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## **REGISTERED NURSES' RESEARCH USE**

A national survey on extent, patterns,  
intentions and associated factors in  
undergraduate education and the first years  
of clinical practice

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*To Hedvig and Herbert*

## ABSTRACT

The gap between research and practice is well-known and has been addressed globally. The application of research-based knowledge in clinical practice has the potential to improve care quality and patient safety. Knowledge and abilities for critical reflection and implementation of new knowledge into practice are among the educational goals for today's nursing education. Knowledge about newly graduated nurses' extent of research use (RU) in clinical practice, as well as factors associated with nurses' RU the first years postgraduation is scarce, however. The **overall aim** of this thesis was to study registered nurses' self-reported instrumental, conceptual and persuasive RU (IRU, CRU and PRU) the first 3 years postgraduation, change in RU over time and associated factors. A further aim was to study nursing students' intentions to use research in future practice and whether intention and educational factors could predict subsequent RU behavior. **Methods:** Data derived from the national LANE (Longitudinal Analysis of Nursing Education) survey study and its three cohorts of nursing students (subsequently registered nurses), graduating in 2002, 2004 and 2006 (the EX2002, EX2004 and EX2006 cohorts). Data were analyzed using quantitative methods. **Results:** In **Study I**, the nurses' RU extent was studied at year 1 and 3 (Y1 and Y3) postgraduation in the EX2004 (Y1) and EX2002 (Y3) cohorts. IRU was reported as most prevalent, occurring on about half of the working shifts, followed by CRU and PRU. Using cluster analysis, seven clusters of nurses were identified at both Y1 and Y3, where each cluster represented a specific RU profile. Cluster profiles with low or very low RU across all three RU kinds predominated (45.5% at Y1, 51.6% at Y3). In **Study II**, the extent of RU was studied at Y2 (EX2004). Furthermore, changes in RU between Y1 and Y2 were studied in relation to changes in working conditions. No significant differences in mean values were found between the time points. The seven cluster profiles were also identified at Y2, with most individuals tending to present the same profile over time. In addition, low users at Y1 tended to become even lower users at Y2 where overall low users constituted 54.9% of the cluster sample. Change towards overall low RU was not associated with changes in working conditions. In **Study III**, individual, work contextual and educational determinants of overall low RU were investigated at Y2 (EX2004). Through multivariate logistic regression modeling, six determinants were identified: work in the psychiatric setting, role ambiguity, sufficient staffing, low work challenge, being male and low student activity. In **Study IV**, nursing students' IRU intentions were studied as a predictor and mediating variable for their IRU behavior at Y1 (EX2006). Intended IRU on more than half or almost every working shift was reported by 34% of the sample. A statistical full mediation model was set-up and tested, showing a direct effect from intention on subsequent behavior. Furthermore, intention acted as a mediating variable for the effects from capability beliefs and perceived support for RU during undergraduate studies. **Conclusions:** The extent of RU was rated relatively low, which is worrying considering today's demand for research-based nursing practice. Multiple factors were associated with the nurses' extent of RU the first years postgraduation, individual as well as educational and work contextual. Undergraduate education, both campus and clinical education, needs a clear focus on how to promote high RU intentions while the healthcare organization needs to provide the right conditions for supporting RU among nursing students and newly graduated nurses. The cluster analysis brought a new perspective into this field of research by illustrating a multidimensional and nuanced picture of RU.

**Key words:** cluster analysis, evidence-based practice, intention, logistic regression, mediation analysis, nursing students, registered nurses, research use, questionnaire.

## LIST OF PUBLICATIONS

This doctoral thesis is based on the following original papers, referred to in the text by their Roman numerals:

- I. Forsman, H., Gustavsson, P., Ehrenberg, A., Rudman, A. & Wallin, L. Research use in clinical practice - extent and patterns among nurses one and three years postgraduation. *Journal of Advanced Nursing*, 2009: 65(6), 1195-1206.
- II. Forsman, H., Rudman, A., Gustavsson, P., Ehrenberg, A. & Wallin, L. Use of research by nurses during their first two years after graduating. *Journal of Advanced Nursing*, 2010: 66(4), 878-890.
- III. Forsman, H., Rudman, A., Gustavsson, P., Ehrenberg, A. & Wallin, L. Determinants of low research use in registered nurses two years after graduation - a national survey. *Submitted*.
- IV. Forsman, H., Wallin, L., Gustavsson, P. & Rudman, A. Nursing students' intentions to use research as a predictor of use one year post graduation: an observational study. *Submitted*.

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## LIST OF ABBREVIATIONS

ASED	Average squared Euclidian distance
CFI	Comparative fit index
CRU	Conceptual research use
EBM	Evidence-based medicine
EBN	Evidence-based nursing
EBP	Evidence-based practice
EESS	Explained error sum of squares
EROS	Edmonton Research Orientation Survey
ES	Effect size
EX	Examination
IRU	Instrumental research use
KT	Knowledge translation
KU	Knowledge utilization
LANE	Longitudinal Analysis of Nursing Education
MAR	Missing at random
NHS	National Health Service
NPQ	Nurse Practice Questionnaire
NSE	Nursing self-efficacy
NSSE	National Survey of Student Engagement
PARiHS	Promoting Action on Research Implementation in Health Services
PRU	Persuasive research use
RMSEA	Root mean-square error approximation of the mean
RN	Registered nurse
RU	Research use/Research utilization
RUQ	Research Utilization Questionnaire
SCB	Statistics Sweden (Statistiska Centralbyrån, Swedish acronym)
SD	Standard deviation
SRMR	Standardized root mean-square residual
TPB	Theory of planned behavior
Y1, Y2, Y3	Year 1, 2 and 3 postgraduation

# 1 BACKGROUND

As nurses, we want to do good to patients. To do good is the overall aim of all health care. We therefore want to provide high quality nursing care to patients. In other words, we want to use sensible knowledge.

Research-based knowledge is knowledge derived from research and has been subjected to testing. “Research is systematic inquiry that uses disciplined methods to answer questions or solve problems. The ultimate goal of research is to develop, refine, and expand a body of knowledge” (Polit and Beck 2008, p. 3). Evidence-based practice (EBP) includes the use of research-based knowledge and has been defined as “the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients” (Sackett et al. 1996, p. 71). A general underlying assumption is that research-based care leads to better quality of care and higher patient safety and the provision of research-based/evidence-based care is a key professional competency for nurses internationally. In Sweden, this is stated in laws and regulations relevant for nursing education (The Swedish Code of Statues 1992, 1993) and nursing practice (The National Board of Health and Welfare 2005), and according to the Patient Safety Act (The Swedish Code of Statues 2010), all health care professions are obliged to practice in accordance with science and proven experience. The nursing profession is the dominating profession among Swedish licensed practitioners within the healthcare system, comprising more than 116,000 nurses (The National Board of Health and Welfare 2010). Consequently, what nurses do and don’t do have great impact on patient care.

There are several examples of how research-based knowledge, if applied in practice, has the potential to improve quality of care and alleviate patients of pain and suffering. But there are also numerous examples of how such research-based practices are under-used by health care professionals illustrating a gap between research and practice. This gap is well-known and frequently addressed but not yet bridged. Recent statistics on pain assessment within palliative care, collected from the Palliative Registry, Sweden, shows that only 18% of all patients were assessed with VAS/NRS (Visual Analogue Scale/Numeric Rating Scale) during their last week in life (Swedish Association of Local Authorities and Regions and The National Board of Health and Welfare 2010). This figure could be compared to the aim of 60% established by the Palliative Registry. VAS/NRS are evidence-based instruments and pain assessment is a nursing responsibility. Increased use of such instruments, i.e. increased use of research-based knowledge, could ameliorate the prerequisites for adequate symptom relief among patients during their last days of life. Further, from a global health perspective, the need for increased and more effective implementation of research into practice in resource-poor settings has been emphasized (Sanders and Haines 2006, Madon et al. 2007). For example, effective evidence-based interventions that are available but unsatisfactorily implemented could prevent up to 72% of the annual 4 million neonatal deaths worldwide (Darmstadt et al. 2005). The translation of research findings into clinical use has been articulated as a research priority by the World Health Organization (WHO 2004, 2006).

Consequently, the gap between research and practice can be devastating for the patient. Evidence-based, including research-based, care can ensure that the patient receives the best possible care according to recent knowledge. This has a clear focus in today's nursing education and the newly graduated nurses are expected to work based on EBP. This thesis focuses on nurses' research use (RU) the first 3 years postgraduation as well as nursing students' intentions to use research-based knowledge. Nurses here correspond to registered nurses (RNs), i.e. licensed nurses who have graduated from a 3-year nursing program at any of Sweden's universities/university colleges.

## **1.1 THE RESEARCH FIELD**

The definition of research use or research utilization adhered to in this thesis is: "the use of research findings in any and all aspects of one's work as a registered nurse. While there are specific kinds of research utilization, such as instrumental, conceptual and persuasive (Estabrooks 1997), at its simplest it is the use of research" (Estabrooks 1998) p. 19. Research use and research utilization are in this thesis treated synonymously and abbreviated as RU.

The RU research field constitutes a sub-set of the more overarching field of study, generally labeled knowledge utilization (KU) (Estabrooks et al. 2008). KU focuses on how to put knowledge to use to bridge what is often referred to as the theory-practice or implementation gap (Bero et al. 1998, Haines et al. 2004, Estabrooks et al. 2008). Another prominent and overarching concept commonly used within this research field is knowledge translation (KT) (Estabrooks et al. 2006, Graham et al. 2006, Graham and Tetroe 2007). The Canadian Institutes of Health Research (CIHR) defines KT as "a dynamic and iterative process that includes synthesis, dissemination, exchange and ethically sound application of knowledge to improve the health of Canadians, provide more effective health services and products and strengthen the health care system" (Canadian Institutes of Health Research, 2011). In the above definition knowledge is not explicitly restricted to research-based knowledge, although the translation of scientific knowledge is what is usually referred to. By definition, the concept of KT encompasses the process from knowledge synthesis to actual application where knowledge is put into practice (Canadian Institutes of Health Research, 2011). According to Estabrooks et al. (2006), KT can be thought of as encompassing RU, as well as a number of other phenomena, such as evidence-based decision-making, innovation diffusion, knowledge transfer, research dissemination, research implementation and research uptake.

The core or parent domain within the KU field was Rogers' work "Diffusion of Innovations" (Rogers 2003) that was groundbreaking when it was first published in 1962 and has continued to dominate the field since then (Estabrooks et al. 2008). Rogers' work has also been very influential within the nursing KU literature, principally during the 1960s and 1970s, while Sackett et al. (1996, 2000) within medicine and Horsley et al. (1983) within nursing have become more prominent during the past two decades (Scott et al. 2010). The first studies on RU in nursing were published in the 1970s with the work by Shore (1972) and Ketefian (1975), showing a weakening trend in the 1980s but a rapid growth in the 1990s (Estabrooks et al. 2004c).

### 1.1.1 Evidence-based practice

Evidence-based medicine (EBM) followed Rogers as dominating the KU field (Estabrooks et al. 2008). EBM emerged as a new domain within the KU field already in the mid-1980s but grew in the 1990s, rapidly taking on a dominating position (Estabrooks et al. 2008). In 1992, the Evidence-Based Medicine Working Group launched their much attended publication in which they argued that the examination of evidence from clinical research should be stressed as grounds for clinical decision-making while intuition, unsystematic clinical experience and pathophysiologic rationale should be de-emphasized. As an underlying assumption of EBM, it was stated that “physicians whose practice is based on an understanding of the underlying evidence will provide superior patient care” (Evidence-Based Medicine Working Group 1992, p. 2421). EBM was considered a means to handle the increased body of new knowledge, new technologies, increased costs and the focus on care quality and outcomes (Evidence-Based Medicine Working Group 1992). Within the field with the cover term EBM lies evidence-based nursing (EBN), which followed the EBM breakthrough with proclamations of their own (Estabrooks et al. 2004b). EBN as a field of study grew stronger with an increased focus among funding agencies, increased international collaboration, appearing institutions dedicated to EBN and scientific journals, e.g. the journal ‘Evidence Based Nursing’ in 1998 (Estabrooks et al. 2004b).

What kind of knowledge that deserves to be called evidence, i.e. what kind of knowledge that is actually referred to when speaking about EBP, is under debate. The EBM movement was, and still is, criticized for its focus on scientific evidence and its de-emphasis of other forms of knowledge. According to Sackett et al. (1996), EBM constitutes an integration of individual clinical expertise and best available external evidence, i.e. clinically relevant research. Within nursing, Scott-Findlay and Pollock (2004) have argued for conceptual specificity, assigning evidence to encompass research findings only. They did not deny the impact of other kinds of knowledge on clinical decision-making, but preferred not to call them evidence. “Being specific to language, the goal is to improve clinical decision-making by increasing practitioners’ reliance on research findings (evidence) while acknowledging (and valuing) the important part played by other forms of knowledge in the decision-making process” (Scott-Findlay and Pollock 2004, p. 92). On the other hand, it has been argued that the term ‘evidence’ should be more encompassing, including e.g. knowledge based on clinical experience, patient experience and information from the local context in addition to research findings (Rycroft-Malone et al. 2004, Rycroft-Malone and Stetler 2004).

Although there is disagreement about what kind of knowledge that deserves to be called evidence, there is a consensus on the need for different kinds of knowledge in order to achieve high quality and patient centred care. This is an underlying assumption also in this thesis, although the focus here is on the knowledge originating from research. How to integrate research findings with other forms of knowledge, whether they are called evidence or not, is an issue that needs to be further studied (Squires et al. 2011c), however not addressed in this thesis. RU is here seen as a sub-set of EBP, as argued by Estabrooks (1998, p. 28): “Research utilization is concerned with research evidence only, and is therefore actually a sub-set, albeit a critical one, of evidence-

based practice”. This implies that in this thesis EBP is referred to as associated with, and including, RU.

## **1.2 NURSES' USE OF RESEARCH**

The concept of 'research use/utilization' is not as simple as it might sound (Strandberg 2011). What do we mean by 'research' and what is 'using' research? Findings from a recent systematic review on self-report RU measures within healthcare (Squires et al. 2011b) show that there are no clear-cut answers to those questions. For example, in studies within nursing, the 'research' to be used can be defined as either nursing research exclusively or as including research findings from other areas. The 'use' of research can be conceptualized in terms of some general, overall use or as the use of specific practices. It can also refer to the implementation of new research findings into practice or the participation in different kinds of RU activities. Furthermore, RU can be conceptualized as a process (Rich 1997) that includes different stages. Such stages are found in the process of innovation adoption according to Rogers (2003), ranging from knowledge to confirmation, or in the 'Pipeline model' of research implementation into practice (Glasziou and Haynes 2005), ranging from awareness to adherence. Research use can also be conceptualized as typologies, i.e. as different kinds of RU (Beyer and Trice 1982, Stetler 1985, Nutley et al. 2007b).

A direct/instrumental application of research in policy and practice decisions is probably the most common understanding of RU, but RU can also occur in other forms and have different kinds of impact on practice (Nutley et al. 2007b). Based on her conclusion that little was known about the structure and function of RU, Estabrooks (1997, 1999) was the first to conceptually model and empirically assess the concepts of instrumental (direct), conceptual (indirect) and persuasive (symbolic) RU (IRU, CRU and PRU, respectively). Instrumental RU refers to a concrete application of research for specific decisions/interventions; conceptual use pertains to an enlightening way of using research where research changes the way of thinking; and persuasive use denotes situations where research is used as a tool to persuade others with the aim to bring about change or to legitimate a position or practice (Estabrooks 1997, 1999). The conceptualizations of IRU, CRU and PRU originally derived from work on knowledge use within social science in which instrumental and conceptual use were discussed by Rich (1975, 1977) and Weiss (1979) and symbolic (persuasive) RU by Pelz (1978) and Beyer and Trice (1982). Later on, Stetler took these conceptualizations into the nursing field (1985, 1994a,b).

### **1.2.1 Measuring research use**

Estabrooks (1997, 1999) concluded that RU, despite its complexity, could be measured with relatively simple questions that are not nursing intervention specific and not only capturing the instrumental use of research. Her measures have lately been referred to as 'Estabrooks' Kinds of Research Utilization' (Squires et al. 2011b).

Measuring RU is necessary in order to describe the extent of nurses' RU in clinical practice. It is also important as a means to evaluate uptake and effectiveness of research-based knowledge and for designing and evaluating intervention effectiveness in the efforts to improve patient and organizational outcomes (Squires et al. 2011b,

Strandberg 2011). ‘Estabrooks’ Kinds of RU’ constitutes one of several ways of measuring RU. In a review from 2003 (Estabrooks et al. 2003c) on existing RU instruments in nursing three commonly used multi-item instruments were identified: the Nurse Practice Questionnaire (NPQ), the Research Utilization Questionnaire (RUQ) and the Edmonton Research Orientation Survey (EROS). Moreover, in a recent review on the reliability and validity of RU instruments (Squires et al. 2011b) the same instruments were identified as the most commonly used measures. These instruments are briefly described below to give an overview. Apart from those three instruments, a large number of other multi- and single-item measures were identified as well. Different conceptualizations of RU (e.g. as a process including a number of stages or as different kinds of RU) entail different operationalizations as measures of RU.

The NPQ measures nurses’ adoption of specific research findings/nursing practices (Brett 1987) based on Rogers’ theory of stages of innovation adoption (Rogers 2003): knowledge, persuasion, decision, implementation and confirmation. The RUQ was developed by Champion and Leach (1989) and includes items measuring the nurses’ amount of incorporation of research findings into practice: e.g., “I base my practice on research”, “I apply research results to my own practice” and “I use research to supply my nursing practice”. The EROS was developed by Pain et al. (1996) and contains one subscale concerning the use of research/EBP including such items as “Research articles provide information which helps me in my day-to-day work” and “Hearing research presentations has changed the way I practice” (McCleary 2002). The formal structure of RU in the different instruments varies, constituting a methodological problem (Estabrooks et al. 2003c, Squires et al. 2011b). Both RUQ and EROS measure RU in a general sense whereas NPQ measures the adoption of specific nursing practices. These instruments lack an operational definition of RU and the unclear conceptualization of RU is one of the main shortcomings within the research area (Estabrooks et al. 2003c).

### **1.2.2 Extent of nurses’ research use**

A recent systematic review on the extent of nurses’ RU in clinical practice (Squires et al. 2011c) gives a good overview of the current state in this issue. The review included published and grey literature and was conducted in 13 online bibliographic databases. A final number of 55 articles were included of which the majority reported on studies with a cross-sectional survey design (n=51) and a few with a quasi-experimental design (n=4). The vast majority of studies were from North America or Europe (93%) and in most cases (80%) the samples originated from acute care (hospital) settings. Most (69%) of the articles were published in the past decade (1996-2007). Multi-item instruments were used in about half (49%) of the studies while the rest used single-item measures. RU in general was measured in most studies (n=36), followed by measures in the use of specific research findings (n=14) and kinds of RU (n=6). NPQ and RUQ were the instruments most commonly used (n=12 and n=10, respectively). Because RU has been measured using multiple instruments with different conceptualizations of RU, a direct comparison of findings across studies could not be performed. The authors did, however, construct a method making indirect comparisons possible by creating equal quartiles for every scoring system/response scale used in the included articles. The four quartiles, thereby constituting a common metric, were labeled ‘low’, ‘moderate-low’, ‘moderate-high’ and ‘high’. It was concluded that nurses’ extent of RU was, on

average, reported as moderate-high (moderate-high RU was reported in 38 of the studies). It was also concluded that RU extent had remained relatively consistent over time. The authors, however, emphasized that the findings should be interpreted with caution because of the mix of instruments, conceptualizations and operationalizations of RU.

### **1.3 NURSING EDUCATION AND EDUCATIONAL OUTCOMES**

Internationally, reforms in nursing education have occurred during the past decades but there are still variations in educational structure across countries (Spitzer and Perrenoud 2006a, 2006b, Davies 2008, Råholm et al. 2010, Salminen et al. 2010). For countries included in the European Union, many of the reforms have been implemented as a consequence of the 'Bologna Declaration' and the 'Bologna Process' (Zabalegui et al. 2006, Davies 2008). Difficulties in relation to the reforms include the competence of nurse educators, the structure and content of nursing curricula and the preparation of graduates for practice (Spitzer and Perrenoud 2006a, 2006b). It has been asserted that newly graduates' increased theoretical/academic skills are acquired at the cost of practical skills, ultimately resulting in inadequate preparation for practice and, in that way, a maintenance of the gap between education and practice (Greenwood 2000). Several challenges for nursing education remain. One central issue is to improve students' critical thinking, problem-solving and clinical decision-making skills, all of which is to enhance students' ability to access and interpret evidence and to translate and apply evidence to practice (Hegarty et al. 2009). Furthermore, the skills of nurse educators need to encompass clinical, pedagogical and research skills, as well as skills for research implementation in order for nursing education to be informed by evidence-based nursing and teaching (Salminen et al. 2010). In Sweden, as a result of several educational reforms, nursing education has undergone a transformation in recent decades, from a vocational and apprentice training program to academic education (Kapborg 1998, Furåker 2001, Götlind 2010). Over time, critical thinking skills and scientific values have been increasingly emphasized in nurse education regulations. The increased emphasis on a scientific basis in the education as well as an interaction between education, research and knowledge poses a serious challenge to the educational institutions. In the USA, a core set of competencies to be integrated into health professions' education, of which EBP is one of those competencies, has been underlined by the Institute of Medicine of the National Academies (2003) and Quality and Safety Education for Nurses (2011). Based on those initiatives, the Swedish Society of Nursing has formulated a strategy for nursing education that includes an emphasis on nurses' skills to provide EBP (2010).

