behoefte aan herstel (OR 1,01; CI 1,00-1,02).

Woonsituatie (niet inwonend bij ouders) (OR=2,26; CI 0,97-5,28), mannelijk geslacht (OR=3,10; CI 1,10-9,80) ziekteverzuim (OR 2,17; CI 0,91-5,18) en beslissingsvrijheid (OR 0,39; CI 0,15-1,00) waren significant geassocieerd met feitelijke uitval.

Uit de baseline gegevens bleek dat van alle deelnemende studenten 40% de intentie had de opleiding te verlaten, maar het aantal studenten dat de school daadwerkelijk verliet, was laag (3,4%). Uit deze studie kwam naar voren dat klachten aan het bewegingsapparaat niet geassocieerd waren met de intentie om te stoppen met de opleiding noch met daadwerkelijke uitval uit de opleiding. Van de fysieke werkfactoren was alleen beeldschermwerk geassocieerd met de intentie om te stoppen met de opleiding. Hoewel we geen verband vonden tussen klachten aan het bewegingsapparaat en de intentie om te stoppen en daadwerkelijke uitval, vonden we dat de prevalentie van klachten aan het bewegingsapparaat onder

onze studenten wel verrassend hoog was. Vroegtijdige opsporing van klachten aan het bewegingsapparaat en een goede training over omgaan met fysieke belasting blijven daarom belangrijk.

Aangezien het percentage studenten met klachten (79%) hoog was, onderzochten we mogelijke cross-sectionele verbanden tussen sociodemografische en stage- en werkgebonden kenmerken, en zelf gerapporteerde klachten aan het bewegingsapparaat op twee tijdstippen bij studenten verpleegkunde. De resultaten van deze studie zijn beschreven in **hoofdstuk 5**. Er is hierbij gebruik gemaakt van de vragenlijstgegevens over sociodemografische, fysieke en psychosociale werkkenmerken, en klachten aan het bewegingsapparaat (hoofdstuk 2). Hierbij werd gekeken naar klachten in drie anatomische gebieden: bovenste extremiteiten (inclusief de nek), lage rug, en onderste extremiteiten. Een generalized estimating equation analyse met achterwaartse binaire meervoudige logistische regressie werd gebruikt om mogelijke cross-sectionele verbanden met ervaren klachten aan het bewegingsapparaat te onderzoeken. Vier determinanten, te weten geslacht (vrouwelijk), tillen en buigen, fysieke taakeisen, en behoefte aan herstel, bleken statistisch significant samen te hangen met klachten aan het bewegingsapparaat in alle drie de anatomische gebieden. De stage setting en studieroute waren statistisch significant geassocieerd met klachten aan het bewegingsapparaat in twee anatomische gebieden. Psychosociale determinanten, zoals psychosociale werkeisen en distress, waren geassocieerd met bewegingsapparaatklachten in de bovenste extremiteiten, en BMI met bewegingsapparaatklachten in de onderste extremiteiten. Monitoring van deze determinanten met vroegtijdige interventie in het onderwijs zou klachten aan het bewegingsapparaat bij studenten verpleegkunde kunnen voorkomen.

Om te begrijpen welke factoren bijdragen aan de voorspelling van late uitval bij leerling- en beginnende verpleegkundigen, hebben we in **hoofdstuk 6** fysieke, mentale en andere voorspellers geïdentificeerd en hebben we hieruit een eenvoudig model afgeleid voor het identificeren van studenten met een significant verhoogd risico op uitval uit de opleiding en/of het verpleegkundig beroep. In totaal hebben 406 respondenten uit de eerste twee studentencohorten de vragenlijsten ingevuld. Backward binaire meervoudige logistische regressieanalyses werden gebruikt om het predictiemodel op te stellen. Gegevens over uitval uit de opleiding werden verkregen van de studentenadministratie van de hogeschool, gegevens over vroege uitval uit het beroep werden verkregen uit de ingevulde vragenlijsten bij de derde meting en telefonische follow-up.