In 1993, Swedish nursing education became a 3-year program, resulting in a general qualification for research education and the possibility to obtain a bachelor degree in nursing. However, according to a report from an evaluation of Swedish health care education programs in 1996, nursing education at 10 of Sweden's university colleges did not meet an acceptable higher education level (Swedish National Agency for Higher Education 1996). The most recent educational reform was performed because of the 'Bologna process' in 2008, with the aim to harmonize higher education in Europe including new academic levels (basic, advanced and research) and new educational outcomes and qualifications for graduation.

According to the ‘Swedish description of competence for registered nurses’ (The National Board of Health and Welfare 2005), nurse competence includes the ability to critically reflect upon care and to inspire to dialogue regarding the implementation of new knowledge. The nurse should further be able to search and critically appraise relevant literature as well as to implement new knowledge into practice, thereby working for care in accordance with science and proven experience. Consequently, these competencies are among the educational objectives for nursing education and higher education in general (The Swedish Code of Statutes 1992, 1993). However, the 2006 evaluation of quality in medical and health care undergraduate education in Sweden (Swedish National Agency for Higher Education 2007) showed that 41% (n=11) of the nursing education programs did not live up to the requirements for higher education. Overall, criticism was leveled at the lack of capacity to link requirements for good professional and academic education for a bachelor degree and an unsatisfactory integration of scientific perspectives. Concerning clinical education, the critique pertained to the competence of clinical preceptors and low, or a lack of, academic ambitions resulting in a focus on the vocational aspects of the profession. The evaluators concluded that students needed more training with respect to the application of a scientific perspective in clinical practice.

### **1.3.1 Students’ intentions to use research**

Laws and regulations clearly emphasize the nurses’ responsibility to work according to evidence-based practice. However, longitudinal studies on what educational outcomes and students’ abilities at graduation result in later on in clinical practice are lacking. It is reasonable to expect that the students at graduation should have the intention to use research in their subsequent work. The theory of planned behavior (TPB) (Ajzen 1988, 1991) has been suggested as an appropriate theory to predict behavior, where behavior intention is the most immediate predictor of subsequent behavior (Perkins et al. 2007, Godin et al. 2008). The association between health care professionals’ intentions and different clinical behaviors have been commonly studied (Michie et al. 2005, Eccles et al. 2006, Godin et al. 2008), but studies on students’ intentions in relation to RU are scarce. Björkström et al. (2003) investigated graduating Swedish nursing students’ expectations to use research in their daily work. Their results showed that 18% expected to use research often or very often, whereas 60% expected to use it occasionally and 16% hardly ever or never. Another study investigated future use of EBP among nursing students in different stages of undergraduate education at two universities in the United States (Brown et al. 2010). Future use referred to future importance, willingness to practice, usefulness and potential barriers in relation to EBP (Johnston et al. 2003, Brown et al. 2010). Mean values of the students’ ratings of expected future use lied between 4 and 5 on the response scale ranging from 1 to 6 where 6 corresponded to high expectations.

## **1.4 THE THEORY-PRACTICE GAP**

The research-practice gap is commonly referred to within the KU field. However, in the research on nursing students and newly graduated nurses’ perceptions and experiences of their situation, a similar phenomenon, the theory-practice gap, is frequently mentioned. This gap has been described both during undergraduate education (Corlett

2000, Holmström and Larsson 2005, Lilja Andersson 2007) and between education and working life (Greenwood 2000, Maben et al. 2006, Higgins et al. 2009).

#### **1.4.1 The transition**

The transition from student to RN can be troublesome. Several decades ago, Kramer (1974) described it as a ‘reality shock’ and recently a similar phenomenon, a ‘transition shock’, was described by Duchscher (2009). A socialization process into the nursing profession begins already during undergraduate education (Levett-Jones and Lathlean 2009), but is even more evident postgraduation when the newly graduated has left education behind and entered clinical practice as an RN (Bisholt 2009, Price 2009). This process might result in ritualization of practice, a ‘doing without thinking’ approach and maintenance of inappropriate norms and values in the struggle towards conformation and ‘fitting in’ (Mackintosh 2000, Maben et al. 2006, Mooney 2007). New nurses experiencing the gap between ideals and values gained during education on the one hand and the ‘real world’/clinical practice on the other have described feelings of discouragement, disillusionment and frustration that might even result in a decision to leave the profession (Maben et al. 2006, 2007).

#### **1.4.2 Research use among newly graduated nurses**

Concerning newly graduated nurses’ RU, the situation as a new nurse becomes problematic if the clinical environment lacks support and understanding for new nurses’ academic skills and situation. Work-related stress, lack of experiential knowledge, undeveloped skills in clinical judgment and lack of time are key factors limiting new nurses’ ability to work according to EBP (Ferguson and Day 2004, 2007). Non-supportive and critical colleagues and managers contribute to a non-supportive context (Ferguson and Day 2004, 2007). In the study by Mooney (2007) nurses witnessed about clinical practice as based on routines and how their attempts to achieve change had failed. Insufficient time and inadequate facilities have been reported as common barriers (Andersson et al. 2007, Gerrish et al. 2008), as well as the culture at the working place if it works to disempower junior nurses to implement change (Gerrish et al. 2008).

Studies on newly graduated nurses’ extent of RU seem to be rare. Wangenstein et al. (2011) used the RUQ instrument to study Norwegian nurses’ RU in daily practice during the first year postgraduation. Their findings showed that 24% of the nurses could be defined as research users. Veeramah (2004) studied RU among British nurses and midwives with up to 5 years of clinical experience and found that 17% reported that they used research findings to inform their practice ‘all the time’, whereas 51% stated ‘frequently’. Boström et al. (2009) studied the application of EBP in clinical practice according to the stages in the EBP process as conceptualized by Sackett et al. (2000) among Swedish nurses 2 years after graduation. They found that 30% of the nurses participated in implementing research knowledge in practice. The use of different instruments for measuring RU in the studies cited above makes it difficult to compare the findings.

Taken together, the situation in undergraduate education and subsequent clinical practice described above gives reason to question the preparation for practice during

undergraduate education, specifically in relation to EBP/RU. Further, the attitude and support within the healthcare organization towards the new nurses and their competence might be problematic.

## **1.5 FACTORS ASSOCIATED WITH RESEARCH USE**

Many models, theories and frameworks are found within the field of KT/KU research and the research-transfer gap is studied from different viewpoints. Depending on the glasses through which this field of research is viewed, different areas of important factors become in focus. For example, Michie et al. (2005) used psychological theory (e.g., motivation, action and organization theories) to explain behavior change in relation to implementation of EBP within the health services. Bucknall (2007) helped open debate about the applicability of decision theory within KT research. By the use of decision science, attention is on the cognitive processes that underlie the filtering and integration of research-based knowledge into practice (Bucknall 2007).

Numerous studies have investigated factors associated with RU, with the aim to increase knowledge about how to improve the extent of RU. In most cases such factors have been categorized as either individual or organizational/contextual. Traditionally, the focus has been on factors related to the individual nurse e.g., beliefs and attitudes towards research, professional characteristics, education and other socio-economic factors (Estabrooks et al. 2003b). The underlying assumptions of such ‘rational agent’ or ‘rational-actor’ models/approaches are that the nurse with the appropriate skills for using evidence will automatically use those skills or that a nurse will always gather, read and consider all information of relevance before making a specific decision (Estabrooks et al. 2004b, Rycroft-Malone 2008). However, the movement toward acknowledging the organizational context of practice as being of considerable importance is evident (Estabrooks et al. 2004b, Rycroft-Malone 2008). Among the arguments for that is the fact that many of the individual determinants cannot be modified. Aiming for aspects of the organizational environment that are possible to change is probably more promising for future interventions (Estabrooks et al. 2004b). It might be that the organizational climate can be seen as a threshold for individual factors to exert their influence on KU (Estabrooks 2003).

The PARiHS (Promoting Action on Research Implementation in Health Services) framework (Rycroft-Malone 2004, Kitson et al. 2008) is commonly referred to in the literature within this field of research. One of the underlying assumptions in that framework is that implementation of evidence into practice is not a linear process, but rather a multi-faceted and complex process. “Successful implementation (SI) is represented as a function (f) of the nature and type of evidence (E), the qualities of the context (C) in which the evidence is being introduced, and the way the process is facilitated (F);  $SI = f(E, C, F)$ ” (Rycroft-Malone 2004, Kitson et al. 2008). It is thereby a presentation of a three-dimensional framework in which successful implementation is a result of the strength and the interplay between the elements included (Rycroft-Malone 2004, Kitson et al. 2008). Consequently, the PARiHS framework emphasizes the importance of context for successful implementation, where context constitutes one of the key elements proposed to consist of three sub-elements: culture, leadership and evaluation (McCormack et al. 2002). The nonlinear approach of this framework is

attractive, considering the need for acknowledging the complexity of influencing factors. However, the framework lacks an element focusing on the individual. A further limitation is that the outcome (i.e., successful implementation) is not clearly defined (Helfrich et al. 2010) and cannot automatically be considered as equal to the actual use of research-based knowledge in daily practice. Still, the PARIHS framework has been commonly used in studies on the associations between contextual factors and RU.

In a study by Cummings et al. (2007), based on the PARIHS framework, it was found that hospital characteristics with a positive influence on nurses' RU included staff development, opportunities for nurse-to-nurse collaboration and staffing and support services. Emotional exhaustion, not found in the PARIHS framework, was associated with less RU. It was concluded that contexts with more positive culture, leadership and evaluation (the key elements of the PARIHS framework) reported significantly higher RU. The PARIHS framework was also used as an underlying structure in the systematic review by Meijers et al. (2006). In that review, in which associations between nurses' RU and contextual factors were investigated, six categories of contextual factors were identified as having a statistically significant association to RU: nurse role, multi-faceted access to resources (e.g., access to research findings, clinical nurse specialist, library), organizational climate, multi-faceted support (e.g., nurses' participation in data collection and seminars, support from key administrative persons and colleagues, material support in the form of conferences, supportive infrastructure), time for research activities and provision of education. Findings were, however, equivocal and methodological limitations led the authors to conclude that further research with more robust research designs was needed.

Rogers' theory of innovation diffusion (2003) is also commonly referred to and has been highly influential within this research area ever since it was launched in the 1960s. In Rogers' theory, diffusion is defined as "the process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers 2003, p. 35). The innovation is described as an idea, practice or object that is new to the adopting individual/unit. The innovation-diffusion process is conceptualized in five steps: knowledge, persuasion, decision, implementation and confirmation. Rogers also specifies five adopter categories on the basis of their innovativeness (i.e. the relative time to adoption): innovators, early adopters, early majority, late majority and laggards. Rogers' theory has been well-used both within nursing and other disciplines, although the theory stems from rural sociology and studies on the diffusion of hybrid corn. Most of the new ideas (innovations) discussed in his book 'Diffusion of innovations' are technological innovations, i.e. not necessarily research findings. The theory has also been questioned for its orderliness and linearity. The conceptualization of an innovation as something new to the adopter and the underlying assumption of innovation-diffusion as a process seem to correspond better to the implementation of something new rather than the use of research-based knowledge in daily practice. As in the PARIHS framework, the context around the individual is emphasized in Rogers' work, here principally in terms of a social system. Factors related to the individual are explicitly considered as important in terms of the different adopter categories with their specific characteristics.

In a recent systematic review of individual determinants of nurses' RU (Squires et al. 2011a) statistically significant associations to RU in general (i.e. not kinds of RU) were found for the following individual characteristics: positive beliefs and attitudes towards research, conference- or in-service attendance, having a graduate degree, nurse role, clinical specialty and job satisfaction. However, when considering the number of studies where each characteristic was assessed as well as the consistency of findings across those studies, only attitudes towards research remained as consistently related to RU. This was true also regarding determinants of kinds of RU in which attitudes were associated with instrumental RU. The authors conclude that many of the reviewed studies had methodological weaknesses and emphasized the need for further research to replicate findings. It should be noted that some variables (nurse role, conferences and education) appear in both the review on individual determinants (Squires et al. 2011a) and in the one on contextual factors (Meijers et al. 2006), illustrating the overlapping nature of some variables and the difficulty to define them as either individual or contextual.

It is largely unknown whether factors of importance to RU differ among newly graduated nurses as compared with nurses in general. However, there seems to be factors within the organizational context that are specifically of importance to newly graduated nurses' RU, in the sense that their role and situation in the organization differ in a number of aspects from what it is like to be a more experienced nurse. Still, knowledge on this issue is thus far very limited. In the study of Norwegian nurses during their first year in clinical practice (Wangensteen et al. 2011) critical thinking, attitudes towards research, availability and support to implement research findings, gender, age and work area were significantly associated with RU. However, the number of variables included in the analyses was limited in relation to what is known from studies among more experienced nurses where a vast number of potential predictors/determinants have been included. In the study by Boström et al. (2009) the association between clinical settings and application of the EBP process was investigated among Swedish nurses 2 years postgraduation. Clinical setting was categorized as elder care, hospitals, psychiatric care and primary care. The results showed that a greater proportion of the nurses within elder care applied EBP compared with nurses within the other settings.

## **1.6 RATIONALE**

Research-based care is included in the EBP agenda with the aim to provide high quality nursing care based on best available knowledge. In undergraduate nursing education the objective is to equip the students with the necessary skills to provide evidence-based (including research-based) care. However, according to findings from previous studies, nursing students and newly graduated nurses experience a gap between research and practice. Moreover, quality evaluations of health care undergraduate education have pointed to students' insufficient skills in applying a scientific perspective in clinical practice. Consequently, there are reasons to question the graduating students' preparation for RU and how their skills are manifested in clinical practice after graduation. Knowledge about newly graduated nurses' extent of RU in clinical practice, as well as factors associated with their use or non-use of research, are poorly studied, however. There is a need for such studies in that the situation as a newly

graduated nurse seems to differ in a number of ways when compared to the situation for more experienced nurses. Furthermore, research about factors related to undergraduate education in relation to subsequent RU in clinical practice is lacking. Consequently, until now, very little is known about the extent of newly graduated nurses' RU and the factors of importance to nurses' RU the first years after graduation. Such knowledge is necessary for the support of new nurses' RU, both during education and in working life and, ultimately, for the quality of nursing care in terms of patient outcomes.

## 2 AIMS

The overall aim of this thesis was to study registered nurses' self-reported instrumental, conceptual and persuasive research use (RU) the first 3 years postgraduation, change in RU over time and associated factors. A further aim was to study nursing students' intentions to use research instrumentally in future practice and whether intention and educational factors could predict subsequent RU behavior.

Specific aims were:

- To describe and compare the extent of the nurses' self-reported RU in two separate nursing cohorts at 1, 2 and 3 years postgraduation (Study I and II).
- To describe the change in RU extent over time from the first to the second year postgraduation in one nursing cohort (Study II).
- To identify, describe and compare clusters of nurses with similar RU profiles in two separate nursing cohorts at 1, 2 and 3 years postgraduation (Study I and II).
- To examine cluster stability over time between the first and the second year postgraduation (Study II).
- To examine the association between working conditions and individual change in RU from the first to the second year postgraduation (Study II), as well as to identify determinants (educational, individual and work contextual) of low RU 2 years postgraduation (Study III).
- To describe graduating nursing students' intentions to use research instrumentally in the future as RNs, and to examine whether RU intention predicted their RU behavior 1 year postgraduation and whether intention mediated the effects from variables from undergraduate education on RU (Study IV).

### 3 METHODS

This thesis includes four studies presented in four papers. The numbering of the studies and the papers correspond. Data for all four studies included in this thesis derive from the larger LANE (Longitudinal Analysis of Nursing Education) study (Rudman et al. 2010). The large amount of educational, individual, and work contextual variables collected for that database, many of which have been proposed to be predictive of nurses' RU, served as a useful basis for the research objectives underlying this thesis. The LANE study is briefly described in order to give a context to the studies included in this thesis. See Table 1 for an overview of the Studies included in this thesis.

The overall hypothesis in this thesis was that nurses' RU is influenced by factors related to the individual, undergraduate education and work context. The individual with his or her abilities and characteristics is influenced by factors related to the educational setting (both from a campus and clinical setting in that there are both campus and clinical education) and, later on, by the clinical setting after graduation.

**Table 1.** Overview of LANE cohorts and time points included in each study as well as study purposes and main statistical analyses applied. EX = Examination, Y = years postgraduation, 6<sup>th</sup> sem. = 6<sup>th</sup> (last) semester of undergraduate nursing studies.

	Study I	Study II	Study III	Study IV
Cohort	EX2002, EX2004	EX2004	EX2004	EX2006
Time point(s)	Y1, Y3	Y1, Y2	Y2	6 <sup>th</sup> sem., Y1
Purpose	<ul style="list-style-type: none"> <li>- To describe and compare RU extent</li> <li>-To identify, describe and compare cluster profiles</li> </ul>	<ul style="list-style-type: none"> <li>- To describe and compare RU extent</li> <li>- To identify, describe and compare cluster profiles</li> <li>- To examine cluster stability over time</li> <li>- To examine the association between working conditions and change in RU over time</li> </ul>	<ul style="list-style-type: none"> <li>- To identify determinants of low RU</li> </ul>	<ul style="list-style-type: none"> <li>- To describe students' IRU intentions</li> <li>- To examine whether intention predicted IRU behavior at Y1</li> <li>- To examine whether intention mediated the effects from variables from undergraduate education on RU</li> </ul>
Statistical analyses	<ul style="list-style-type: none"> <li>- Descriptive statistics</li> <li>- t-test</li> <li>- Chi square tests</li> <li>- Cluster analysis</li> </ul>	<ul style="list-style-type: none"> <li>- Descriptive statistics</li> <li>- t-test</li> <li>- Cluster analysis</li> </ul>	<ul style="list-style-type: none"> <li>- Multivariate logistic regression modeling</li> </ul>	<ul style="list-style-type: none"> <li>- Descriptive statistics</li> <li>- Mediation analysis</li> </ul>

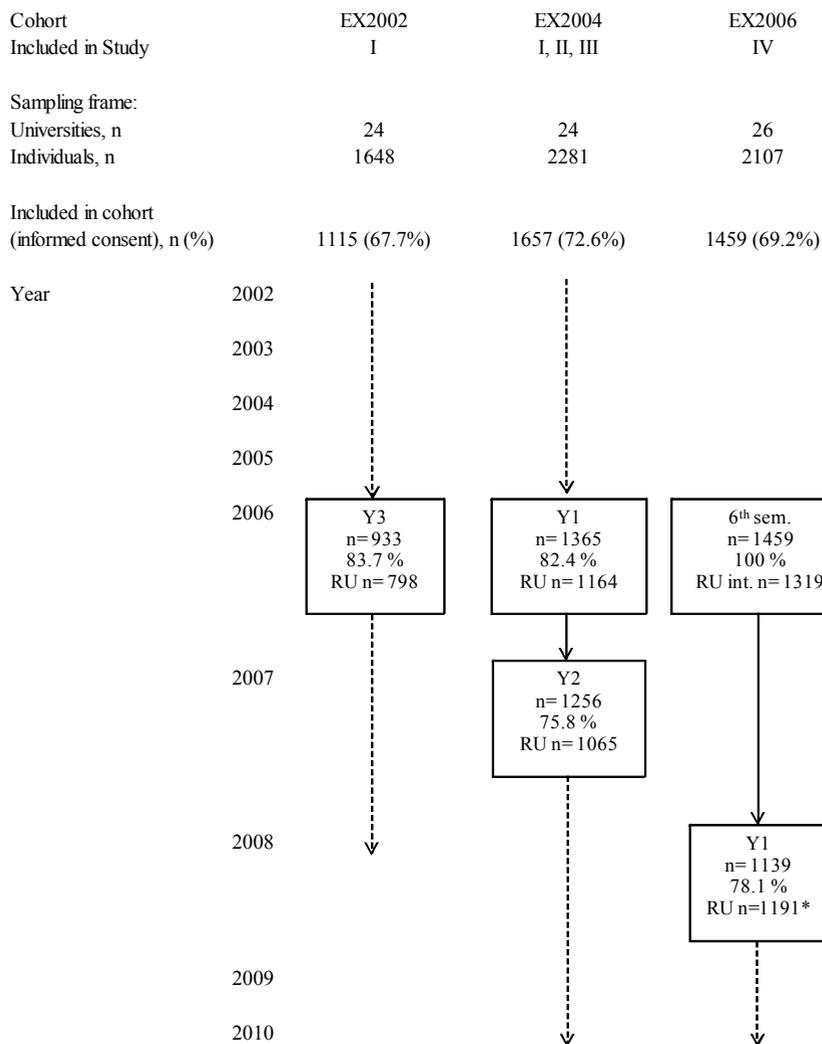
### **3.1 THE LANE STUDY**

The LANE study is a nationwide study with an observational longitudinal design (Rudman et al. 2010). The overall aim of the LANE study was to investigate the development of individual health outcomes, professional competence and employment patterns, with particular focus on the transition from undergraduate studies into working life. The study was set up with the background of the increasing number of individuals being on sick leave in Sweden during the late 1990s, where nurses were mentioned as a professional group at risk. The LANE study included three cohorts, i.e. groups of nursing students, graduating in 2002, 2004 and 2006. The cohorts were therefore called the EX2002, EX2004 and EX2006 cohorts (EX = examination). Using a postal survey, data have been collected annually, first during the individual's education and then during his or her working life. The data collection period was from 2002 until 2010 (Figure 1). Measures of RU were included in the questionnaire from 2006 and onwards. The number of years postgraduation are denominated as Y1 (year one), Y2 (year two) etc. While many variables have been assessed at several time points in all three cohorts, the cohorts had somewhat different areas of focus: occupational values (EX2002), education, personality factors and RU (EX2004) and psychosocial factors at work (EX2006).