De uitval uit de verpleegkunde opleiding en aan het begin van de verpleegkundige loopbaan bedroeg 12%. Twaalf factoren, waaronder mannelijk geslacht (OR 3,76, 90% BI 1,65-8,57), leeftijd (OR 1,06, 90% BI 1,01-1,11), migratieachtergrond (OR 2,42, 90% BI 1,25-4,68), stagesetting (inclusief geestelijke gezondheidszorg, OR 0,18, 90% BI 0,05-0,65), klachten aan het bewegingsapparaat (OR 1,20, 90% BI 1,05-1,38) en psychosociale werkkenmerken (inclusief blootstelling aan geweld; OR 3,12, 90% BI 1,45-6,74) bleken statistisch significante voorspellers in ons uitvalmodel. De verklaarde variantie van het uiteindelijke model was 26%. De studie benadrukt het belang van het in overweging nemen van fysieke en mentale gezondheidsklachten, psychosociale werkkenmerken, evenals geslacht, leeftijd en migratieachtergrond als voorspellers voor uitval onder verpleegkundestudenten en beginnende verpleegkundigen. Dit onderzoek is een eerste stap in de ontwikkeling van een predictiemodel.

DEEL III

Effectiviteit en haalbaarheid van preventieve interventies met betrekking tot fysieke weerbaarheid

De review in **hoofdstuk 7** geeft een overzicht van interventies die onderzocht zijn in verpleegkundeopleidingen gericht op het voorkomen van fysieke gezondheidsproblemen bij studenten of beginnende verpleegkundigen. Het implementeren van effectieve interventies in de opleiding tot verpleegkundige om fysieke gezondheidsklachten te voorkomen zal mogelijk ook bijdragen aan het behoud van verpleegkundestudenten in de opleiding en beginnende verpleegkundigen in het verpleegkundig beroep.

De databanken CINAHL, EMBASE, ERIC, MEDLINE, de Cochrane Library, Web of Science, en Google scholar zijn systematisch doorzocht op onderzoeken die gegevens verschaften over uitval uit opleiding/werk en klachten aan het bewegingsapparaat. Na screening van 7111 titels en abstracts werden elf studies geïncludeerd, met een totaal van 1634 deelnemers. Training in patiëntverplaatsingen was de meest onderzochte interventie (in zeven van de elf studies). Vier studies evalueerden andere interventies. Geen enkele studie richtte zich op onze primaire uitkomst uitval uit onderwijs of het verpleegkundig beroep. Alle studies rapporteerden alleen over fysieke klachten bij verpleegkundestudenten. Over het algemeen was het risico op bias in alle studies hoog en klinische heterogeniteit verhinderde het poolen

van gegevens. Interventie-effecten waren klein en inconsistent. Concluderend, bewijs voor de effectiviteit van interventies die ingezet zouden kunnen worden in de verpleegkunde opleiding voor de preventie van fysieke klachten is schaars en waar beschikbaar tegenstrijdig. Goed en betrouwbaar onderzoek naar uitval uit de opleiding en/of het verpleegkundig beroep als gevolg van fysieke gezondheidsproblemen, alsmede naar preventie/behandeling van fysieke klachten is dan ook noodzakelijk.