### **3.2 SAMPLES**

The eligible individuals for each LANE cohort were students in their 2<sup>nd</sup> (EX2004) and 6<sup>th</sup> (EX2002, EX2006) semester at any of the 26 universities and university colleges (henceforth called universities) running nursing programs in Sweden. For the EX2002 and EX2004 cohorts, two of the universities did not provide the research group with student lists. The students at these two universities were informed about the study by staff from the university who also asked the students about their permission to provide the research group with their names and addresses. The number of students attending these two universities and the number of students that were actually informed about the study was therefore uncertain. Following that, cohort samples included in this thesis do not include the students from those two universities, because the sampling frame could not be reliably defined. For the EX2006 cohort, student lists were provided from the national register by Statistics Sweden (SCB).

Information about the study was given orally and written by a member of the research group to the eligible students in the EX2002 and EX2004 cohorts (except at the two universities mentioned above). Students who did not take part of that information, or who studied at any of the universities where the visits were cancelled (number of universities: EX2002, n=10; EX2004, n=2) were contacted by regular mail.



**Figure 1.** Measurement waves including outcomes (RU and RU intention) studied within the present thesis. Dashed arrows illustrates measurement waves not represented with outcomes in the present thesis. Continuous lines indicate analyses over time. Y = year postgraduation, 6<sup>th</sup> sem. = 6<sup>th</sup> (last) semester of undergraduate nursing education. % in boxes = proportion of baseline cohort. ‘RU/RU int. n’ = sample eligible to answer the RU/RU intention items, i.e. individuals who were currently working as nurses or, for Study IV, individuals who were currently studying in 6<sup>th</sup> semester of undergraduate studies. For EX2006, data from 6<sup>th</sup> semester was collected in the end of 2006 and data from Y1 collected early in 2008 resulting in about a one-year time span.

\* Number of individuals included in the mediation model analysis (Study IV), i.e. higher than actual response rate at Y1 due to the use of auxiliary variables as a handling procedure for missing data.

The questionnaires were distributed to the students either at or through each of the universities or by regular mail from the research group. For the EX2006 cohort, all eligible students were contacted by mail and all questionnaires were distributed by mail. For each data collection from 2002-2007, two reminders were sent to non-responders, followed by a telephone reminder to students who still had not responded. From 2008 and onwards (for EX2006 also in 2006), there were no telephone reminders; instead, three reminders were sent by mail. The cohorts were defined as constituting all students who had given their informed consent to participation, i.e. who had returned the questionnaire and stated their social security number. Baseline data collections for EX2002 and EX2004 were administered by the LANE research group. Since 2003, all data collections have been administered by SCB. Social security numbers for all students in the cohorts were given to SCB making it possible to identify and continuously update addresses from a population register and to check that members of the cohort were still in the population. See Figure 1 for an overview of sampling frames, consented participants and response rates over time for samples at time points included in this thesis. The reason for non-response at each data collection was most often unknown to the researchers. Some responders explicitly declined further participation in the study. Other reasons for non-response known to the researchers were e.g. death, moved abroad, secret/protected address or lack of address, blank response, temporarily gone away, unwillingness to participate or prevented from participation for other reasons.

In this thesis the samples for analyses in Study I to IV were defined as the individuals eligible to answer the RU/RU intention items, i.e. individuals who were currently working as nurses or, for Study IV, individuals who were currently studying in their 6<sup>th</sup> semester of undergraduate studies (Figure 1). Sample characteristics are listed in Table 2.

### **3.3 DATA COLLECTION**

All LANE data are self-reported, except for some sociodemographic data. Year of birth, sex and social security number were originally retrieved from the national registry of educational statistics, but later checked, and thereby validated, against the same data provided by the participants in their written informed consent. For EX2006, sex, year of birth and basic information about university etc. were retrieved from the national registry. All questionnaires were scanned. Between 2003 and 2010, the questionnaires were registered and scanned by SCB after which data files were prepared. The questionnaires were checked by SCB during and after the registration procedure, including identification of double responses and to ensure that only valid responses occurred in the data files. Each questionnaire comprised about 25 pages and ended with two open-ended questions, one where the respondents could write down additional thoughts related to themselves or the LANE study and another question covering a specific area of relevance for the time point in education or working life.

**Table 2.** Sample characteristics for samples eligible to answer the RU/RU intention items in the different cohorts at the different time points. (n.a. = not applicable) \*More than one alternative could be reported, % based on total number of responses (n=1107).

	EX2004 Y1 n=1164		EX2004 Y2 n=1065		EX2002 Y3 n=798		EX2006 6 <sup>th</sup> sem. n=1319	
Age								
Mean	32.8		34.1		35.1		29.9	
SD	7.5		7.5		7.6		7.1	
Missing	n=1 (0.1%)		n=0 (0%)		n=1 (0.1%)		n=0 (0%)	
	n	%	n	%	n	%	n	%
Gender								
Women	1040	89.3	952	89.4	713	89.4	1174	89.0
Men	123	10.6	113	10.6	84	10.5	145	11.0
Missing	1	0.1	0	0	1	0.1	0	0
Previous college experience								
Yes	281	24.1	266	25.0	168	21.0	947	71.8
No	871	74.8	788	74.0	620	77.7	366	27.8
Missing	12	1.1	11	1.0	10	1.3	6	0.4
Previous healthcare work								
Yes	720	61.9	661	62.1	441	55.3	716	54.3
No	433	37.2	395	37.1	348	43.6	596	45.2
Missing	11	0.9	9	0.8	9	1.1	7	0.5
Present employment (type of organization)							n.a.	
Hospital ward	776	66.8	703	63.4	500	62.7		
Out-patient clinic	96	8.2	114	10.3	94	11.8		
Home nursing	43	3.7	67	6.1	38	4.8		
Nursing home	82	7.0	83	7.5	44	5.5		
Ambulance service	43	3.7	56	5.1	37	4.6		
Other	42	3.6	84	7.6	45	5.6		
Missing	82	7.0	n.a.*	n.a.	40	5.0		

Data included in this thesis are derived from all three LANE cohorts:

- **EX2002**

Data on RU at Y3 was available in 2006 together with RU data from Y1 (EX2004, see below). This arrangement made it possible to compare RU in a cross-sectional design between two samples at two time points postgraduation, which became the research question for Study I.

- **EX2004**

Data on RU at Y1 (EX2004) was available in 2006 and used for Study I. Results from Study I led to the question regarding change in RU over time the first years postgraduation within the same cohort. Data from Y1 were therefore used together with Y2 data (2007) in Study II. Moreover, results from Study II led us focus on the overall low users at Y2 in Study III, where Y2 data were used to study factors associated with low RU.

- **EX2006**

The studies of RU in working life led us to further investigate RU intention while the participants were still in undergraduate education, and whether intention predicted

subsequent RU in clinical practice (Y1). Data for those analyses were available in the EX2006 cohort (in 2006 and 2007) and reported in Study IV.

### **3.3.1 Cohort representativeness**

Inclusion rates in the cohorts were: 67.7% (EX2002), 72.6% (EX2004) and 69.2% (EX2006). To evaluate cohort representativeness data from population-based national registers were used for all three cohorts when students were in their last semester (in 2002, 2004 and 2006) (Rudman et al. 2010). Demographic characteristics were compared between the total population of nursing students and those who consented to participate in the LANE study. Because population data were not available to the LANE research group, SCB performed those comparisons. Variables included in the comparisons were: age, gender, country of birth, residency (larger city), marital status and parenthood. Results for each of the cohorts were as followed:

- **EX2002:** Higher prevalence (+3%) of Swedish-born students among the participants.
- **EX2004:** No significant differences between the population and cohort.
- **EX2006:** Higher prevalence (+2%) of female and Swedish-born students and lower prevalence (-2%) of students living in larger cities among the participants.

### **3.3.2 Sample representativeness**

Response rates at the different time points included in this thesis are specified in Figure 1. Response rates for the different time points (in relation to the consented participants included in the cohorts) varied between 100% (EX2006 at baseline) and 75.8% (EX2004 at Y2). Internal dropouts (missing values) on outcome variables (RU behavior and intention) were low, ranging between 0.9% and 2.5%.

For each of the cohorts, longitudinal analyses of response rates have been performed to evaluate the influence from a number of demographic factors on participation across time (Rudman et al. 2010). The factors were: age, gender, country of birth, civil status (cohabiting or not) and self-rated health. Statistically significant differences in those factors across time for the cohorts and time points relevant in this thesis were:

- **EX2002:** Lower response rates for men across time, statistically significant at the 4<sup>th</sup> measurement wave (Y3).
- **EX2004:** Lower response rates for younger and non-Swedish-born participants across time, statistically significant at the 5<sup>th</sup> (younger, Y2) and 4<sup>th</sup> and 5<sup>th</sup> (non-Swedish-born, Y1 and Y2) measurement waves.
- **EX2006:** No statistically significant selection effects across time (according to recent analyses that will be published on the LANE web page).

## **3.4 QUESTIONS AND INSTRUMENTS**

### **3.4.1 Outcome variables - research use**

The three kinds of RU, instrumental, conceptual and persuasive (i.e. IRU, CRU and PRU) constituted the outcome variables in Study I, II and III. In Study I and II, the

three kinds of RU were analyzed separately and as components of composite RU profiles. In Study III, IRU, CRU and PRU occurred only as profiles on which the outcome of overall low RU was based. In Study IV, only IRU constituted the outcome, together with IRU intention.

IRU, CRU and PRU were measured as three single items, originally developed by Estabrooks (1997, 1999). These items have been previously used in Canadian and American contexts with slightly differing designs; in recent publications these items have been referred to as ‘Estabrooks’ Kinds of Research Use’ (Squires et al. 2011b, 2011c). The items were here translated and adapted for use in a Swedish context based on the Canadian version from 2004 as reported by Estabrooks et al. (2004a).

In her measures Estabrooks denominated IRU and CRU as ‘direct’ and ‘indirect’ RU because those terms were thought to be more readily and consistently understandable (1997, 1999). These latter terms most closely correspond to the Swedish translations, where ‘direkt’ and ‘indirekt’ have been the terms used. Symbolic use has commonly been referred to as persuasive, also in Estabrooks’ measures and in the Swedish translation (‘övertalande’).

The RU items in this Swedish version were designed in a similar way as in previous studies. Each item had a heading, stating the kind of RU, which was followed by a short definition (see Box 1) based on the definitions of the concepts in previous research. The definitions were followed by three examples of application in clinical practice (i.e. three examples for each kind of RU), where the examples in the Swedish version were adapted to be comprehensible in a Swedish context, e.g.:

- ‘Assessing the risk of pressure ulcers by using, e.g., the modified Norton Scale’ (IRU),
- ‘Reflecting upon the need for pressure-redistribution mattresses in patients confined to bed, based upon awareness that pressure ulcers can be prevented by using such mattresses’ (CRU)
- ‘Trying to persuade your manager to buy pressure-redistribution mattresses based on research findings about the positive effects of such mattresses’ (PRU)

In previous studies the measures included five- and seven-point response scales (Squires et al. 2011c). A five-point response scale was chosen for use in the Swedish version. Furthermore, the recall time in previous studies was 1 year. In the Swedish version, 4 weeks were considered appropriate. Consequently, the extent of RU the past 4 working weeks was estimated by the respondents on a frequency scale ranging from 1 to 5: 1 (‘Never’), 2 (‘On some shifts’), 3 (‘On about half of the working shifts’), 4 (‘On more than half of the working shifts’) and 5 (‘On almost every shift’). A ‘Don’t know’ alternative was also included.

**Box 1.** Wordings of the RU items used in the Swedish version (translated into English).

**Direct research use**

means using research findings (nursing or other kinds of research) in a *concrete* way in providing patient care. Direct research use can be based on scientific articles or recommendations in systematic literature reviews, clinical guidelines, protocols or other documents based on research findings.

**Indirect research use**

means that the research (nursing or other kinds of research) is more enlightening than instructive. Your *attitude*, and/or your *way of thinking*, regarding patients and patient care situations may change, but without direct application of the research results.

**Persuasive research use**

means using research findings (nursing or other kinds of research) with the aim of *influencing others* to achieve change, for example, in conditions, guidelines or care performance.

### **3.4.2 Outcome variables - research use intention**

The intention to use research instrumentally was measured in the last semester of undergraduate education using a single item constructed by the research group. It was identical to the item on IRU in clinical practice, except for the question asking for intention instead of actual use. The response scale was identical to the one for the RU items in accordance with recommendations for constructing questions on intention based on the theory of planned behavior (TPB) (Francis et al. 2004).

### **3.4.3 Independent variables**

The LANE database contains a large number of variables related to the individual nursing students (subsequent nurses) and their perceptions of the situation during undergraduate education and clinical practice. Because the original aim of the LANE study was to examine health and ill-health over time in nursing education and working life, several of the variables analyzed in relation to RU were derived from instruments developed to measure employee health and aspects of working environment hypothesized to relate to employee health. Variables were also derived from other Swedish population-based studies or developed especially for use in the LANE study. Based on previous theoretical and empirical work within this research field, individual and organizational/contextual factors were considered two major areas of importance to RU. Furthermore, factors from undergraduate education were considered as essential to subsequent RU, constituting the prerequisites that the newly graduates bring with them into clinical practice. Consequently, variables from the LANE database were selected for use in the different studies included in this thesis based on the overall hypothesis that newly graduated nurses' RU is influenced by factors related to the individual, undergraduate education and work context.

In Study II, change toward overall low RU between Y1 and Y2 was analyzed in relation to employee turnover and major changes in working conditions. The selected variables were considered to represent changes in such areas as culture, leadership and

workload - factors that have shown to have an impact on RU in previous studies. In Study III, variables related to the individual, working context and educational conditions were analyzed as determinants of overall low RU. In Study IV, variables representing educational gains and experiences as well as capability beliefs were analyzed as educational outcomes and predictors of subsequent RU in clinical practice. See Appendix for a list of the variables used in the different studies.

The variables studied in relation to RU in Study II were developed specifically for use in the LANE study. In Study III, the independent variables included in the logistic regression modeling were also derived from a number of other sources, several of them from the QPS<sub>Nordic</sub> and NSSE/'The Student Mirror'. QPS<sub>Nordic</sub> (The General Nordic Questionnaire for Psychological and Social Factors at Work) (Lindström et al. 1997, Dallner et al. 2000) is a questionnaire intended to measure psychological, social and organizational work conditions. It was developed to be used in general analyses of situations in the work organization or as a tool to evaluate the implementation of individual or organizational interventions. The content of the QPS<sub>Nordic</sub> is based on theories and conceptual models of organizational behavior, work motivation and job satisfaction, but also on theories of job stress, well-being and health (Lindström et al. 1997, Dallner et al. 2000). In Study III, the scales and variables originating from the QPS<sub>Nordic</sub> included perceptions of role clarity, leadership, job demands, positive challenge at work, control and mastery. The NSSE (The National Survey of Student Engagement) was designed to measure student engagement and educational gains in US undergraduate students (Kuh 2004). Items from the NSSE have been translated and used in the Swedish 'Student Mirror', a national survey of undergraduate students, performed by the Swedish National Agency for Higher Education (2002). In Study III, variables originating from the 'NSSE'/'The Student Mirror' were: time allocated to studies, asking questions in class, contribution to discussions in class and global importance of studies. See Appendix for information about the origin of all variables.

Variables representing the students' capability beliefs/self-efficacy and gains and experiences from education were used in Study IV as predictors of IRU at Y1 through IRU intention as a mediating variable. Capability beliefs/self-efficacy was chosen because it was stated as predictors of intention according to e.g. the theory of planned behavior (TPB) (Ajzen 1991) and in the review by Godin et al. (2008) on predictors of intention and behavior among health care professionals. This variable was operationalized as students' *Nursing self-efficacy (NSE)* and *EBP capability beliefs* in their last semester of undergraduate studies (see Appendix), referring to "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura 1997, p. 3). NSE referred to professional self-efficacy according to the theory by Bandura (1997) and was measured with a scale developed for use in the LANE study (Hagquist et al. 2009). The scale measuring EBP capability beliefs was developed for use in the LANE study (Wallin et al. 2011) based on the conceptualization of EBP by Sackett et al. (2000).

Another predictor of intention in the hypothesized theoretical framework proposed by Godin et al. (2008), was habit/past behavior. Because the students had not yet acquired an RU habit or a past RU behavior as registered nurses, this factor was operationalized in Study IV as *Educational gains and experiences* (see Appendix). This was done in

accordance with Triandis' theory of interpersonal behavior (Triandis 1980), in which habits are regarded as a function of the ability of the individual and past experience, including e.g. reinforcements, rewards or punishments. *Educational gains*, reflecting ability, were studied using a scale measuring gains in relation to intellectual development and included skills thought to be necessary for RU. The items were brought into the LANE study from the NSSE (Kuh 2004). *Support for RU* was measured as reflecting education experiences and concerned support from campus and clinical education. The items were developed for use in the LANE study (Florin et al. 2011).

### **3.5 VALIDITY AND RELIABILITY**

Validity and reliability in relation to the outcome variables (RU behavior and intention) are described here based on findings from previous studies and in relation to this thesis.

Evidence from former use of the RU measures has been synthesized in a systematic review of the psychometric properties of self-report RU measures within healthcare (Squires et al. 2011b). In that review the 'Standards for educational and psychological testing' (AERA, APA, NCME 1999) were used as a framework for synthesis of psychometric data. The 'Standards' include different types of validity evidence rather than different types of validity. Validity is seen as a unitary concept defined as "the degree to which all the accumulated evidence supports the intended interpretation of the test scores for the proposed purpose" (AERA, APA, NCME 1999, p. 11). According to the 'Standards', there are four sources of validity evidence: content, response processes, internal structure and relations to other variables, where all four sources contribute to construct validity and no individual source is considered superior to the others. The number of validity sources for an instrument indicates the strength of its construct validity.

In the review on measures of nurses' extent of RU (Squires et al. 2011b) the authors did not discuss measures as being valid or invalid, "only as more or less valid for selected populations, settings and situations" p. 13. Results of the review showed that the RU measure used in this thesis, 'Estabrooks' Kinds of RU', has been used repeatedly and presented supporting validity evidence for all three validity sources applicable for single-item measures (i.e. not internal structure). Evidence for content validity (the relationship between test content and the construct that the test is supposed to measure) was found in one of the included studies (the 'original' study by Estabrooks [1999]). In that study such evidence was provided through review by researchers with expertise in the field, through careful attention to the literature in terms of theoretical conceptualizations of RU and by providing participants with definitions and examples of the different kinds of RU. Validity evidence pertaining to response processes (based on responders' statements with respect to performance strategies or responses to particular items) resulted from e.g. pilot testing regarding design, clarity, ease of completion and the labeling of the response scale. Validity evidence based on relations to other variables corresponds to the degree to which relationships of test scores and external variables are consistent with the underlying construct. This type of validity evidence was assessed based on a priori established relationships between RU and related variables according to commonly used RU theories and systematic reviews.

External variables included individual and organizational/contextual characteristics and interventions. Findings from the studies using ‘Estabrooks’ Kinds of RU’ supported validity evidence based on relations to other variables. Concerning relevant reliability coefficients for single-item measures (e.g., stability/test-retest reliability), no such statistics had been reported for ‘Estabrooks’ Kinds of RU’.

The Swedish version of the instrument has been reviewed by clinical nurses and scrutinized by the technical and language laboratory at SCB. The item measuring IRU intention was formulated in the same way as the item on IRU behavior (this item was also scrutinized by SCB).

## **3.6 DATA ANALYSIS**

### **3.6.1 Extent of research use**

Descriptive statistics were used to study the extent of IRU, CRU, PRU (Study I and II) and IRU intention (Study IV). Frequency distributions were analyzed, including the ‘Don’t know’ alternative. For clarification, the response scale was dichotomized where response alternatives 1 to 3 were collapsed into one category and response alternatives 4 and 5 into a second category. Data were considered as interval data and parametric statistics was therefore used. Mean- and standard deviations (SD) were used to report extent on an aggregated level (excluding ‘Don’t know’ responses).