Hoofdstuk 8 laat zien dat een ergonomische training in patiëntverplaatsingstechnieken die gebaseerd is op de principes van haptonomie, een veelbelovende en haalbare aanpak is voor toepassing in het verpleegkundeonderwijs. In een pilot werd de training gegeven aan 21 verpleegkundestudenten die stage liepen op een leerwerkdienst van het Erasmus MC. Twaalf studenten van een andere leerwerkdienst vormden de controlegroep. Voor deze studie werden kwantitatieve en kwalitatieve methoden gecombineerd en werden vier elementen uit het haalbaarheidsmodel van Bowen (aanvaardbaarheid, behoefte, implementatie en integratie) beoordeeld aan de hand van presentielijsten, vragenlijsten onder de studenten verpleegkunde die aan de training deelnamen, en interviews met de trainer, de onderwijsmanager en de houder van de cursus verpleegtechnische vaardigheden. De meeste studenten vonden dat de methodieken in de training bijdragen aan een verbeterde houding bij het verplaatsen van patiënten in bed. Zij vonden de training inspirerend en motiverend en waren van mening dat de training helpt om de fysieke belasting te verminderen. De gemiddelde waardering voor de training op een schaal van 1 tot 10 was 7,7 (range 5-10). De vragenlijsten voor en na de training toonden een afname van musculoskeletale klachten in de lage rug en de onderste ledematen in de interventiegroep. Deze kleine verbeteringen in het optreden van klachten aan het bewegingsapparaat zijn veelbelovend voor de effectiviteit van de training. Brede steun van het management en samenwerking tussen de verpleegkunde opleiding en de stage-instellingen zijn essentieel voor een succesvolle implementatie van de training.

In **hoofdstuk 9**, de algemene discussie, worden de belangrijkste bevindingen van de onderzoeken in dit proefschrift nader besproken, gevolgd door enkele methodologische kanttekeningen. Tot slot worden aanbevelingen gedaan voor het onderwijs, de praktijk en voor toekomstig onderzoek.



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Curriculum Vitae

Jos Kox (1964) was born in Eersel, the Netherlands. After obtaining his high school diploma at Rythoviuscollege, he moved to Dordrecht, where he started the in-service nursing training in the former municipal hospital, to become a general nurse. After his graduation Jos decided to fulfill his substitute conscription in combination with the in-service training for psychiatric nurse at 'Zon en Schild' in Amersfoort. From 1999 Jos started working as a sociotherapist at psychiatric hospital 'De Grote Rivieren' in Dordrecht. At the same time he did the training as a Social Psychiatric Nurse (SPN) at Hogeschool Midden Nederland in Utrecht. He completed his SPN internship at the children's and youth department of RIAGG Eindhoven and the Kempen, where he also started working as an SPN member after graduating. In the meantime, he studied the Community Health Officer course at Hogeschool Leiden. Between 1995 and 2003 Jos worked for the Netherlands and International Red Cross Society in various war and conflict areas, including Rwanda, the former Yugoslavia, Yemen, Afghanistan, Sri Lanka, Sudan and Israel and the Palestinian territories. In 2001 Jos decided to do the Master of Community Health at the School for Tropical Medicine, University of Liverpool in the United Kingdom. His interest in the research field arose by the qualitative research he conducted in Cambodia. Since 2003 he has been working in the Bachelor of Nursing program at Rotterdam University of Applied Sciences and in 2015 Jos started his doctoral research into the dropout of nursing students from nursing school and novice nurses from the nursing profession due to physical work factors and musculoskeletal complaints. The PhD trajectory was initiated from research centre Innovations in Care in collaboration with the Department of General Practice of ErasmusMC. Jos is currently working as a university lecturer / researcher in the nursing program and the research centre Innovations in Care of Rotterdam University of Applied Sciences.