### **3.6.2 Comparisons of research use extent**

To compare the extent of RU at the different time points (Y1 and Y3 in Study I; Y1 and Y2 in Study II), t-test statistics were used for comparison of mean values, independent tests for non-related data (Study I) and paired tests for related data (Study II). In Study I, ‘Don’t know’ proportions were compared between Y1 and Y3 using chi-square tests. The level of statistical significance was set at  $p < 0.05$  (two-tailed).

### **3.6.3 The person-oriented approach and cluster analysis**

The person-oriented approach and its application in the form of cluster analysis have been described by e.g. Bergman et al. (2003). At the theoretical level, the person-oriented approach looks at the individual as an organized whole. At the methodological level, the theoretical perspective is translated or operationalized into person-oriented methods. In this case pattern analysis serves as such a methodological tool. The pattern-oriented approach is thus an application of the person-oriented approach and uses patterns of variable values as the basic analytic unit (Bergman and Trost 2006). The pattern-oriented approach rests on the assumption that the variables have a greater meaning as parts of a common configuration or pattern than as separate variables. Another basic underlying assumption is that there are a limited number of typical, optimal or critical value configurations of systems and that those configurations can be found by using the appropriate methods. The configurations have their characteristic value pattern across relevant variables and clusters are thereby formed based on pattern similarity. The person-oriented approach can be seen as a way to “bring back ‘the person’ into quantitative research” (Bergman et al. 2003, p. 3).

Furthermore, Bergman et al. (2003) describe how variable- and person-oriented approaches complement each other. The person-oriented approach does not assume that relationships between variables apply to all individuals studied, i.e. that all individuals function and develop in the same way. The combinations of the approaches may be useful and thought provoking, where the combined information may illustrate more than the separate parts. Whereas a variable-oriented approach provides generalizations about relations among variables using, e.g., comparison of means, correlation or regression analyses, cross-sectionally or over time, a person-oriented approach generalizes in terms of individuals' patterns of operating factors within a system and the stability and change in those patterns over time.

In this thesis the use of a pattern-oriented approach provides focus on research *users* as individuals in addition to research *use* as a variable. To study the nurses' RU profiles rather than each dimension (IRU, CRU and PRU) separately, a pattern-oriented approach was applied using cluster analysis. Studying RU through this approach reveals the naturally occurring RU profiles in nurses, i.e. how the three aspects of RU appear together. This approach gives a multidimensional and more nuanced picture of nurses' RU than just analyzing each aspect of RU separately. Cluster analysis was used in this thesis to study the nurses' RU profiles at Y1 and Y2 (EX2004, Study I and II) and at Y3 (EX2002, Study I). In addition, the stability of RU profiles has been studied over time between Y1 and Y2 (Study II). In the cluster analyses only individuals with complete responses (1 to 5 on the response scale for all three RU kinds) were included.

#### *3.6.3.1 Cluster analysis and research use profiles*

Cluster analyses were performed in SLEIPNER, version 2.1 (Bergman and El-Khoury 2002) with the aim to identify and describe homogeneous clusters of individuals presenting similar RU response profiles. SLEIPNER comprises a package of 16 modules for pattern-oriented data analysis. Ward's hierarchical agglomerative clustering method was used in which the squared Euclidian distance was applied as a measure of profile similarity. This method implies that, at the starting point, every individual with their three responses to the RU items is assumed to be a single cluster. In the clustering procedure fusions of clusters/individuals that are most similar proceed, resulting in subgroups/clusters comprising individuals (in this case nurses) that are similar in their response-patterns. The explained error sum of squares (EESS) (Bergman et al. 2003) was used to evaluate cluster homogeneity. To identify outliers preparatory analyses were performed before the actual cluster analysis. Following the cluster solution, a relocation procedure was performed to optimize/maximize cluster homogeneity. Individuals were allowed to be relocated to a different cluster than their original ones, if that resulted in an increase in the EESS value, i.e. more homogeneous clusters (Bergman et al. 2003). When the final cluster configuration had been decided on (primarily based upon EESS values and theoretically-reasonable profiles), each cluster could be described and graphically mapped according to its centroids (cluster mean values) and accompanying standard deviation values for each kind of RU. Standardized centroids (z-values) were used as measures of effect size (ES) to illustrate the centroids in relation to the sample as a whole.

In Study I, differences between two cluster solutions at two separate time points (Y1 and Y3) and in two separate samples were studied using K-means cluster analysis in SPSS. Such an analysis represents a non-hierarchical clustering procedure in which one sample (here Y3) was classified using the centroids from another sample (here Y1) as seed points.

### *3.6.3.2 Stability of research use profiles over time*

To study the RU profiles over time within the same sample (EX2004, Study II), structural as well as individual stability and change were analyzed based on the cluster analyses at each time point. In Study II, for the analyses of individual stability, individuals that were not included in the cluster analyses because of non-complete responses on the RU items constituted a separate group.

Structural stability is the study of whether, and to what extent, a cluster classification at one time point is reproduced at a second time point (Bergman et al. 2003). The centroid similarity between two sets of clusters was compared through pairwise matching and the Average Squared Euclidian Distance (ASED) was used as a measure of similarity (Bergman et al. 2003). The K-means cluster analysis was also applied here, where the Y2 sample was classified according to the Y1 cluster centroids. The EVALUATE module was used to compare the original Y2 cluster solution with the one that resulted from the K-means analysis and the adjusted rand index constituted a measure of structural similarity (Hubert and Arabie 1985).

Individual stability is the study of individuals' cluster membership over time, i.e. the tendency of individuals in a cluster solution at one time point to reemerge in a similar or different cluster solution at a second time point (Bergman et al. 2003). This was investigated in the EXACON module where a contingency table based on the individuals' cluster membership at the two time points was analyzed cell-wise based on exact tests (Bergman et al. 2003).

### **3.6.4 Change in research use and working conditions**

In Study II, individual change in RU was dichotomized and analyzed against employee turnover and other changes in working conditions (see Appendix for variables included in the analyses). The analyses were performed using chi-square tests of change in RU against each of the variables representing changed conditions. Furthermore, a collapsed and dichotomized variable constituting change in one or more aspects of working conditions in one category and no change in the other category was analyzed against change in RU.

### **3.6.5 Multivariate logistic regression modeling**

#### *3.6.5.1 Analytic schedule*

Because RU in this thesis is seen as a function of the individual, the organization/context and the undergraduate nursing education, a theory, model or framework that included all three dimensions was needed. Dopson et al. (2002) assert that context can be conceptualized as exercising its influences in different layers in the organization, from the outer government health policy layer to the inner single

organization and individual practitioner layers. In an attempt to model these ‘layers’ of the organization, including the individual within the organization, an adapted version of the NHS (National Health Service) model (Michie and West 2003, 2004) was used as a guiding tool (‘analytic schedule’) for analysis of data in Study III. Within the LANE study, the adapted NHS model has previously served as a tool to organize variables related to the organizational context, staff behavior and staff experiences within the organization, as well as organizational and individual outcomes (Rudman et al. 2008). The original model constitutes an attempt to systematize knowledge to understand people management and performance in healthcare organizations and has guided the preparation of the NHS staff survey, an annual survey of work conditions and health among health care employees in the UK (Michie and West 2003, 2004). The outcome in the NHS model is organizational performance in the form of patient care and its underlying assumption is that people and their performance are essential to an organization’s effectiveness. Management and psychological approaches are integrated in the framework with the aim to assist future explanation, prediction and organizational change. The original model has five levels: *context*, *people management*, *psychological consequences for employees*, *employee behavior* and *organizational performance*. The effectiveness of a healthcare organization is proposed to be influenced by these components as well as by their interactions. The *context* is proposed to include culture, climate and inter-group relations. *People management* refers to aspects of the management supposed to directly affect the individuals within the organization. *Psychological consequences for employees* concern emotional and physical well-being as well as attitudes to work and the organization. *Employee behavior* is here seen as levels of absenteeism, rate of turnover, errors and near misses and employee performance. *Organizational performance* refers to patient care. The components and links between these levels have been examined in relation to empirical evidence and the model is proposed to be evidence-based and having face validity (Michie and West 2004).

To fit the purpose of Study III the original NHS model was adapted. The outcome originally focused on the organizational level and was collected from quality registers, including the organization’s quality and effectiveness, with a focus on patient outcomes. In the LANE study the organization is primarily seen as an employer in which quality of care and patient outcomes occur as indirect objectives. Furthermore, the focus in the LANE study on the transition from education into working life has influenced the selection and placing of the variables in the model. For instance, individual and educational characteristics have been included. However, the ‘layered’ structure of the original model has been retained to illustrate the individual within the organization where the different layers together influence the final outcome.

The adapted model served as an analytic schedule used in Study III and included four elements (instead of levels), three sub-elements and the final outcome (RU). The elements included *Work context*, referring to structural circumstances related to employment, and the work setting. Work context was assumed to influence *Management* within the context, including the realization of staff policies and characteristics of management. Within the element *Individual qualities and characteristics* the sub-element *Individual perceptions of work* was expected to be influenced by management as well as the two sub-elements *Socio-demographic*

*characteristics and Individual perceptions and management of education*. Together this was assumed to result in *Psychological consequences for employees* and, finally, in *Staff performance* (RU). See Appendix for a description of the variables in each element/sub-element of the analytic schedule.

### 3.6.5.2 *The logistic regression procedure*

Because the focus in Study III was on the dominating proportion of respondents that scored overall low on all three kinds of RU, the sample was dichotomized into two groups representing overall low RU in one group (i.e. individuals with low RU across all three RU kinds) and the rest of the clustered sample (with high RU on one or more of the RU kinds) in the other group. To identify determinants of low RU logistic regression was chosen as the method for analysis and most of the independent variables were dichotomized. For variables measured using multi-item instruments mean values were calculated and dichotomizations were based on those mean values in relation to the response scale. See Appendix for information about response alternatives and cut-offs. The regression procedure was performed in three steps:

- **Step 1:** Bivariate logistic regression

Variables were selected from the LANE database based on results from previous studies and the assembled experience of the members of the research group. The pool of variables was organized according to the analytic schedule into elements and sub-elements. For descriptive purpose, the variables were then analyzed against the outcome by means of bivariate logistic regression.

- **Step 2:** Selection of variables for final multivariate logistic regression model

Separate regression models were performed for each element/sub-element to further select variables for a final multivariate logistic regression model with all elements/sub-elements represented. The objective was to find the variables with statistically significant associations to low RU when adjusting for multicollinearity with variables in the same element/sub-element.

- **Step 3:** The final multivariate logistic regression model

Variables with statistically significant relationships to the outcome in step 2 were included in a final regression model. Variables were entered sequentially, i.e. one element/sub-element at a time was added to the model in the following order, guided by the structure of the analytic schedule: (1) *Work context*, (2) *Management*, (3) *Socio-demographic characteristics and Individual perceptions and management of education*, (4) *Individual perceptions of work*, and (5) *Psychological consequences for employees*. (Variables pertaining to the two sub-elements *Socio-demographic characteristics and Individual perceptions and management of education* were entered together in the final regression model because the hypothesis was that both of them influenced the sub-element *Individual perceptions of work*.)

### 3.6.6 **Mediation analysis**

In Study IV, the focus was on RU intention among graduating nursing students. The purpose of the study was to test a model in which IRU intention constituted the core variable. Intention was tested as a predictor of subsequent IRU behavior and as a

mediating variable through which gains and experiences as well as capability beliefs from undergraduate education were allowed to exert their effects on IRU behavior. A mediation analysis was performed to investigate the plausibility of the hypothesized full mediation model that was set up to explain the interrelationships between the variables (Iacobucci 2008, Hu and Bentler 1998). The model was based on the work by Michie et al. (2005) and Godin et al. (2008). Michie et al. (2005) developed a framework of key theoretical constructs from psychological theory. The framework was suggested to be used in the interdisciplinary study of understanding and changing behavior related to implementation of evidence-based practice (EBP) and/or for designing interventions to improve implementation (Michie et al. 2005). Twelve theoretical domains explaining behavior change were identified and intention toward the behavior was one of those domains. In Godin et al.'s systematic review (2008) the 12 domains were used to suggest a theoretical framework and to classify variables found to be associated with intention or behavior.

To evaluate model fit, i.e. the extent of agreement between the hypothesized model and the observed data, a number of fit indices were used, as recommended by Hu and Bentler (1998): RMSEA (root mean-square error approximation of the mean) to evaluate model parsimony, SRMR (standardized root mean-square residual) to evaluate absolute model fit and CFI (comparative fit index) to evaluate relative model fit. The cut-off values were those, recommended by Hu and Bentler (1999): for RMSEA, close to or lower than 0.06; for SRMR, close to or lower than 0.08; and for CFI, close to or higher than 0.95.

Furthermore, intraclass correlations were computed with the aim to evaluate whether seat of learning should be included in the model analysis as a variable affecting the individual variation in RU intention and behavior.

### **3.6.7 Handling of missing data**

For RU, 'Don't know' and missing values have been reported for a descriptive purpose. In Study I, 'Don't know' proportions were analyzed separately and in the cluster stability analyses in Study III individuals lacking complete RU responses at each time point (and thereby not included in the cluster analyses) constituted an additional group included in the analyses. Thus, 'listwise deletion', i.e. complete deletion of a subject who has missing information (Polit and Beck 2008, p. 646), was the approach used in Study I, II and III. In Study IV, however, an inclusive analysis strategy was applied and auxiliary variables were used, which improves statistical power and makes the assumption of missing at random (MAR) more plausible (Collins et al. 2001, Enders 2010). In the analysis common patterns of missing data (missing responses and 'Don't know' responses) were identified in the outcome variables (RU intention and behavior) and auxiliary variables created different 'weights' to those different patterns. The auxiliary variables in this case were age, sex, aspects of student engagement (active and collaborative learning) and educational gains (regarding personal and social development) because those variables were found to be related to levels of the outcomes (intention and RU), which would indicate that data were not MAR. By including those variables in the model analyses they assisted in correcting for any systematic bias that could be involved because of sample selection (Collins et al. 2001,

Enders 2010) and made it possible to include the missing responses in the model estimation analyses.

### **3.6.8 Statistical programs and level of statistical significance**

Statistical programs used for the analyses included in the studies were:

- SPSS (SPSS Inc., Chicago, IL, USA) versions 14.0 (Study I), 16.0 (Study II and III) and 18.0 (Study IV).
- Sleipner, version 2.1 (Study I and II) (Bergman and El-Khoury 2002)
- Mplus, version 6.1 (Study IV) (Muthén and Muthén 1998-2010)

The level of statistical significance was set at  $p < 0.05$ . In Study II, the Bonferroni inequality method (Hair et al. 2006) was used to adjust the p-value in the analyses of individual stability in the EXACON module (Bergman and El-Khoury 1987), resulting in a p-value of  $< 0.002$ .

### **3.7 ETHICAL CONSIDERATIONS**

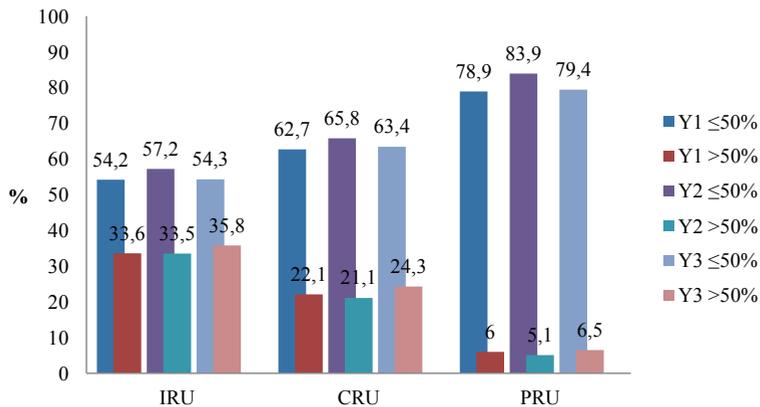
Participants gave their written informed consent to participate by signing and/or sending back the first questionnaire to the research group. In a cover letter, participants were informed about the LANE study, including e.g. its background and overall aim. Furthermore, the continuing cover letters kept the participants updated as to the progress of the LANE study. Participants were also informed about the voluntariness of participation and that they could withdraw from the study at any time if they wanted to. The cover letter also included information about the data handling procedure, i.e. that data files were sent from SCB to the research group and that information making individual identification possible was removed from the files. Each individual was represented by a study number making it possible to couple information from the same individual over time. A data file with social security numbers and their corresponding study numbers was stored at SCB, except for those participants who had declined further participation. Information given in the questionnaires was protected according to the Official Secrets Act and the Personal Data Act, also stated in the cover letter. For EX2006, participants were also informed about that some information was to be collected from a national register. The cover letters included contact details to members of the research team. Ethical approval for the LANE study, including the four studies in this thesis, was given by The Regional Research Ethics Committee at Karolinska Institutet, Stockholm, and by the Regional Ethical Review Board in Stockholm (Dnr 01-045, 04-587, 2008/226-32, 2006/973-32). The data files are stored on a secure server at Karolinska Institutet and only members of the research group have access to these data. The original data are stored safely at Karolinska Institutet.

## 4 RESULTS

The main findings from Study I to IV are here summarized and presented together.

### 4.1 EXTENT OF RESEARCH USE

Frequency distributions, means and standard deviations (SD) for the extent of RU according to the variable-oriented approach (Study I and II) are presented in Table 3. To facilitate interpretation, RU frequencies were dichotomized (Figure 2). At the group level, mean values for each kind of RU were almost identical across the different time points with the highest values for instrumental RU (IRU, 2.9-3.0), slightly lower for conceptual RU (CRU, 2.6-2.7) and lowest for persuasive (PRU, 1.7-1.8). This order was more apparent when the response scale was dichotomized, the proportion of nurses reporting RU on more than half or on almost every working shift was highest for IRU (33.5-35.8%), lower for CRU (21.1-24.3%) and lowest for PRU (5.1-6.5%). One particularly notable finding was the considerable proportions of nurses responding that they never used research, which ranged from 14.0% (CRU, Y1) to 40.1% (PRU, Y2). The proportions of nurses responding ‘Don’t know’ ranged from 7.9% (IRU, Y2) to 13.2% (PRU, Y3) and no statistically significant differences were found between time points in Study I.



**Figure 2.** RU extent dichotomized for IRU, CRU and PRU at Y1, Y2 and Y3. Response alternatives 1-3: on about half or less of the working shifts ( $\leq 50\%$ ), 4-5: on more than half or almost every working shift ( $> 50\%$ ). % based on total n (RU) at each time point. ‘Don’t know’ and missing responses excluded in the presentation.

### 4.2 THE PERSON-ORIENTED APPROACH

Using the variable-oriented approach, descriptive analyses were performed for each kind of RU at each time point. The mean values for each kind of RU only revealed the average ratings on the group level, where the SD values gave a brief indication of the individual variations within the sample. Through the pattern-oriented analyses, applied in Study I and II, the focus became on the nurses as research *users* rather than on research *use* as a variable.