Jos Kox (1964) is geboren in Eersel. Na het behalen van zijn HAVO diploma aan het Rythoviuscollege, verhuisde hij naar Dordrecht, alwaar hij begon aan de in-service opleiding tot A-verpleegkundige in het voormalige gemeenteziekenhuis. Na zijn diplomering besloot Jos zijn vervangende dienstplicht te vervullen in combinatie met de in-service opleiding tot B-verpleegkundige bij Zon en Schild in Amersfoort. Vanaf 1999 is Jos als sociotherapeut gaan werken bij GGZ De Grote Rivieren in Dordrecht. Tegelijkertijd deed hij de opleiding tot Sociaal Psychiatrisch Verpleegkundige aan Hogeschool Midden Nederland in Utrecht. Zijn SPV stage volbracht hij bij de kinderen jeugdafdeling van RIAGG Eindhoven en de Kempen, waar hij na diplomering ook als SPV-er ging werken. Ondertussen volgde hij ook de opleiding Community Health Officer aan Hogeschool Leiden. Tussen 1995 en 2003 werkte Jos voor het Nederlandse en Internationale Rode Kruis in diverse oorlogs- en conflictgebieden, waaronder Rwanda, voormalig Joegoslavië, Jemen, Afghanistan, Sri Lanka, Sudan en Israël en de Palestijnse gebieden. In 2001 besloot Jos de Master of Community Health te gaan doen aan de School for Tropical Medicine, Universiteit van Liverpool in het Verenigd Koninkrijk. Via het kwalitatieve onderzoek wat hij verrichtte in Cambodja werd zijn interesse voor het doen van onderzoek gewekt. Sinds 2003 werkt hij bij de opleiding HBO-Verpleegkunde aan Hogeschool Rotterdam en in 2015 begon Jos aan zijn promotieonderzoek naar uitval van verpleegkundestudenten en beginnende verpleegkundigen uit het verpleegkunde onderwijs of het verpleegkundig beroep als gevolg van fysieke werkfactoren en musculoskeletale klachten. Een promotietraject vanuit kenniscentrum Zorginnovatie van Hogeschool Rotterdam in samenwerking met afdeling huisartsengeneeskunde van ErasmusMC. Momenteel werkt Jos als hogeschooldocent / onderzoeker bij de opleiding verpleegkunde en het kenniscentrum Zorginnovatie van Hogeschool Rotterdam.



PHD Portfolio

PHD Portfolio

Erasmus MC, Department of General Practice

PHD Period: November 2015 – November 2021

Promotor: prof. dr. S.M.A. Bierma-Zeinstra

Co-promotors: dr. J. Runhaar & dr. P.D.D.M. Roelofs

	Year	Workload (ECTS)
Conferences		
<i>Poster presentations</i>		
Wellbeing at work Amsterdam (the Netherlands)	2016	0.9
1st annual meeting Amsterdam public health Amsterdam (the Netherlands)	2016	0.3
WEON Antwerp (Belgium)	2017	0.6
Annual ACE, Bone & Joint meeting	2019	0.1
<i>Oral presentations</i>		
EDCNS Maastricht (the Netherlands)	2018	0.6
WDPI Odense (Denmark)	2019	0.9
SPRiNG Webinar Rotterdam, (the Netherlands)	2021	0.2
<i>Conference attendance</i>		
SZW scientific day, The Hague (the Netherlands)	2018	0.3
<i>Stand holder</i>		
‘Op de kaart gezet’, Lof der Verpleegkunst, Rotterdam (the Netherlands)	2019	0.1
<i>Presentations / workshops to stakeholders</i>		
Practical supervisors meeting Erasmus MC, Rotterdam (the Netherlands)	2018	0.1
Workshop SPRiNG “Gezond en Zeker innovatiedag, Nieuwegein (the Netherlands)	2018	0.3
LOOC (Landelijk Overleg Opleidings Coördinatoren), University Medical Centers, Utrecht (the Netherlands)	2018	0.1
Consultation meeting with the professional field, Rotterdam University of Applied Sciences (the Netherlands)	2019	0.1
Network 010, Rotterdam (the Netherlands)	2019	0.1
Visitation of the Nursing program, Rotterdam University of Applied Sciences (the Netherlands)	2019	0.1
Nursing conference, Amsterdam UMC (the Netherlands)	2019	0.3
AnnA Alumni Webinar, Amsterdam University of Applied Sciences (the Netherlands)	2021	0.1
Topcare lecture, Amphia hospital, Breda (the Netherlands)	2021	0.1
Workshop SPRiNG, sterk gestart voor de zorg, VIVES, (Belgium)	2021	0.3

Teaching activities

Minor education activities: coaching students in projects	2015 -2021	3
Lecturing Research Skills / Evidence based practice (Bachelor of Nursing)	2015 -2021	6
Supervising students Bachelor thesis (Nursing)	2015 -2021	6