**Table 3.** Frequency distributions of IRU, CRU and PRU extent at Y1, Y2 and Y3.

	Instrumental			Conceptual			Persuasive		
	Y1	Y2	Y3	Y1	Y2	Y3	Y1	Y2	Y3
	n	n	n	n	n	n	n	n	n
Never	197 16.9	211 19.8	138 17.3	163 14.0	193 18.1	128 16.0	461 39.6	427 40.1	291 36.5
On some shift	310 26.6	297 27.9	209 26.2	425 36.5	381 35.8	297 37.2	409 35.1	415 39.0	290 36.3
On 50% of shifts	124 10.7	101 9.5	86 10.8	142 12.2	127 11.9	81 10.2	49 4.2	51 4.8	53 6.6
On > 50% of my shifts	135 11.6	101 9.5	76 9.5	102 8.8	97 9.1	72 9.0	31 2.7	29 2.7	32 4.0
On almost every shift	256 22.0	256 24.0	210 26.3	155 13.3	128 12.0	122 15.3	38 3.3	26 2.4	20 2.5
Don't know	123 10.6	84 7.9	70 8.8	148 12.7	127 11.9	91 11.4	152 13.0	102 9.6	105 13.2
Missing	19 1.6	15 1.4	9 1.1	29 2.5	12 1.2	7 0.9	24 2.1	15 1.4	7 0.9
TOTAL	1164 100	1065 100	798 100	1164 100	1065 100	798 100	1164 100	1065 100	798 100
Mean (SD)*	2.9 (1.5)	2.9 (1.5)	3.0 (1.5)	2.7 (1.3)	2.6 (1.3)	2.7 (1.4)	1.8 (1.0)	1.7 (0.9)	1.8 (1.0)

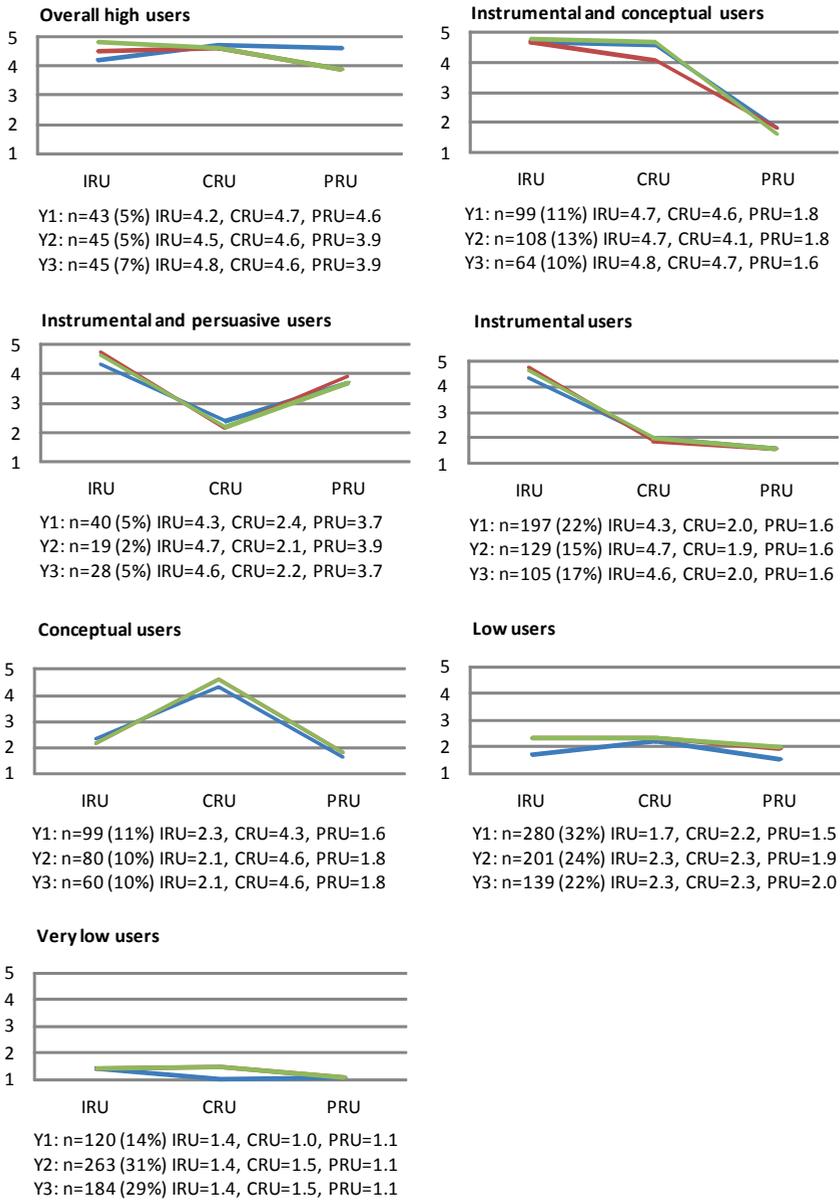
\*'Don't know' excluded

#### 4.2.1 Research use profiles

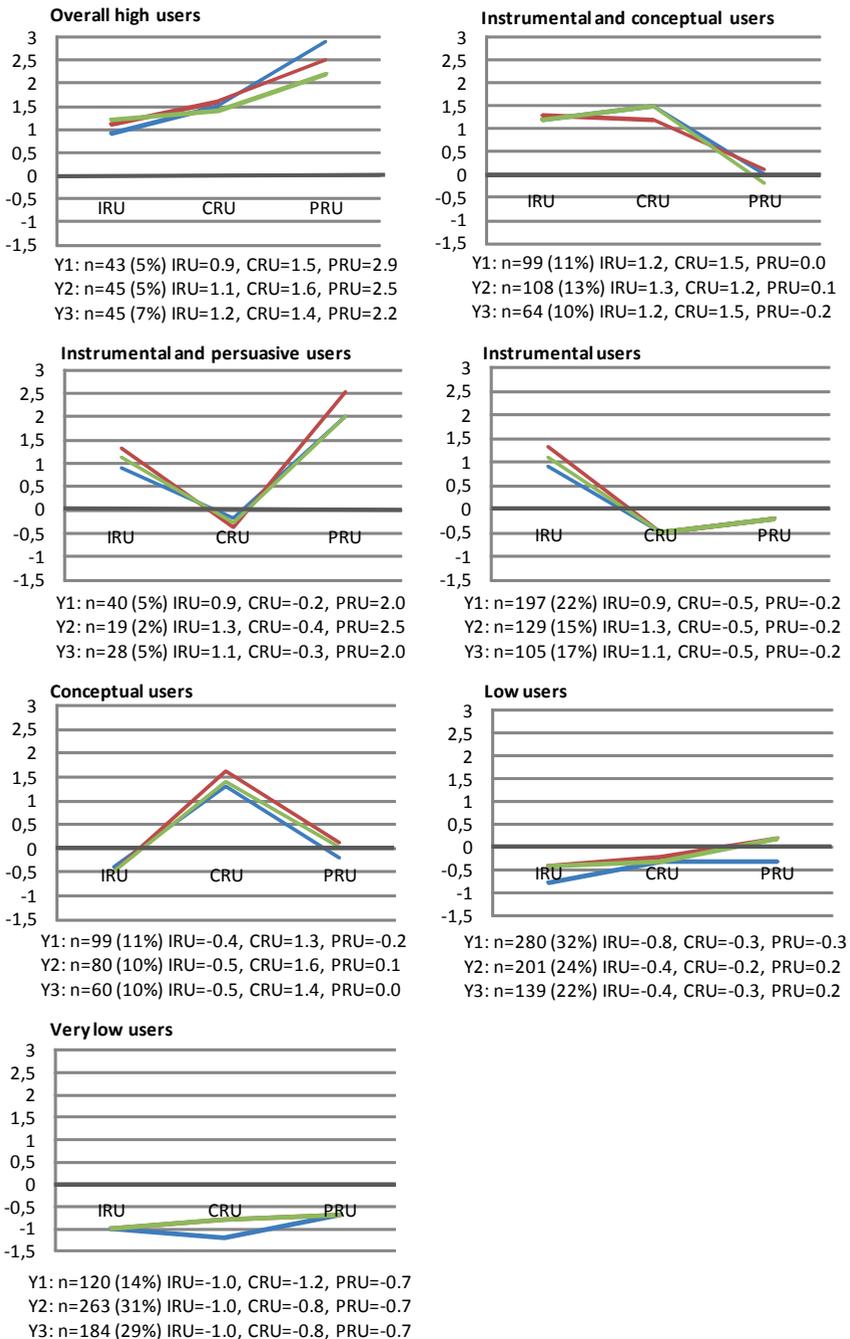
Profiles of RU were analyzed at year one and two (Y1 and Y2, EX2004) and year three (Y3, EX2002) postgraduation. Although the approach was explorative for each of the three analyses, the hierarchical clustering procedure resulted in seven clusters at each time point, each cluster presenting a specific RU profile based on the individual response profiles. EESS values were 80% (Y1), 82% (Y2) and 83% (Y3), indicating well-functioning classifications with respect to cluster homogeneity (according to Bergman et al. (2003), 67% and above indicates a satisfactory solution). The decision of cluster solution, i.e. the final number of clusters, was at each time point also based upon a judgment of theoretically-reasonable profiles. The seven profiles were very similar across all three time points and named 'Overall high users', 'Instrumental and conceptual users', 'Instrumental and persuasive users', 'Instrumental users', 'Conceptual users', 'Low users' and 'Very low users' (see Figure 3a and b for graphical illustrations of the profiles based on cluster mean [centroid] values and standardized mean values). High RU, judged upon visual inspection and *z*/effect size (ES)-values, corresponded to centroid values ranging from 3.7 to 4.8 and ES values between 0.9 and 2.9. The remaining cluster centroids were designated as low or very low, with centroid values ranging from 1.0 to 2.4 and ES values between -1.2 and 0.2. The consecutive order of the clusters for prevalence was similar at all time points. Collapsing the frequencies for 'Low' and 'Very low' use showed that the subgroup representing overall low RU was most common at all three time points with proportions ranging from 46-55%. The second most common profile was 'Instrumental users' (15-22%) while 'Overall high users' and 'Instrumental and persuasive users' were least common (2-7%) at all time points. High IRU was found in 35-43% of the cluster samples, while the corresponding proportion for high CRU was 27-28% and for high PRU 7-12% of the cluster samples.

When looking at the overall low users as two separate profiles ('Low' and 'Very low' users) the analyses in Study I showed that the cluster representing very low use was twice as prevalent at Y3 (29%) than at Y1 (14%). Because the cluster centroids differed somewhat between the samples at the different time points, the K-means cluster analysis was applied to determine whether the differing proportions were 'real' or rather due to differing cluster centroids. This analysis implied that the Y3 individuals were clustered according to the centroids from the Y1 sample and showed that 95% of the individuals ended up in the same cluster as in the original cluster configuration at Y3. It could therefore be concluded that the 'Very low users' were actually more common in the Y3 sample than at Y1.

Two theoretically possible combinations of high and low RU, 'Conceptual and persuasive users' and 'Persuasive users', did not appear in the cluster analyses indicating that those profiles are not naturally occurring RU profiles.



**Figure 3a.** Cluster mean values (centroids) across IRU, CRU and PRU at Y1 (blue), Y2 (red) and Y3 (green).



**Figure 3b.** Standardized cluster mean values (z-values) across IRU, CRU and PRU at Y1 (blue), Y2 (red) and Y3 (green) illustrating the deviance from total cluster sample RU mean values.

## **4.2.2 Structural and individual stability over time**

Results from Study I showing that overall low use was more common in the EX2002 sample at Y3 than in the EX2004 sample at Y1 and that ‘Very low users’ were actually more common in the Y3 than in the Y1 sample led us to study the cluster configurations in the same sample (EX2004) over time. Our overall objective was to study whether low RU was more common over time. For that purpose, the structural and individual stability of the clusters were examined. Structural stability, i.e. cluster similarity in both form and level, was demonstrated in the CENTROID analysis through comparisons of the Y1 and Y2 centroids, where ASED values ranged between 0.06 and 0.20 (mean value of 0.11). The Y2 sample was also clustered according to the Y1 centroids in a K-means cluster analysis and those two cluster configurations were then compared in the EVALUATE analysis where an adjusted rand index of 0.70 indicated high structural stability. Individual stability was also shown for all but one cluster. According to the EXACON analysis, all individuals, except those in the cluster representing high IRU and PRU, tended to keep their cluster profile over time. Furthermore, in addition to being stable, individuals being among the low research users at Y1 showed individual change over time, ending up among the very low users at Y2. Finally, the group with non-complete RU responses showed individual stability.

## **4.3 ASSOCIATED FACTORS**

The results from Study I and II, showing a predominance of overall low RU and a tendency to go from rating low to very low RU led us further to the study of factors associated with this low use to learn about the determinants of low RU.

### **4.3.1 Change in research use and working conditions**

In Study II, change toward overall low RU between Y1 and Y2 was analyzed in relation to employee turnover and major changes in working conditions. The cluster configurations at Y1 and Y2 were used to create the outcome variable, which was dichotomized as follows: individuals in cluster 1-5 at Y1 found in cluster 6 or 7 (overall low users) at Y2 in one group (n=121) and individuals being stable or making other changes over time in the other group (n=207). Those individuals who were already in cluster 6 or 7 at Y1 or who gave non-complete RU responses at Y1 and/or Y2 were excluded from the analysis (n=604). The analysis of change toward overall low RU resulted in no statistically significant associations in relation to the included variables: employer, form of employment, working hours, form of organization, working shifts, work overtime, further training and organizational change influencing working conditions. No associations were found in relation to each variable separately or in relation to the collapsed variable representing global change versus non-change.

### **4.3.2 Determinants of low research use**

The dominating proportion of individuals presenting overall low RU at Y2 (i.e. pertaining to the clusters ‘Low users’ and ‘Very low users’) constituted the outcome in Study III. The sample was dichotomized into one group consisting of overall low users (n=464) against the remainder of the sample (n=381). Factors relating to the individual, the undergraduate education and working context were modeled with the aim of identifying determinants of low RU (see Appendix for a presentation of the variables).

The analytic schedule based on the NHS model was used to demonstrate the relationships between the variables in relation to RU and to each other.

- **Step 1:** Bivariate logistic regression

A number of variables were found to be significantly related to low RU in the bivariate analyses when multicollinearity between the variables was still not taken into consideration. Variables showing significant associations to low RU in this first step of the analysis, but turning out as non-significant in the next step, were for the *Management* element: less work overtime and no individual plan for competence development. Further study after nursing degree represented *Socio-demographic characteristics*, while low ratings of global importance of studies, time allocated to studies (where more than full-time studies were less common among overall low users) and low preparation for work as a nurse were found as significantly associated with overall low RU within the sub-element *Individual perceptions and management of education*. Within the element *Psychological consequences for employees*, perceptions of disengagement were significantly related to overall low RU.

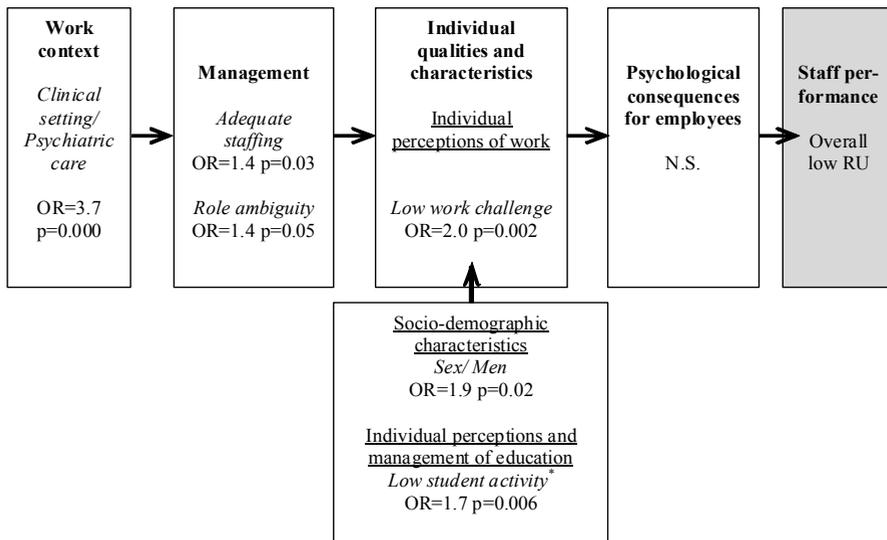
- **Step 2:** Each element/sub-element separately

In step 2 separate multivariate logistic regression analyses were performed for each element/sub-element. Most of the variables significantly related to the outcome in the bivariate analyses remained so after controlling for the effects from other variables within the same element/sub-element.

- **Step 3:** Final multivariate logistic regression model

In the final multivariate logistic regression model, including the variables with significant associations from step 2, all elements and sub-elements except one, *Psychological consequences for employees*, contributed with variables significantly associated with the outcome (Figure 4).

Consequently, the stepwise regression procedure resulted in six variables significantly associated with overall low RU. The variables were: clinical setting, staffing, role ambiguity, sex, student activity and work challenge. Those variables represented organizational factors as well as individual qualities and characteristics, including individuals' perceptions and management of education. For clinical setting, nurses within psychiatric care were more likely to be among the overall low users than nurses working in hospital care. For staffing, nurses who rated that staffing was adequate in relation to patients' need of care were more likely to be found among the low users. Nurses rating role ambiguity, i.e. the perception of low role clarity in terms of work goals and objectives, awareness of expectations and responsibility, had an increased probability of being overall low users. Male nurses were more likely low research users. Nurses who rated their student activity (in terms of contribution to discussion in class) as low during undergraduate education were more likely to be found among the low users two years postgraduation. Finally, the experience of low work challenge, where work challenge referred to the perception of one's skills and knowledge as useful and that work is meaningful and positively challenging, increased the probability of being among the overall low research users



**Figure 4.** Variables found as significantly associated to overall low RU in the final multivariate logistic regression model using the analytic schedule. Bold headings indicate elements and underlinings indicate sub-elements. N.S. = non significant. \*Contribution to discussion in class.

#### 4.4 INTENTION AS PREDICTOR OF SUBSEQUENT RESEARCH USE

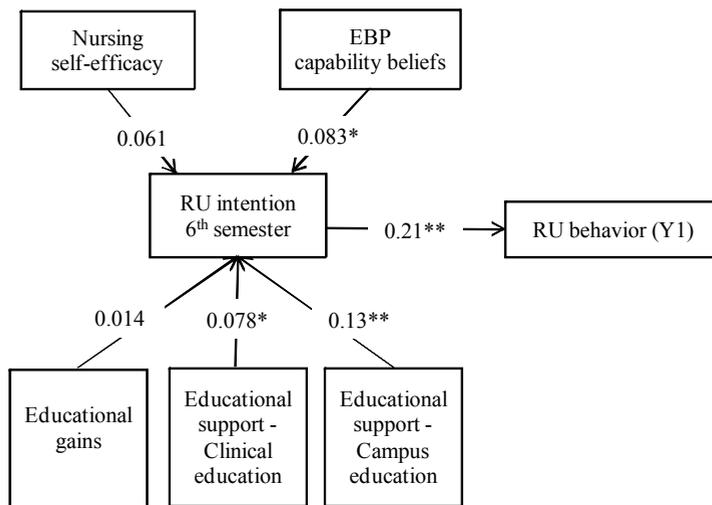
The results on the nurses' RU at Y1, Y2 and Y3, with the predominance of overall low RU (Study I and II), gave reason to focus on the nurses' starting point, here examined as graduating nursing students' intentions to use research instrumentally in future clinical practice as an RN. The role of intention as predictor of RU 1 year after graduation, as well as its role as a mediating variable, was examined in Study IV. The frequency distribution of IRU intention is shown in Table 4. The students' intentions showed variation: 1.5% (n=19) of the respondents reported that they never intended to use research in their future work and 34.0% (n=449) intended to do so on more than half or almost every working shift. A considerable proportion (n=273, 20.7%) responded 'Don't know' to the question on IRU intention.

The effects of the different universities on IRU intention and behavior were not large enough to be controlled for in the model analysis (intraclass correlations resulted in effects of 0.051 for intention and 0.015 for behavior). In mediation analyses, the hypothesized full mediation model with intention as the core variable was tested showing satisfactory model fit ( $\chi^2=11.51$ ,  $df=5$ ,  $p=0.042$ ;  $RMSEA=0.033$ ;  $CFI=0.94$  and  $SRMR=0.026$ ). Intention to use research instrumentally showed a direct effect on IRU behavior ( $r=0.21$ ,  $p<0.001$ ). In addition, IRU intention acted as a mediating variable for the effects of *EBP capability beliefs* and *Educational support for RU* (from campus and clinical education respectively), both presenting indirect effects on IRU behavior. The full mediation model explained 6.6% of the variance in intention and 4.5% of the variance in behavior. Figure 5 illustrates the full mediation model including direct and indirect effects, standardized parameter effects and p-values.

**Table 4.** Frequency distribution of IRU intention (6<sup>th</sup> semester in undergraduate education).

	IRU intention	
	n	%
Never	19	1.5
On some shifts	354	26.8
On about half of the working shifts	212	16.1
On more than half of the working shifts	190	14.4
On almost every shift	259	19.6
Don't know	273	20.7
Missing	12	0.9
Total	1319	100.0
Mean (SD)*	3.3	(1.2)

\* 'Don't know' excluded



**Figure 5.** The full mediation model with standardized parameter effects, \* p<0.05, \*\* p<0.001

## **5 DISCUSSION**

This section starts with a summary of the main findings from Study I to IV followed by a discussion in which the results from the four studies are integrated. First, the extent of RU as high or low is discussed based on the findings in Study I, II (RU) and IV (RU intention) and with regard to previous research and the different kinds of RU. The extent of RU for new nurses is further discussed in relation to expected outcomes of nursing education and the conditions of the organizational context that the new nurses face after graduation (Study III and IV). Of the six determinants of overall low RU found in Study III, the discussion focuses on the findings related to clinical setting, staffing and student activity. The discussion of findings is followed by a section on methodological considerations in which strengths and limitations are discussed. Finally, the section ends with concluding remarks and suggestions for future research.

### **5.1 SUMMARY OF MAIN FINDINGS**

At all time points, instrumental RU (IRU) was reported as most prevalent, followed by conceptual RU (CRU) and persuasive RU (PRU). Dichotomizing the data, about one third of the respondents reported IRU on half or more than half of the working shifts. Analysis according to a pattern-oriented approach using cluster analysis revealed seven clusters of nurses, showing seven RU profiles over the three kinds of RU. The two clusters representing overall low and very low RU across all three kinds of RU predominated at all time points, i.e. at 1, 2 and 3 years after graduation (Y1: 45.5%, Y2: 54.9%, Y3: 51.6%). The cluster representing very low users was more common at Y3 (EX2002) than at Y1 (EX2004) and an analysis over time showed that the low users tended to become even lower between Y1 and Y2 (EX2004). The seven profiles showed structural stability between Y1 and Y2 and all profiles except one demonstrated individual stability. A number of changes in working conditions over time between Y1 and Y2 could not explain the change toward overall low RU. Results from multivariate logistic regression analyses showed that six factors were significantly related to overall low RU at Y2: work in the psychiatric setting, role ambiguity, sufficient staffing concerning patient's need of care, low work challenge, being male and low student activity. IRU intention was investigated in the last semester of undergraduate studies in a third sample (EX2006), showing that 34.0% of the student sample intended to use research instrumentally on more than half or almost every working shift as RN in their subsequent clinical practice. When tested in a full mediation model, IRU intention in the last semester of education showed a direct effect on IRU behavior at Y1. In addition, intention acted as a mediating factor for the effects from EBP capability beliefs as educational outcome and perceived support for RU (from campus and clinical education) on IRU behavior.