Organization

Weekly ('Spreekkamer') meetings, Dept. General Practice, Erasmus MC	2015 -2021	1
Regular meetings with PhD students of research centre Innovations in Care Rotterdam University of Applied Sciences	2015 -2021	1

Courses

LimeSurvey training	2016	0.1
Gemstracker training	2016	0.1
Systematic literature searches in PubMed (Part 1 + 2)	2016	0.2
Systematic literature searches in other Databases (Part 3)	2016	0.1
Endnote course	2016	0.1
CPO Course (Patient oriented research)	2016	0.3
Principles of research in Medicine and epidemiology (NIHES)	2016	0.7
Introduction to Data-analysis (NIHES)	2016	0.7
Cohort studies (NIHES)	2016	0.7
Primary and secondary prevention research (NIHES)	2016	0.7
Qualitative analysis	2016	0.6
PhD-course on Scientific Integrity	2016	0.3
PhD day	2017	0.1
Biomedical English writing and communication	2017	3
EpidM, V20 Principles of epidemiology: data-analysis	2017	3
EpidM, V10 Epidemiological research: basic principles	2018	4
Introduction course to SPSS	2018	1
Processing quantitative data with SPSS (Sub-theme: Research in education)	2019	0.2



List of publications

This thesis:

Kox, J.H., Bakker, E.J., Miedema, H. S., Bierma-Zeinstra, S., Runhaar, J., Boot, C. R., van der Beek, A.J., & Roelofs, P. D., (2018). Physical and mental determinants of dropout and retention among nursing students: protocol of the SPRiNG cohort study. *BMC nursing*, 17(1), 1-9. <https://doi.org/10.1186/s12912-018-0296-9>

Kox, J. H., Bakker, E. J., Bierma-Zeinstra, S., Runhaar, J., Miedema, H. S., & Roelofs, P. D., (2020). Effective interventions for preventing work related physical health complaints in nursing students and novice nurses: A systematic review. *Nurse education in practice*, 44, 102772. <https://doi.org/10.1016/j.nepr.2020.102772>

Kox, J. H. A. M., Groenewoud, J. H., Bakker, E. J. M., Bierma-Zeinstra, S. M. A., Runhaar, J., Miedema, H. S., & Roelofs, P. D. D. M., (2020). Reasons why Dutch novice nurses leave nursing: A qualitative approach. *Nurse education in practice*, 47, 102848. <https://doi.org/10.1016/j.nepr.2020.102848>

Kox, J. H. A. M., Runhaar, J., Groenewoud, J. H., Bierma-Zeinstra, S. M. A., Bakker, E. J. M., Miedema, H. S., & Roelofs, P. D. D. M. (2022). Do physical work factors and musculoskeletal complaints contribute to the intention to leave or actual dropout in student nurses? A prospective cohort study. *Journal of Professional Nursing*, 39, 26-33. <https://doi.org/10.1016/j.profnurs.2021.12.010>

Kox, J., Runhaar, J., Bierma-Zeinstra, S., Groenewoud, H., Bakker, E., Miedema, H., & Roelofs, P. (2022). What sociodemographic and work characteristics are associated with musculoskeletal complaints in nursing students? A cross-sectional analysis of repeated measurements. *Applied Ergonomics*, 101, 103719. <https://doi.org/10.1016/j.apergo.2022.103719>

Other publications:

Bakker, E.J.M., **Kox, J.H.A.M.**, & Roelofs, P. D. D. M., (2016). SPRiNG sterk gestart in de zorg: Onderzoek naar fysieke en mentale determinanten van uitval onder studenten verpleegkunde en beginnende verpleegkundigen. *Verpleegkunde*, 31(3), 4-6.