### **5.2 EXTENT OF RESEARCH USE - HIGH OR LOW?**

Can the extent of RU found in Study I and II be considered as high or low? Generally, this is a difficult question to answer because the findings cannot be compared to a 'gold standard' (Squires et al. 2011c). I believe the answer is relative and can be looked at from several perspectives. In the present thesis, extent of RU was presented as frequency distributions and mean values from a variable-oriented viewpoint and as

clusters using a pattern-oriented approach. These different illustrations of data provide a promising path for elaborating on the issue of RU extent.

### **5.2.1 Extent of research use in previous research**

The extent of RU found in Study I and II will here be related to results from previous studies including IRU, CRU and PRU that are included in Squires et al.'s (2011c) systematic review on nurses' extent of RU. In that review, including various RU measures and instruments, equal quartiles were created for each of the response scales to make it possible to make comparisons across studies. The quartiles were categorized as representing 'low', 'moderate low', 'moderate-high' and 'high' RU. For the RU response scale from 1 to 5 used in the present thesis, such a categorization corresponds to: 1-1.99 ('low'), 2-2.99 ('moderate-low'), 3-3.99 ('moderate-high') and 4-5 ('high'). Based on this categorization, mean values for IRU are classed as moderate-low/moderate-high, mean values for CRU as moderate-low and mean values for PRU as low. Cluster centroid values assigned as high in this thesis correspond to values between 3.7 and 4.8, which is equivalent to moderate-high or high use according to the proposed categorization. Centroid values assigned as low in this thesis (1.0-2.4) correspond to 'low' or 'moderate-low use'. Results from Squires et al.'s (2011c) review showed that the extent of RU was reported as moderate-high in the majority of the studies. For the studies using 'Estabrooks' Kinds of RU' (as in this thesis), RU was, at the lowest, reported as moderate-low. Thus, the average extent of IRU, CRU and PRU reported in this thesis seem to be lower compared to the extent found in the systematic review. Furthermore, the present findings from the cluster analyses in which the two clusters representing overall low RU were dominating, indicate a problematic situation. It might be that similar findings of overall low research users would have emerged if a pattern-oriented approach had been used in the previous studies. However, because relatively newly graduated nurses exclusively rated the extent of RU investigated in this thesis, this sample is not fully comparable with other more heterogeneous samples for worklife experience and time since graduation. The importance of that difference is unknown, but should be kept in mind when comparing the present findings with those from previous research.

### **5.2.2 Extent of research use in relation to the samples**

To relate the cluster centroids for each separate cluster to the RU values in the cluster sample as a whole standardized values (z-values) were calculated as measures of effect size (ES) (Study I and II). The ES values illustrated the deviances of the centroid values from the mean value of the total cluster samples. For the centroids denominated as high, ES values ranged between 0.9 and 2.9; for centroids denominated as low, values ranged between -1.2 and 0.2. An ES of 0.8 is a large effect according to the accepted standard (Cohen 1992) and thus all centroids denominated as high exceeded that threshold. PRU depicted the highest ES values, which is due to the relative unusualness of high PRU ratings in comparison with the other kinds of RU. For the centroids denominated as low, some clearly deviated from the sample mean values, whereas others deviated only slightly or not at all. Their deviance from the high clusters was substantial, however. The labeling of values as high and low was therefore justified in relation to the scorings made by the samples under study.

### **5.2.3 No use at all? - The ‘never’ response**

At all time points and also for IRU intention while still in education, there were nurses reporting that they never used research or that their intention was to never use research in subsequent clinical practice. The proportion of ‘never’ responses for RU in clinical practice ranged from 16.9 to 19.8% for IRU, from 14 to 18.1% for CRU and from 35.6 to 40.1% for PRU. For IRU intention, that proportion was 1.5%. While the extent of RU on the scale from 2 to 5 can be discussed in terms of what level that should be regarded as high and low, a ‘never’ response (1 on the response scale) definitely corresponds to no use at all. As will be discussed below, such a response might be more expected and defensible when it comes to PRU and possibly to CRU, but a ‘never’ response for IRU indicates an alarming unawareness about the source of knowledge for one’s actions.

### **5.2.4 Different kinds of research use**

It is conceivable that the expected extents of RU could differ between the different kinds of RU because of their diverging purposes, i.e. that the labeling of high and low RU should not be done according to the same criteria for all three kinds of RU. The extent of RU at all three time points was reported as being highest for IRU, followed by CRU and PRU. This relative order of the three kinds of RU is not in accordance with previous findings. According to the systematic review on nurses’ extent of RU (Squires et al. 2011c), RU extent was highest for CRU, followed by IRU and PRU.

A possible argument for why CRU would be expected to occur more frequently than IRU would be that action, i.e. IRU, is more demanding than thinking and reflecting in the sense that IRU can be seen as ‘going one step further’. Such a position agrees with the view of RU as a cumulative process according to stage models in which RU often ‘stays’ at a conceptual stage rather than developing further to actual application of the findings (IRU) (Nutley et al. 2007a). However, in this thesis CRU is not seen as necessarily preceding IRU: the cluster analysis showed that there are ‘Instrumental users’ that score low on the other two kinds of RU. IRU can be understood here as something that can be done more or less ‘automatically’, without barely a thought on the source of the knowledge used. That kind of IRU could be compared to ‘protocol-based care approaches’ that have been referred to as mechanisms for standardization and includes the use of guidelines, care pathways, protocols and algorithms (Rycroft-Malone et al. 2008). Such use of research is not very strenuous for the individual; it rather aims at facilitating their daily practice and could therefore be expected to occur in daily clinical practice among most nurses providing patient care, i.e. more frequently than CRU and PRU (and more frequently than reported here). In Strandberg’s (2011) thesis IRU could occur as a result of simply following instructions, i.e. not necessarily requiring awareness or active engagement of the user. ‘Passive’ IRU was suggested as corresponding to following already implemented research-based routines or guidelines without reflecting on their knowledge base (Strandberg 2011). Passive or non-reflected IRU, however, has most likely not been measured in this present thesis because the nurses could only report what they themselves were aware of. Nurses’ actions are most likely more research-based than they actually report, indicating that IRU is sometimes non-reflective and that the extent reported here is probably an underestimation. This constitutes a problem (and a risk) because a ‘reflective practitioner’ (Plack and

Greenberg 2005) is needed to ensure safe and high quality nursing care, to avoid mechanistic acting and to ensure that the application of research findings correspond to patient needs (Stetler 2001, Rycroft-Malone et al. 2004, Plack and Greenberg 2005). As for IRU, the nurses might sometimes be unaware of their CRU and PRU, i.e. that they think and reflect upon something or try to persuade others about something, but without knowing that the underlying knowledge is research-based.

Another possible argument for why CRU is reported to occur more often than IRU in previous studies might be a slightly different formulation of the IRU item in several of the previous studies: “Direct research use often results in protocol, procedure, routine or policy development” (Estabrooks et al. 2003a, 2004a). Because that alludes to IRU on a policy level rather than at the individual nurse level, it could possibly have lowered the extent of IRU reported in previous research. That formulation was not included in the RU items in this thesis. Another conceivable explanation to the different relative ordering of the three kinds of RU could be related to the samples in this thesis, which differ from previous ones in that they only included relatively newly graduated nurses. It has been suggested that nurses might be more of task-oriented ‘doers’ (here to be compared to instrumental users) in the beginning of their career while their critical analysis of nursing practice develops over time (Duchscher 2001).

The relative order of the different kinds of RU found in this thesis is, however, in accordance with findings in Strandberg et al. (2010). In that study the thinking and learning processes underlying CRU were described as more difficult than IRU because CRU is more demanding in terms of energy and engagement and because it might require changed attitudes. Consequently, it might follow that CRU could be expected to occur less frequently than IRU. In addition, CRU requires that the individual nurse has access to the actual research result in some form (journal article, conference presentation, etc.) to reflect upon, whereas IRU only requires access to the already implemented research findings (e.g., in the form of a clinical guideline or protocol). Therefore, CRU might be more demanding and, consequently, occurring less frequently.

PRU can most likely not be expected to be frequently occurring in daily clinical practice because it aims at influencing others to achieve change in areas such as conditions, guidelines or care performance. PRU as least common is also consistent with previous findings (Squires et al. 2011c). In the work by Strandberg (2011) members of an expert panel perceived PRU as being unusual in a nursing context with direct nursing care providers and that organizational prerequisites, such as opportunities to discuss research findings, are often lacking in clinical practice at hospital wards. It is also conceivable that PRU could be expected to be particularly uncommon among relatively newly graduated nurses because they usually have less authority at the work place and often strive to ‘fit in’ rather than making their voice heard (Maben et al. 2006).

#### *5.2.4.1 Profiles across the three kinds of research use*

The seven cluster profiles identified in two separate samples and at three separate time points, together with the structural stability of the profiles, strongly indicate that those

profiles are the ones that are naturally occurring. At first sight, 'Overall high users' seems desirable and worth aiming for, but how plausible is it actually? Is it reasonable with such high extent of PRU? What did those nurses refer to with respect to the extent of their PRU? Were they in the middle of some kind of lobbying for changed conditions at their workplace? Or, did they define PRU as not only related to major changes in working conditions or care performance but also persuasive use of research knowledge in relation to the patient (e.g., when speaking in favor of life style changes)? However, this was an unusual profile, comprising only 5-7% of the cluster samples. The profile that comprises 'Instrumental users' seems reasonable because it is possible, e.g., to work in adherence with research-based protocols and guidelines without applying CRU and/or PRU. Using research instrumentally and conceptually but without high PRU (i.e. 'Instrumental and conceptual users'), also seems reasonable but what about the 'Instrumental and persuasive users'? This was also an unusual profile (2-5% of the cluster samples) and raises questions about the application of IRU and PRU without some kind of cognitive processing of research findings. Concerning the profiles representing 'Conceptual users', 'Low users' and 'Very low users', they have low IRU in common, which seems somewhat unreasonable in relation to what was discussed above regarding the expected extent of IRU. It is important to keep in mind, however, that RU reported as low (i.e. as less salient) does not mean no use at all. The cluster centroids illustrate the average RU among the nurses within that cluster, i.e. there was a variation in RU also within the clusters. For instance, 'Conceptual users' may apply some IRU and PRU as well, but to a relatively low extent.

Profiles with high CRU and PRU or with solely high PRU did not appear as naturally occurring in the cluster analyses. By that these profiles correspond to 'white spots' (Bergman and Magnusson 1997), i.e. patterns occurring seldom or not at all, and are valuable to note in relation to RU as a phenomenon because "...it is the combination of patterns that occur often and those that occur seldom or not at all which describes the empirical world" (Bergman and Magnusson 1997, p. 313). The non-existence of those profiles seems reasonable in that both lack the most common 'daily' RU component in the form of IRU.

The clusters consisting of subgroups of individuals characterized by different RU profiles can be compared to Rogers' (2003) categorization of individuals into adopter categories. His categorization, however, was based on the individual's degree of innovativeness, defined as time to first use of a new idea. The five adopter categories ranged from 'Innovators' to 'Laggards' and represented ideal types with their specific generalized characteristics and values. By that kind of 'audience segmentation', i.e. "a strategy in which different communication channels or messages are used to reach each subaudience" (Rogers 2003, p. 292), the aim was to facilitate change by tailoring the interventions to the specific audience. Whether the RU profiles in this thesis can serve a similar purpose needs to be studied in future work, but they can at least provide a starting point with the potential to improve the understanding of meaning and clinical consequences of the different RU profiles.

### **5.3 OUTCOMES OF UNDERGRADUATE EDUCATION**

Considering the nursing samples in the present thesis, what could we expect in terms of RU? A simple answer would be that they are expected to provide research-based care to patients according to the description of competence for nurses (The National Board of Health and Welfare 2005), as well as the educational objectives for nursing education and higher education in general (The Swedish Code of Statues 1992, 1993). This lies within their responsibility, and as RNs, they are bound to fulfill these professional requirements. However, our and previous results suggest that the question is more complicated than it may first appear. Whether the new nurses fulfill their professional duties or not depend on a number of factors, such as that nursing education holds high quality in accordance with requirements in laws and regulations and that the individual nurse students possess the ability and engagement required to attain the educational goals.

In a recent examination of nursing education by the Swedish National Agency for Higher Education (2007) several of the universities failed because of unmet requirements for higher education. The specific reasons for the failure varied but were, e.g., related to an unsatisfactory integration of the scientific perspectives into education. Many of the students in the samples underlying this thesis graduated from universities that later on failed in the examination. Therefore, the quality of undergraduate nursing education that those students had passed cannot be taken for granted.

Results from Study III showed that individual perceptions and management of education in terms of student activity played a role for subsequent RU 2 years postgraduation. This finding is of particular interest because research about factors related to undergraduate education in relation to subsequent RU in clinical practice is lacking. The variable student activity was categorized in this thesis as pertaining to individual qualities and characteristics, but the difficulty to designate a variable as purely individual, educational or organizational/contextual in nature needs to be emphasized.

#### **5.3.1 Research use intention**

Study IV showed that only about one third of the students intended to use research instrumentally on more than half or almost every working shift after their graduation. Other results showed that educational outcomes in the form of evidence-based practice (EBP) capability beliefs and educational support for RU from campus and clinical education predicted IRU intention. Consequently, intention thereby acted as a mediating variable for the effects from educational factors on RU behavior 1 year postgraduation. Results from the intraclass correlations demonstrated that a negligible amount of the variation in RU intention and behavior was due to the seat of learning, indicating that the student (and later nurse) as an individual played a more prominent role. Educational activities and their quality was most probably also important, but the results did not indicate that any specific activity pertaining to the university setting or other group-related phenomena affected all students equally. From the modest extent of IRU intention reported by the students close to graduation, it seems that their starting point regarding RU was unsatisfactory in regards to educational goals and expectations.

This indicates that undergraduate education has somewhat failed in providing the students with prerequisites for EBP (including RU).

Since undergraduate nursing education includes campus and clinical education, students' experiences from both areas are important to their future work as RNs. As mentioned previously, the theory of planned behavior (TPB) (Ajzen 1988, 1991) has been suggested as appropriate in predicting behavior, with behavior intention as the most immediate predictor of subsequent behavior (Perkins et al. 2007, Godin et al. 2008). According to TPB, attitudes toward the behavior predict behavior intention. Attitudes are also an important determinant of nurses' RU based on a recent systematic review (Squires et al. 2011a). Furthermore, beliefs and behaviors among important others also predict intention according to TPB (e.g., in the form of a 'subjective norm', i.e. the perception of social pressure to perform the behavior, as well as 'normative beliefs', referring to the performance or non-performance of the behavior by important others). 'Perceived behavioral control' (equivalent to self-efficacy/capability beliefs [Ajzen 1991, Armitage and Conner 2001]) is also proposed as being important where capability beliefs, here in the form of EBP capability beliefs, are built up from, among other things, mastery experiences, i.e. successes and failures in performing the behavior (Bandura 1997). The influence from important others is evident also in relation to building capability beliefs (in terms of role modeling and social persuasion) (Bandura 1997). Consequently, a focus on the predictors mentioned above appears relevant for educators in campus education as well as preceptors (and other nurses) that students encounter during their clinical studies. Educators and preceptors constitute important others that can positively support the students' views about RU. Building favorable attitudes and ensuring positive mastery experiences in relation to RU appear as promising target activities.

#### **5.4 THE NEWLY GRADUATED AND THE ORGANIZATIONAL CONTEXT**

Whether the new nurses fulfill their professional duties also depends on the clinical context that students (future nurses) meet during clinical studies and as newly graduated nurses. A key question is whether that context makes it possible to practice the kind of nursing care that today's nurses are expected to provide. In previous studies on newly graduated nurses' experiences in clinical practice the new nurses experienced a gap between education and clinical practice (Greenwood 2000, Maben et al. 2006, Higgins et al. 2009), a gap that was already felt during education (Corlett 2000, Holmström and Larsson 2005, Lilja Andersson 2007). Experiences of the transition from education to clinical practice were not investigated in this thesis, but nurses' experiences have been described in a recent report based on data from the EX2006 LANE cohort (Djordjevic et al. 2011). Many of the new nurses 2 years after graduating had experienced that their undergraduate education had failed to give a clear and realistic picture of the nursing profession, that there was a gap between theory and reality, that scientific perspectives were not welcomed in practice and that practical skills need to be given priority (Djordjevic et al. 2011). Experiences as the ones described above might have contributed to the low and very low RU ratings found in Study I and II. Terms such as 'Reality shock' (Kramer 1974) or 'transition shock' (Duchscher 2009) have been used in previous studies to describe the transition experience. How long a 'reality' or 'transition shock' might last is not clearly defined,

but the shock might result in the establishment of behaviors that are maintained by the context. This maintenance has to do with a process of socialization into the nursing profession (Kramer 1974, Melia 1987, Price 2009). To show a behavior that is 'accepted' by important others can be one strategy to survive and deal with feelings of divided loyalty (Maben et al. 2006, Mooney 2007).

#### **5.4.1 The clinical setting**

Previous research has shown that RU might differ between clinical settings. In a recent review of individual determinants of RU (Squires et al. 2011a) a significant relationship was found between clinical specialty and RU, with nurses in critical care areas reporting higher RU. In the study by Boström et al. (2009) a greater proportion of nurses in elder care applied EBP than nurses in hospitals and within psychiatric and primary care. It was suggested that this might be due to the supervisory role of the nurse within elder care in Sweden where nurse aids, who lack university education, dominate the staff.

Regarding the association between low RU and the psychiatric setting found in this thesis, it is difficult to know what characteristics are shared among different psychiatric units or among the nurses working within psychiatry. Research is lacking that compares RU between nurses within the psychiatric and other care settings. Newly qualified mental health nurses have reported similar perceptions of the transition from education into working life and the situation as a new nurse within other health care settings (Rungapadiachy et al. 2006). For example, nurses reported experiencing a theory-practice gap and that they had difficulties in applying EBP. Koivunen et al. (2010) found a deficiency in information retrieval skills in Finnish nurses in psychiatric hospitals and Swedish psychiatric nurses have reported both low use of evidence-based literature and limited access to the literature (Bahtsevani et al. 2005). Consistent with findings from other nursing areas, research literature has been reported as a rarely used knowledge source by Irish psychiatric nurses (Yadav and Fealy 2011b). Barriers for EBP and RU reported by psychiatric and mental health nurses include lack of time to find research, difficulty to find research reports and difficulty to understand research (Yadav and Fealy 2011a), similar to the ones reported from other settings. However, in the study by Carrion et al. (2004) on barriers to RU in forensic mental health nurses, the item stating "the research is not relevant to nurses' practice" was among the top five items, which constituted an exception from previous findings. The authors concluded that this might indicate that nurses within mental health care are having difficulties finding research that is applicable to their own setting. Zauszniewski and Suresky (2003) asserted that tradition has a strong influence within psychiatric and mental health nursing practice and that there is a lack of intervention studies within the area. They call for more psychiatric nurse researchers, increased relevance of the research and implementation of change guided by empirical evidence (Zauszniewski and Suresky 2003). Representing the area of psychiatric medicine, Maier (2006) acknowledged that evidence-based psychiatry is an important and useful approach but claimed that it is of limited benefit because of particularities of psychiatric diagnoses and therapeutic practice.

Taken together, research findings on RU and EBP in psychiatric settings are in many ways similar to findings from other health care settings. However, it is possible that the reasons for the association between low RU and the psychiatric setting in Study III, are lack of relevant research and perceptions that the evidence-based agenda is not fully applicable within psychiatric care. Another possible explanation could be of a methodological nature. The RU items used in this thesis included no specific examples on RU in a psychiatric setting, which might have made those nurses less inclined to find out examples on RU from their own practice. This problem might have contributed to the gap between the extent of RU rated by psychiatric nurses and nurses within other settings.

#### **5.4.2 Staffing**

Staffing is a strongly debated issue in relation to today's requirements for cost savings and streamlining within the health care sector. It has been previously investigated in relation to nursing care quality and patient outcomes, including patient mortality (Sochalski 2004, Cho et al. 2008, Thomas-Hawkins et al. 2008). Staffing has also been studied previously in connection with RU (Cummings et al. 2007), where increased staffing was associated with higher RU. In Paper III, however, results showed an association in the opposite direction than what would be expected from previous research, i.e. the perception of adequate staffing was more common in overall low research users. The survey question referred to the adequacy of staffing for patients' need of care. It might be the case that nurses who are critically reflecting on their work and who believe that research-based care is important for patient outcomes, might be those who also reflect most on staffing adequacy. Nurses with an overall low RU profile might be less inclined to perceive RU as a prerequisite for care quality. They might therefore respond that staffing is adequate in that they do not perceive a need for changed conditions to bring about increased care quality. Furthermore, the actual number of staff might not always be most decisive. Instead, skill management has to do with staff skills and how those skills can best be used (Dubois and Singh 2009). It is therefore management's responsibility to ensure that staff skills are appropriate.

#### **5.4.3 Research use over time postgraduation**

In Study I, no true longitudinal analyses were possible because the samples at Y1 and Y3 originated from different cohorts. Results from that study, however, did serve to raise a hypothesis for further investigation in Study II, namely whether the cluster comprising very low research users increased over time. In Study II, the analysis of one single sample over two time points (Y1 to Y2) showed that the proportion of overall low users increased over time and that low users at Y1 tended to become even lower users at Y2. The analyses were performed on the data available at that time, but the time span between Y1 and Y2 was very short in this matter and restricts the possibility to draw firm conclusions. However, other findings from the LANE study on the development of burnout over time show a similar negative picture at Y2 in which burnout levels increased substantially, most likely because of the influence of practice work environments (Rudman and Gustavsson 2011). This finding indicates that the situation 2 years postgraduation is particularly troublesome also in other aspects than RU.

It is worrying that there was nothing indicating a ‘recovery’ over time in the low or very low users; rather, the opposite seemed to be the case. This could be the result of a socialization process into the nursing profession that aims at ‘fitting in’ (Maben et al. 2006) and at conformation to existing practice (Mooney 2007) where reflections upon the knowledge base of the work is not always valued. Such a clinical setting might hinder RU ‘recovery’. What could be expected in RU development over time is difficult to know. The association between years of nursing experience and RU have been previously investigated, but with nonsignificant results (Karkos and Peters 2006, Chau et al. 2008). In a recent review on individual determinants of nurses’ RU (Squires et al. 2011a) years employed as a nurse was not among the variables showing a consistent and statistically significant relationship to RU. In a sample of US military nurses (Kenny 2005, Estabrooks et al. 2007) years of experience, however, correlated negatively with RU. It was suggested that this finding might be an indication of solidified practice over time, i.e. that nurses become less inclined over time to find new ways of doing things (Kenny 2005), and that knowledge sources used by experienced nurses may include more tacit forms of knowledge (Estabrooks et al. 2007). Further research on RU development over time that covers a longer time span is needed. It would also be interesting to study new nurses’ experiences regarding their use of knowledge over time, using a qualitative approach.

## **5.5 METHODOLOGICAL CONSIDERATIONS**

The studies included in this thesis have methodological strengths as well as limitations that have to be considered when interpreting the findings. Such issues will be discussed according to the different steps in the research process, both in relation to the overall LANE study and the four studies in this thesis.

### **5.5.1 Design**

The LANE study is unique with its large nationwide sample and its prospective longitudinal design. Further, the study is homogenous as far as of type of undergraduate education, time since graduation and in working life experience. Many of the variables studied within LANE had previously been identified as variables of importance to RU, both in empirical studies and theoretical work. The designs of the different studies in this thesis were based on data available at the moment and the research questions were partly generated based on the emerging findings. These circumstances made it necessary to use data from all three LANE cohorts, a fact that restricts the possibility to draw true longitudinal conclusions. The analyses based on different cohorts, however, did constitute considerable strengths: for instance, the validity of the cluster profiles could be strengthened through the structural stability shown across different samples.

### **5.5.2 Instruments**

The measure, ‘Estabrooks’ Kinds of RU’, was chosen to measure the outcome because of a number of strengths in comparison with many of the other instruments used to measure RU extent (Squires et al. 2011b). ‘Estabrooks’ Kinds of RU’ has been previously used in a number of studies resulting in an assembled body of validity evidence. This constitutes a strength in the sense that the limited use of many of the instruments, i.e. the use of an instrument in only one single study, is a problem within this field of research. Furthermore, lack of construct clarity, including lack of definitional

precision of RU and confusion regarding the formal structure of RU, has been targeted as one of the core methodological problems within the field. There is also confusion regarding measuring factors associated with RU, on the one hand, and RU per se on the other. For most studies that included definitions of RU, those definitions varied significantly between studies. In this thesis the typological structure of RU was deemed appropriate for our study aim. 'Estabrooks' Kinds of RU' is based on explicit definitions of RU (including a definition of both 'research' and 'use'). Furthermore, it measures RU per se instead of using proxies for RU. The instrument has been used in multiple studies and the RU definitions have been consistent across studies. 'Estabrooks' Kinds of RU' was developed for nurses, which is the target group also in this thesis, and it has been used in a variety of settings, which is also in accordance with the use in this present thesis based on a general nursing sample. Because the validation process of a test proceeds continuously (AERA, APA, NCME 1999), findings and experiences of the use of the measure in the studies presented here can contribute to this assembled body of evidence.

The limited use of the translated and adapted items in a Swedish context might constitute a limitation. The studies included in the systematic review of self-report RU measures in health care (Squires et al. 2011b) originated from Canada and the USA exclusively and did not include samples of newly graduated nurses. The Swedish items were pilot tested but are not yet as extensively used as the North American version. The items, however, are used in ongoing research from which results will contribute to a body of evidence also in a Swedish context. The single-item format of the three kinds of RU has its drawbacks regarding measurement reliability, in which the underlying hypothesis of multi-item instruments is that they allow random measurement errors to average out (Spector 1992). Also, the measure of IRU intention, while still in education, had a single-item format. As for the RU items, the response scale was formulated as a frequency scale, which is recommended for constructing questions on intention based on the TPB (Francis et al. 2004). In addition, the frequency scale was in correspondence with the response scale for behavior, which is considered a strength (Sheeran 2002).

### **5.5.3 Data analysis**

In the analyses RU data were seen as interval data and parametric statistics was applied. This made it possible to perform the cluster analysis, an approach considered as valuable to further understand RU in clinical practice and its associations with other factors. However, another approach to data analysis was tested in which the RU scale was dichotomized (low RU: response alternatives 1-3, high RU: response alternatives 4-5) and the cluster sample was then divided into subgroups of respondents showing all possible combinations of high and low RU across the three kinds of RU. Those profiles were compared with those generated in the three different cluster analyses showing that the prevalence of the profiles corresponded between the two approaches. This observation implies that our treatment of data did not considerably alter the results. A crucial strength of the cluster analysis as a method is that it generates the 'naturally occurring' profiles, i.e. the researcher does not 'impose', e.g., cut-offs on data.

### 5.5.3.1 *Cluster analysis*

Ward's method, which is a widely used and often well-functioning method (Bergman et al. 2003), was chosen as cluster algorithm for the cluster analyses performed in this thesis. The risk that a different algorithm would have resulted in a partly different classification of data is small if the analysis performed is of high quality and properly evaluated (Bergman et al. 2003), which was the case in this thesis. Because the purpose was the identification of common RU patterns in the data, a few residual cases (i.e. individuals that presented unique patterns with no resemblance to other individuals) were identified and removed from the analysis using the RESIDUE module in the SLEIPNER software (Bergman 1988, Bergman and El-Khoury 2002, Bergman et al. 2003). Analyses that both included and excluded the residue cases were performed and compared in order to evaluate the influence of the residues. A decisive decision that the researcher has to make during the clustering procedure is to determine the final number of clusters. There are no definitive rules in determining the number of clusters other than general recommendations (Bergman et al. 2003). For instance, the minimum level of EESS (67% for a satisfactory solution) was considered as well as the decrease in EESS for the different steps (iterations) along the clustering procedure. (A sharp decrease should be noted because it indicates that two relatively heterogeneous clusters have been collapsed.) Furthermore, the aim was to arrive at a manageable number of clusters, including theoretically reasonable profiles in relation to RU. These recommendations ('stopping rules') were considered together in relation to the specific subject under study, i.e. patterns of IRU, CRU and PRU. A consequence of the hierarchical clustering procedure is that individuals that have been classified early in the process are no longer optimally classified in the end so that cluster homogeneity is not maximized. However, the use of the RELOCATE module in the SLEIPNER software (Bergman and El-Khoury 2002, Bergman et al. 2003) was able to handle that issue. Starting out from the seven-cluster solution with the aim to achieve maximal cluster homogeneity, ill-fitting individuals (Y1: n=149, Y2: n=85, Y3: n=82) were moved to a more suitable cluster. EESSs for the final cluster solutions were clearly above the minimum level, indicating high cluster homogeneity and well-functioning classifications.

### 5.5.3.2 *Logistic regression*

Because the aim of Study III was to focus on the overall low research users vs. the remaining to study factors associated with low RU, logistic regression with a binary outcome was chosen for data analysis. The cut-off underlying the binary outcome was based on the structurally stable cluster configuration and the deviance of the overall low users from the rest of the sample. The cut-off was therefore not arbitrary. To facilitate interpretation the majority of the independent variables were dichotomized. Although having advantages (e.g., making the interpretation of the findings easier), dichotomization of data has its drawbacks. It might lead to misinterpretations of statistical significances and relationships among variables because of, e.g., loss of information about individual differences (MacCallum et al. 2002). However, in many cases different cut-offs were tested for the variables included in the bivariate analyses, which did not affect the results much, indicating robustness of the findings.

### 5.5.3.3 *Bivariate vs. multivariate analysis*

There is a call for more advanced statistical analyses in relation to research on RU and its associated factors (Estabrooks 2007). This call includes multivariate techniques that can take multicollinearity between the variables into account to identify variables with unique associations with RU. In regression analyses an effort is made to include all relevant variables (Hair et al. 2006). In our endeavor to achieve that, variables were selected based on findings from previous studies as well as on theories within this area of research. Furthermore, we used the analytic schedule to guide the variable selection and categorize the potential determinants. We performed bivariate analyses among a great number of variables in relation to the outcome. We also considered possible conceptual overlaps to find variables as uniquely associated with RU as possible. We performed the regression analysis according to a stepwise procedure to maximize transparency. Without an organizing tool, the analytic process would have been less sound and reliable.

### 5.5.3.4 *Model analysis*

When evaluating the fit of the mediation model tested in Study IV, alternative methods for model estimation were tested to correct for non-normality and the ordinal character of the data. Model stability was indicated because results from the different methods did not show any major differences. However, it has to be noted that “models are best regarded as approximations of reality” (Hu and Bentler 1998, p. 425), i.e. that all possible relationships, including alternative directions of the associations, have not been tested.

### 5.5.3.5 *Handling of missing data*

A major problem in longitudinal designs is the attrition over time. In Study I, II and III, individuals with missing values were excluded in the different analyses, resulting in a reduced sample size and loss of power. In the cluster analysis only complete response profiles were included. Because of the great sample size of the LANE study and the relatively high response rates over time, the loss of individuals with missing values was not considered a major problem. In Study IV, however, an inclusive strategy was used in which the use of auxiliary variables made the missing at random (MAR) assumption more plausible, improving accuracy without changing model parameters (Collins et al. 2001, Enders 2010). This strategy is currently recommended in the methodological literature and should be considered as a strength compared to traditional imputation techniques.

## 5.5.4 **Interpretation of the results**

### 5.5.4.1 *Measures of research use and research use intention*

Low ratings of RU, including the ‘never’ responses, might be overrepresented because of the examples provided in each of the RU items. The nurses may have focused on those examples exclusively and, if those did not fit their own practice, the risk is that they rated their RU as very low, or even as non-existent, because of the examples. As discussed previously, a contributing reason for the association between overall low RU and the psychiatric setting might be that none of the examples derived from the psychiatric care setting. However, we believe that the examples mainly constituted a

strength in that they helped to define the concepts under study and therefore were considered as important to the validity of the items. Given the design of the LANE study, it was impossible to direct RU items with differing examples to nurses within different clinical areas. For the item on IRU intention, the proportion of ‘Don’t know’ responses was large (see below) and the response distribution showed a slight bimodality, indicating possible problems with the response scale. Future research using other methods could provide more knowledge of how the items are interpreted by the respondents from different clinical settings, etc. For instance, cognitive/think aloud interviews could give more information about the response process, i.e. about individuals’ thoughts while answering the questions (Tourangeau et al. 2000). Such investigations could further contribute to the validity evidence of the items (AERA, APA, NCME 1999).

The fact that the cluster analyses were successful, indicating scoring consistency, speak in favor of the validity and reliability of the items. This was further indicated by the structural and individual stability of cluster profiles across two time points. Regarding the response scales, a reasonable spread among the response alternatives was found, i.e. not indicating any ceiling or floor effects (Polit and Beck 2008). Considering validity evidence based on relations to other variables (AERA, APA, NCME 1999), findings from the regression analyses in Study III (bivariate and multivariate analyses) and also from the model analyses in Study IV support to some extent the associations found with RU in previous research. Further research is needed, however.

#### *5.5.4.2 ‘Don’t know’ responses*

Both the RU items as well as the item measuring IRU intention included a ‘Don’t know’ alternative. The proportions of ‘Don’t know’ responses were highest for the item measuring intention. Whether a no-opinion alternative should be offered or not and what effects on data quality such an alternative might have are debatable (Krosnick et al. 2002). It is, of course, conceivable that respondents actually do not know what kind of knowledge they base their work on at present (RU behavior) or how often they intend to use research in the future (IRU intention). However, a respondent might also give a no-opinion answer more or less because it is the most convenient response to give (Krosnick et al. 2002). A no-opinion answer might also be given because the respondent is uncertain of the meaning of the question or, because the respondent lacks motivation or perceives the task as too difficult (Krosnick et al. 2002). The reasons for these responses given in this thesis are unknown. It is possible that such a response alternative has encouraged hesitating respondents to use it because it provided a simple way to respond but there is also a possibility that it was used because respondents perceived the items as unclear. Such a lack of clarity could in that case be due to the design or wording of the questions or respondents’ unawareness of their use of research-based knowledge. Both scenarios are problematic, but for different reasons. Future research is needed to provide more knowledge on these issues.

#### *5.5.4.3 Self-report, recall and social desirability bias*

It is important to recall that in this thesis RU refers to self-reported RU, because that was what was possible given the survey design. As previously discussed, this implies that the actual RU is probably more frequently occurring than the one assessed through

self-reports. Use that is in fact research-based but where the nurse is unaware of the origin of the knowledge will not be reported and, hence, not captured using a survey design. This problem probably constitutes the major threat to validity within RU studies (Estabrooks et al. 2005). Furthermore, some common drawbacks of self-reports are social desirability and recall bias, also common within this field of research (Squires et al. 2011c). Because the nurses probably are aware of the fact that RU is expected to be included in their daily practice, this might imply that they over-report their use on account of social desirability. Future studies using e.g. observational methods for data collection are recommended (Estabrooks et al. 2011).

The time frame of the past four working weeks was considered a strength. In previous studies respondents have been asked about their RU during the past year (Squires et al. 2011b), which probably increases the risk of recall bias. An optimal time frame is difficult to say. Given that the extents of the different kinds of RU might be expected to vary, a reasonable time frame should capture both more common and unusual use.

#### *5.5.4.4 Contributions of the pattern-oriented approach*

The variable- and pattern-oriented approaches complemented each other and provided a detailed, multidimensional and nuanced illustration of data. A clear example of that was the fact that no differences in the extent of RU at the three time points were identified with the variable-oriented approach whereas the pattern-oriented approach revealed the two overall low using clusters as well as stability and change over time. The proportion of the sample reporting overall low RU, as well as the individuals moving toward overall low and from low to even lower RU over time (Study I and II) were 'hidden' in the analysis based on mean values. The pattern-oriented approach brought a new perspective to this field of study and opened up for perspectives that include more than just use or non-use of research. It further illustrated the complexity of RU as a phenomenon that could enrich the discussion about the extent of RU often based on mean values.

The cluster analysis was successful using available data, i.e. an acceptable cluster configuration could be identified. The fact that the seven-cluster solution was replicated in two separate samples (Study I, EX2002 and EX2004) and showed structural stability over time in one of the samples (Study II, EX2004), constitutes strong arguments for the validity of the cluster profiles, i.e. that the clusters found are the ones that are actually 'naturally occurring'.

#### *5.5.4.5 Intention as predictor of research use behavior*

In Study IV, the correlation between IRU intention and subsequent behavior was 0.21 and the model explained 4.5% of the variance in RU. According to Cohen (1992) a correlation of 0.2 corresponds to something between a small (0.1) and a medium (0.3) effect size. It is possible that the time between intention and behavior (here one year) could have a considerable influence on the magnitude of prediction because unforeseen events between reported intention and actual behavior might influence the accuracy of behavior prediction (Ajzen 1988). The respondents went from undergraduate education and into working life during the time between the data collections, i.e. their ratings occurred in relation to two different contexts. Because that transition is well-known as

being very turbulent at times, where many new nurses experience that the work role does not correspond to what they learnt during education, it is likely that this might entail that their intention-behavior ratings become inconsistent and thus influencing the magnitude of prediction negatively. Taken together, considering the time between assessments, including the transition from an educational to a clinical context, this implies that the degree of intention-behavior prediction identified in Study IV can be regarded as relatively high.

#### *5.5.4.6 The analytic schedule and the use of theory*

We found the analytic schedule helpful as a guiding tool in the structuring of the regression analyses. However, the analytic schedule represented a simplified picture of reality. It illustrated a 'one-way linearity' from left to right in which causal relationships were not tested and potential feedback loops or associations in the opposite direction were not accounted for. It also illustrated the difficulty to sort variables as individual, educational or organizational. For some variables (e.g., sex and clinical setting) this was not a problem while the nature of data as self-reported involved a difficulty to separate the individual's perceptions of and reactions to work context and the educational setting from the 'actual' characteristics of the settings. It might be argued, however, that it is the individual perceptions and reactions that are of importance, irrespective of the objective matters (Kasl 1998). However, the difficulty to categorize the variables and the difficulty to know how to design interventions for change based on the results still remain. More 'objective' data, perhaps based on observations, might be one solution to this problem but this was not possible within the LANE study with its large and nationwide design. Taken together, the multivariate approach with the analytic schedule constituted a strength and resulted in a number of determinants with unique associations to low RU, where multicollinearity with variables both within the same element/sub-element as well as with variables from other elements/sub-elements was taken into account.

Although RU theory, models or frameworks were not explicitly used to design our studies or analyses, such work was 'implicitly' used in that it influenced our approach to the RU research area. For instance, Rogers' theory of innovation diffusion (Rogers 2003), the PARIHS framework (Rycroft-Malone 2004, Kitson et al. 2008) and the theory of planned behavior (TPB, Ajzen 1988, 1991) influenced our apprehension of what areas (e.g., individual and organizational/contextual factors) might be of relevance to consider in relation to our research questions. Furthermore, we related our findings to Rogers' theory, the TPB and the PARIHS framework. In that way they have assisted in framing and making sense of our findings.

#### *5.5.4.7 Generalizability of the findings*

In relation to many of the previous studies on nurses' extent of RU that are restricted to single-site studies the LANE design has great advantages, including the use of a national sample and relatively high response rates. Consequently, this also constitutes strengths for the studies included in this thesis.

The cluster configurations showed structural stability across cohorts and time points, i.e. the RU profiles were replicated when studied in two cohorts and at three points in

time after graduation. These findings speak clearly in favor of the representativity of the outcome variable (RU).

Regarding cohort representativeness, men were underrepresented at baseline in the EX2006 cohort; in the EX2002 cohort men had a lower response rate across time which was statistically significant at Y3. According to the systematic review on individual determinants of nurses' RU gender has not been found to be associated with RU in previous studies (Squires et al. 2011a). However, in Study III the likelihood of being an overall low research user was larger for men than for women. Based on those findings, nurses' ratings of RU found at Y1 (EX2006) and Y3 (EX2002) might be overestimations in relation to population values. In the EX2004 cohort younger respondents were underrepresented at Y2. No consistent findings on the association between age and RU have been reported in previous studies (Squires et al. 2011a). Concerning the underrepresentation of non-Swedish born students, it is difficult to decide if and, in that case how, that had an impact on the findings regarding the extent of RU. In fact, all participants, Swedish-born or not, are homogeneous in the sense that they all had a Swedish nursing degree.

Various analyses have been undertaken to study the representativity of the selected RU samples. The representativity of the RU sample (n=845) at Y2 (EX2004) was tested using a number of variables representing demographic characteristics, health and previous experience of health care work (age, sex, family situation, country of origin, social class, previous assistant nurse training, previous experience with health care work, health behaviors [smoking, alcohol and sleep quality], general self-rated health and chronic disease). Findings showed that respondents included in the sample more often have children at baseline. This was the only statistically significant difference found and was not surprising knowing that maternity leave was common among individuals not presently working as nurses (Rudman et al. 2010), i.e. among those individuals excluded from the sample used in Study II and III (Y2). This finding implies that the representativity of the Y2 RU samples in Study II and III is high. In Study IV, the inclusive analysis strategy through the use of auxiliary variables made the missing at random assumption more plausible (Collins et al. 2001, Enders 2010), thereby handling the potential bias that might have been caused because of sample selection.

It can be questioned whether results from this thesis are valid for nurses that are newly graduated today. For instance, the 2006 evaluation of quality in Sweden's medical and health care undergraduate education (Swedish National Agency for Higher Education 2007) resulted in changes across nursing educations at Swedish universities, which might have had an impact on students' preparation for practice as well as on the clinical settings that students meet both while still in education and postgraduation. However, the situation as a newly graduated nurse has been described as troublesome for such a long time, both in Sweden and internationally (Kramer 1974, Duchscher 2009). This gives reason to believe that time does not have a major influence on the experience of transition from being a nursing student to being a registered nurse and therefore not on RU either, if we assume that the theory-practice gap is at least one of the reasons to low RU ratings.