Bakker, E., **Kox, J.**, Groenewoud, H., Miedema, H., & Roelofs, P., (2019). Uitval studenten en startende verpleegkundigen. *TVZ-Verpleegkunde in praktijk en wetenschap*, 129(6), 17-19. <https://doi.org/10.1007/s41184-019-0131-0>

Bakker, E. J., Verhaegh, K. J., **Kox, J. H.**, van der Beek, A. J., Boot, C. R., Roelofs, P. D., & Francke, A. L., (2019). Late dropout from nursing education: An interview study of nursing students' experiences and reasons. *Nurse education in practice*, 39, 17-25. <https://doi.org/10.1016/j.nepr.2019.07.005>

Bakker, E. J., **Kox, J. H.**, Boot, C. R., Francke, A. L., Van Der Beek, A. J., & Roelofs, P. D., (2020). Improving mental health of student and novice nurses to prevent dropout: A systematic review. *Journal of advanced nursing*, 76(10), 2494-2509. <https://doi.org/10.1111/jan.14453>

Bakker, E. J., Roelofs, P. D., **Kox, J. H.**, Miedema, H. S., Francke, A. L., van der Beek, A. J., & Boot, C. R., (2021). Psychosocial work characteristics associated with distress and intention to leave nursing education among students; A one-year follow-up study. *Nurse Education Today*, 104853. <https://doi.org/10.1016/j.nedt.2021.104853>

Bakker, E. J., Dekker-van Doorn, C. M., **Kox, J. H.**, Miedema, H. S., Francke, A. L., & Roelofs, P. D. (2022). Conflict or connection? A feasibility study on the implementation of a training based on connecting communication in a nursing curriculum. *Nurse Education Today*, 105302. <https://doi.org/10.1016/j.nedt.2022.105302>

Buitendijk, J.K., **Kox, J.H.A.M.**, (2014). De patiënt aan het woord over de zorgrelatie met de psychiatisch verpleegkundige. *Psychiatrie en verpleging*, 90(3) 17-24.

Kox, J., (2006). Een SPV werkzaam in de internationale hulpverlening. *Sociale psychiatrie*. 25(78), 23-30.

Kox, J.H., de Lange, J., & Visser, A.P., (2012). De vertrouwensrelatie tussen asielzoekers en verpleegkundigen in de geestelijke gezondheidszorg. *Verpleegkunde-Nederlands Vlaams Tijdschrift voor Verpleegkundigen*, 27(1), 15.

Kox, J. H. A. M., Bakker, E. J. M., Bierma-Zeinstra, S. M. A., Runhaar, J., Miedema, H. S., & Roelofs, P. D. D. M., (2020). Interventies tegen lichamelijke klachten en uitval bij verpleegkunde studenten. *Onderwijs en Gezondheidszorg*, 44(7), 25-29. <https://doi.org/10.24078/oeng.2020.12.126228>

Kox, J., Bakker, E., Groenewoud, H., Miedema, H., & Roelofs, P., (2020). Uitval van studenten en startende verpleegkundigen. *Het SPRiNG onderzoek*. *VIP Science*, 2020(10) 6-7.

Pontier, H., Visser, A., **Kox, J.**, (2012). Begeleiding voor kinderen waarvan een ouder kanker heeft: een inventarisatie. *Psychosociale Oncologie*, 20(2), 20-21.



Retaining nursing students and novice nurses

The role of musculoskeletal symptoms and physical work factors

SPRiNG - Studying Professional Resilience in Nursing students and new Graduates

Student and novice nurse attrition are of growing concern. Retaining nursing students and novice nurses is essential to maintain quality of care. It is, therefore, imperative to understand the determinants and predictors that contribute to their dropout. The focus of this thesis is on the physical resilience of nursing students and novice nurses in order to contribute to the retention of this particular group of (student) nurses.

This thesis is divided into three parts. In the first part, we explored the motives and determinants that contribute to dropout intention and actual dropout of student and novice nurses. The second part describes the determinants and predictors of dropout intention, actual dropout and musculoskeletal complaints in nursing students and novice nurses. In the third part, we focused on the effectiveness and feasibility of preventive interventions with regard to physical resilience.

This thesis contributes to the scientific knowledge on the motives and determinants of dropout of nursing students and novice nurses with focus on their physical resilience. It provides practical recommendations for education and practice on how to improve the physical resilience of these target groups, in order to retain (student) nurses.