To sum up, the LANE study with its various strengths related to design and participation over time, as well as the stability of cluster configurations and analyses of representativity, support a high generalizability of the findings to our population, i.e. Swedish newly graduated nurses.

## **5.6 CONCLUDING REMARKS**

### **5.6.1 High research use - something to always strive toward?**

A highly relevant question is whether high RU is something to always strive toward. I dare to say that I don't believe that. According to a broader definition of evidence, it includes knowledge from research findings together with knowledge from clinical experience, patient experience and preferences as well as information from the local context (Rycroft-Malone et al. 2004). To combine different sources of evidence and to ensure their robustness is a challenge (Rycroft-Malone et al. 2004). Research-based nursing interventions might not always be the best for the patient; for instance, they might not always be in accordance with patient preferences. Non-use of research because of such a misfit of research-based knowledge and the situation, patients' preferences, etc., could be defined as justified non-use (Nutley et al. 2007b), which is not measured with the items used in this thesis. On the other hand, high RU can include over-use or misuse of research findings (Nutley et al. 2007b), which is non-preferable relative to patient outcomes.

According to findings from previous studies, nurses use a variation of knowledge sources, with research knowledge not being reported as the one most frequently used (Spenceley et al. 2008, Cranley et al. 2009). Nurses generally have a high reliance on informal, interactive knowledge sources, e.g., colleagues (Spenceley et al. 2008). Although knowledge derived from colleagues or personal experience is not automatically non-research-based knowledge, the primary source of such knowledge is often less clear, making it more difficult to judge in terms of reliability. The nurse needs to be critically reflective (Stetler 2001, Rycroft-Malone et al. 2004) and use research and other sources of evidence based on "reasoned individualization" (Stetler 2001). Caring without thinking/reflecting might be harmful and dangerous to the patient, irrespective of the knowledge source used. A reflective practitioner uses knowledge in a well-informed and conscious way (Plack and Greenberg 2005, Mantzoukas 2008). We have measured the nurses' self-reported RU, i.e. the reflected RU that they are aware of themselves. This is a starting point, and further research is needed regarding interventions that can increase nurses' attention to the knowledge sources they use. The general underlying assumption in this thesis has been that higher RU or, more specifically, higher reflected RU, leads to better quality of care and higher patient safety.

### **5.6.2 Low research use - whose responsibility?**

Taken together, multiple factors determine the extent of RU among nurses the first years after graduation. Considering the role of undergraduate education, the individual nursing student (future nurse) and the organizational context, there appears to be no single party to hold responsible. All stakeholders need to contribute with the 'right' prerequisites for a successful outcome. One of the key issues must be to make an effort

for the reflective use of knowledge in general, including the use of research-based knowledge in particular, from the very beginning. Furthermore, it is crucial to try to maintain and further stimulate RU behavior in the clinical practice setting postgraduation. Nurses need to have awareness and a reflective approach for the knowledge sources they use and an intention to base their work on research findings. Undergraduate education needs to have a clear focus on how to promote high RU intentions and in what manner to best foster future research users. Focusing on strengthening students' capability beliefs as well as supporting them in RU in both campus and clinical education could be one way to start. Furthermore, education must be allocated enough resources to make this possible. The healthcare organization needs to provide the right conditions for RU/EBP. Because RU intention can be regarded as a promising predictor of subsequent RU behavior, it is important that the context that the new nurses face after graduation can provide the support needed to transform their intentions into action. Discussions about how RU can best be supported in clinical practice probably need to occur both from a general point of view and with reference to different clinical settings. This is because different settings might need to focus on different kinds of interventions in order to support and improve RU. A view of shared responsibility between nurses as individuals and the different stakeholders is in line with the current demand for a broad research focus that includes different categories of determinants, individual as well as organizational (Squires et al. 2011a). As argued in the literature, a focus on the individual according to a 'research-based practitioner model' (Nutley et al. 2008) with rationality and linearity as the underlying assumptions and where the individual practitioner is responsible for RU needs to be accompanied by the recognition of the context and the complexity of this issue (Rycroft-Malone 2008). Research as embedded in practice ('the embedded research model' [Nutley et al. 2008]) in the form of different kinds of research-informed guidelines, tools and/or protocols is probably more realistic in many situations (as long as the use of such products is still reflected use). 'The organizational excellence model' (Nutley et al. 2008) represents yet another, and probably complementary, perspective in which the structures, processes and cultures within the organization are in focus and where the key to RU lies more on a management level.

It is surprising (and alarming) that the previously well-described gap between theory and practice seems to have been a problem with such negative consequences for new nurses internationally for such a long time. Most likely new nurses' use, or non-use, of research findings is related to that gap. It is also reasonable that the theory-practice gap that is related to undergraduate education and clinical practice is part of the research transfer gap commonly referred to as hindering the implementation of research-based knowledge into practice. The questions, then: Are the new graduates ready for practice? And is practice ready for them? Findings from this thesis and previous research indicate that the answer might be no to both questions. Our findings can contribute to further elaboration on this issue, including research on newly graduated nurses' RU and interventions for support and improvement.

## 5.7 FUTURE RESEARCH

Needs for future research have already been expressed in the discussion section and the section on methodological considerations. Here, some additional needs and suggestions are proposed.

From a general standpoint, further research is needed to study the situation of the newly graduated nurse. The research should focus particularly on knowledge use and factors that facilitate (or hinder) the use of research-based knowledge the first years after graduation. Such research would benefit from the use of both quantitative and qualitative methods.

Because of the predominance of overall low research users in Study I and II, overall low RU constituted the outcome variable in Study III. However, the cluster analyses revealed a profile (although uncommon) comprising overall high RU. Accordingly, it would be valuable to study factors associated with high RU. Why do these nurses consider themselves as high users of research? What does their RU look like? In what situations do they use research and how? Did they graduate with high RU intentions and, in that case, when and how were those intentions formed and how were they maintained and transformed into action? Can these nurses specify factors during undergraduate education that were decisive in their decision to use research in their daily work as RNs? How do they describe their experiences of transition from students to RN's and how was their initial time in the profession, the prerequisites in the clinical setting, etc.? Once the high users have been identified, these questions could be answered preferably using qualitative methods.

Since RU occurs through the interplay between the individual nurse and the context, further research is needed about tools for research-based practice that are available for use in clinical practice. Is the use of such tools as electronic reminders, protocols and guidelines helpful in nurses' RU? To what extent are such tools available? Are these tools being used, and if so, how?

## 6 SAMMANFATTNING (SUMMARY IN SWEDISH)

Gapet mellan, å ena sidan, den kunskap som finns tillgänglig i form av forskningsrön och, å andra sidan, vården som når patienten, är välkänt sedan länge, såväl i Sverige som internationellt. Forskningsbaserad vård, som en del i den evidensbaserade vården, syftar till att säkerställa god vårdkvalitet för patienten samt till ett effektivt utnyttjande av hälso- och sjukvårdens resurser. Användningen av rätt kunskaper inom hälso- och sjukvården kan ytterst utgöra skillnaden mellan liv och död. I de allmänna utbildningsmålen för högskoleutbildning såväl som för sjuksköterskeutbildningen betonas studenternas förmåga till kritisk reflektion samt förmåga att använda nya och relevanta kunskaper i syfte att bedriva omvårdnad i överensstämmelse med vetenskap och beprövad erfarenhet. Dessa förmågor är även tydligt uttryckta i den svenska kompetensbeskrivningen för legitimerade sjuksköterskor och dessa aspekter av sjuksköterskans kompetens har blivit allt tydligare genom åren som resultat av ett flertal utbildningsreformer och i takt med ökade krav på evidensbaserad omvårdnad. Användningen av forskningsresultat, samt faktorer som påverkar användningen, har tidigare studerats främst i grupper av sjuksköterskor med mångårig och varierad yrkeserfarenhet. Forskningen kring detta bland nyutbildade sjuksköterskor är dock mycket begränsad, liksom forskningen kring betydelsen av olika utbildningsrelaterade faktorer för forskningsanvändningen som färdig sjuksköterska.

Det övergripande syftet med detta avhandlingsarbete var att studera den självskattade användningen av forskningsresultat i klinisk verksamhet bland sjuksköterskor de första tre åren efter examen. Mer specifikt var syftet att beskriva användningen över tid och att identifiera faktorer av betydelse för användningen. Vidare var syftet att beskriva sjuksköterskestudenters intentioner att använda forskning i sin kommande yrkesroll samt att undersöka huruvida intentionen och utbildningsrelaterade faktorer predicerade forskningsanvändningen ett år efter examen. Data hämtades från den större LUST-studien (Longitudinell Undersökning av Sjuksköterskors Tillvaro), en nationell enkätstudie i tre kohorter sjuksköterskestudenter, sedermera sjuksköterskor, som följts årligen i utbildning och yrkesliv från 2002 till och med 2010. Kohorterna benämns utifrån examensåret (EX): EX2002, EX2004 och EX2006. Utfallsvariablerna i detta avhandlingsarbete var tre olika former av användning av forskningsresultat: instrumentell, konceptuell och övertalande, samt också intentionen att använda forskning instrumentellt. Data analyserades med kvantitativa metoder.

I **delstudie I** studerades forskningsanvändningen ett och tre år efter examen i EX2004-respektive EX2002-kohorterna. Instrumentell användning var vanligast förekommande med medelvärden som motsvarade användning på ungefär hälften av arbetspassen. Därefter följde den konceptuella användningen medan den övertalande rapporterades som minst frekvent. Med hjälp av klusteranalys identifierades sju kluster i respektive undersökningsgrupp där varje kluster bestod av en grupp sjuksköterskor med liknande svarsprofil över de tre olika formerna av forskningsanvändning. Klusterprofiler som motsvarade låg eller mycket låg forskningsanvändning i alla tre former dominerade och utgjorde 45.5% respektive 51.6% av urvalet ett respektive tre år efter examen. I **delstudie II** studerades forskningsanvändningen två år efter examen (EX2004). Vidare studerades förändring i forskningsanvändning mellan det första och andra året efter

examen i relation till förändrade arbetsförhållanden. Inga skillnader i forskningsanvändning kunde observeras på gruppnivå mellan de olika tidpunkterna. Även i denna grupp identifierades sju olika kluster och dessa uppvisade strukturell stabilitet över tid. Alla kluster utom ett uppvisade även individuell stabilitet. Låganvändare tenderade dessutom att gå mot ännu lägre forskningsanvändning över tid och de två klustren med låga eller mycket låga användare motsvarade 54.9% av den grupp som ingick i klusteranalysen två år efter examen. Inget samband kunde identifieras mellan förändring mot låganvändning mellan år ett och år två och förändrade arbetsförhållanden. I **delstudie III** studerades individfaktorer tillsammans med faktorer relaterade till utbildning och arbete i syfte att identifiera faktorer associerade med låg forskningsanvändning två år efter examen (EX2004). Med hjälp av multivariat logistisk regression identifierades sex faktorer associerade med låganvändning: arbete i psykiatrisk vård, rolltydlighet, tillfredsställande bemanning, låg utmaning i arbetet, kön (man) och låg studentaktivitet (mätt som bidrag till diskussionen i klassrummet). I **delstudie IV** studerades intentionen för instrumentell forskningsanvändning bland sjuksköterskestudenter sista terminen i utbildningen (EX2006) som prediktor och som medierande variabel för den faktiska instrumentella forskningsanvändningen ett år efter examen. Ungefär en tredjedel (34%) av de inkluderade studenterna rapporterade en intention som motsvarade användning på mer än hälften eller nästan varje arbetspass. Intentionens betydelse för forskningsanvändningen testades med hjälp av en medieringsmodell. Intentionen uppvisade där en direkt effekt på beteendet och utgjorde också en medierande variabel för effekterna från tre andra utbildningsrelaterade variabler: tilltron till förmågan att bedriva evidensbaserad vård samt stödet för forskningsanvändning under campus- respektive kliniskt förlagda studier.

Sammantaget kan sjuksköterskornas skattningar av sin forskningsanvändning i denna avhandling betraktas som relativt låg, vilket är oroande med tanke på det fokus på evidensbaserad vård som finns inom dagens hälso- och sjukvård och dess betydelse för patientutfallet. Flera olika typer av faktorer av betydelse för sjuksköterskornas forskningsanvändning de första åren efter examen framkom i detta avhandlingsarbete, såväl individ- som utbildnings- och organisationsrelaterade faktorer. I sjuksköterskeutbildningen behöver ett tydligt fokus finnas kring hur studenternas intentioner att använda forskning bäst kan utvecklas och stöttas, såväl i campus- som i verksamhetsförlagda studier. Hälso- och sjukvården måste bidra med de rätta förutsättningarna för att kunna stötta nyutbildade sjuksköterskor i deras forskningsanvändning under deras första tid i yrkesverksamhet som ofta upplevs som turbulent på många sätt. Den personorienterade ansatsen som tillämpades i form av klusteranalys utgjorde ett nytt inslag i forskningen inom detta fält och uppvisade klara fördelar då den belyste forskningsanvändning som företeelse på ett flerdimensionellt och nyanserat sätt.

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**Appendix.** A presentation of the variables analyzed in relation to RU in Study II to IV.

**Study II:** Variables included in the analysis of association between changes in RU and changes in working conditions between Y1 and Y2. Response categories are specified and the variables were dichotomized as change vs. non-change where nothing else is specified.

**Study III:** Variables in each element/sub-element of the analytic schedule, including response alternatives and how those alternatives were categorized in the logistic regression analyses. Where nothing else is specified, measures were developed specifically for use in the LANE study.

**Study IV:** Predictors included in the mediation analysis including origin and response scales.

<b>STUDY II</b>	
Employer	County council, municipality, private caregiver, private staffing agency, other
Form of employment	Permanent, temporary post, employed by the hour, engaged on project, other non-permanent position
Working hours <sup>1</sup>	Full-time or part-time
Form of organization	Nursing ward, out-patient reception, home-nursing, nursing home, ambulance care, other
Working shifts <sup>2</sup>	Day time Mo-Fri, day- and evening shifts Mo-Fri, day- and evening shifts 7 days/week, shifts around the clock, night shift, other
Overtime <sup>3</sup>	Several times/week, about once/week, about once/month, <once/month, no
Further training <sup>4</sup>	Specialist nurse or midwife
Organizational change influencing working conditions	Yes, no
Global change	Collapsed variable including change vs. no change in one or more of variables above.
<sup>1</sup> Change of $\geq 50\%$ vs. others <sup>2</sup> Change (i.e. dayshifts towards shifts including nights - or the reverse) vs. others <sup>3</sup> Change = Several times/week, about once/week towards About once/month, <once/month, no - or the reverse <sup>4</sup> Yes (i.e. finished specialty training during the year) vs. others	
<b>STUDY III</b>	
<b>WORK CONTEXT</b>	
Present form of employment	Permanent
	Temporary, employed by the hour, engaged in project, other non-permanent position
Clinical setting	Hospital care (acute somatic care)
	Primary care (community health care centres, home care)
	Elder care (special housing for seniors)
	Psychiatric care (hospitals and outpatient clinics)
Full- or part-time	>75%
	≤75%

Work shift	Day, evening, night
	Monday to Friday (day, evening)
	Night
<b>MANAGEMENT</b>	
Work overtime	Several times per week
	About once a week, about once a month, <once a month, never
Adequate staffing compared with patients need of care	Yes
	No
Individual plan for competence development	Yes
	No, Don't know
Experience of role clarity Clarity of work goals and objectives, awareness of expectations and responsibility (Dallner et al. 2000) 3 items, Cronbach's $\alpha = 0.75$	1 ('Very often/always'), 2 ('Quite often'), 3 ('Sometimes'), 4 ('Quite seldom'), 5 ('Very seldom/never')  High (0-2.0) Low (2.01-5.0)
Experience of leadership Support from a superior, empowering leadership, fair leadership (Dallner et al. 2000) 6 items, Cronbach's $\alpha = 0.91$	1 ('Very often/always'), 2 ('Quite often'), 3 ('Sometimes'), 4 ('Quite seldom'), 5 ('Very seldom/never')  High (0-2.0) Low (2.01-5.0)
<b>INDIVIDUAL QUALITIES AND CHARACTERISTICS - Socio-demographic characteristics</b>	
Sex	Men
	Women
Age	≤30 years
	>30 years
Previous assistant nurse training	Yes
	No
Further study after nursing degree Specialist nurse, midwife, master's degree, doctoral degree	Have studied, study now
	No
<b>INDIVIDUAL QUALITIES AND CHARACTERISTICS - Individual perceptions and management of education</b>	
Global importance of studies (Dallner et al. 2000)	1 ('One of the most important things in life') to 7 ('One of the least important things in life')  Important (1-3) Less important (4-7)
Time allocated to studies (Swedish National Agency for Higher Education 2002, Kuh 2004)	Full-time
	>Full-time
	75% , 50%, <50% of full-time

<p>Asked questions in class (Swedish National Agency for Higher Education 2002, Kuh 2004)</p>	<p>Often Sometimes, seldom, never</p>
<p>Contributed to discussion in class (Swedish National Agency for Higher Education 2002, Kuh 2004)</p>	<p>Often Sometimes, seldom, never</p>
<p>Quality during education, scientific theory and method</p>	<p>Very good, quite good Neither good nor bad, quite bad, very bad</p>
<p>Feel prepared to manage work as a nurse (Hagström et al. 2000)</p>	<p>1 ('Totally agree') to 7 ('Do not agree at all')  Yes (1-3) No (4-7)</p>
<p><b>INDIVIDUAL QUALITIES AND CHARACTERISTICS - Individual perceptions of work at Y2</b></p>	
<p>Job demands Quantitative job demands (time pressure and amount of work), decision demands (demands for quick and complex decisions) (Dallner et al. 2000) 4 items, Cronbach's <math>\alpha = 0.75</math></p>	<p>1 ('Very often/always'), 2 ('Quite often'), 3 ('Sometimes'), 4 ('Quite seldom'), 5 ('Very seldom or never')  High (0-2.0) Low (2.01-5.0)</p>
<p>Positive challenge at work Perception that skills and knowledge are useful and that work is meaningful and positively challenging (Dallner et al. 2000) 3 items, Cronbach's <math>\alpha = 0.70</math></p>	<p>1 ('Very often/always'), 2 ('Quite often'), 3 ('Sometimes'), 4 ('Quite seldom'), 5 ('Very seldom or never')  High (0-2.0) Low (2.01-5.0)</p>
<p>Control Influence on decisions in the work situation, control of work pacing (Dallner et al. 2000) 4 items, Cronbach's <math>\alpha = 0.66</math></p>	<p>1 ('Very often/always'), 2 ('Quite often'), 3 ('Sometimes'), 4 ('Quite seldom'), 5 ('Very seldom or never')  High (0-2.0) Low (2.01-5.0)</p>
<p><b>PSYCHOLOGICAL CONSEQUENCES FOR EMPLOYEES</b></p>	
<p>Often think about leaving the profession (Cohen 1998)</p>	<p>1 ('Completely accurate') to 5 ('Completely inaccurate')  Yes (1-2) No (3-5)</p>
<p>Disengagement One of two core dimensions of burnout according to the Oldenburg Burnout Inventory. Distancing oneself from work, experiencing negative attitudes towards work. (Demerouti et al. 2001, Halbesleben and Demerouti 2005) 6 items, Cronbach's <math>\alpha = 0.84</math></p>	<p>1 ('Completely accurate'), 2 ('Quite accurate'), 3 ('Not very accurate'), 4 ('Completely inaccurate')  High (0-2.50) Low (2.51-4.0)</p>

<p>Exhaustion One of two core dimensions of burnout according to the Oldenburg Burnout Inventory. A consequence of intensive physical, affective and cognitive strain. (Demerouti et al. 2001, Halbesleben and Demerouti 2005) 6 items, Cronbach's <math>\alpha = 0.75</math></p>	<p>1 ('Completely accurate'), 2 ('Quite accurate'), 3 ('Not very accurate'), 4 ('Completely inaccurate').  High (0-2.50) Low (2.51-4.0)</p>
<p>Mastery Contentment with own quantity and quality of the work performed as well as with own ability to solve problems at work (Dallner et al. 2000) 3 items, Cronbach's <math>\alpha = 0.77</math></p>	<p>1 ('Very often/always'), 2 ('Quite often'), 3 ('Sometimes'), 4 ('Quite seldom'), 5 ('Very seldom or never')  High (0-2.0) Low (2.01-5.0)</p>
<b>STUDY IV</b>	
<p>Nursing self-efficacy (NSE), 9 items  Professional self-efficacy relevant to the nursing profession (Bandura 1997, Hagquist et al. 2009), reflecting students' confidence in doing typical nursing tasks within the areas 'nursing theory and practice', 'research development and education' and 'leadership' based on competencies stipulated in the Higher Education Ordinance (The Swedish Code of Statutes 1993) and the description of competence for RN:s (The National Board of Health and Welfare 2005).</p>	<p>Used as summated scale, Cronbach's <math>\alpha = 0.88</math>  Response scale ranging from 1 to 11: 1 ('No, I can't manage'), 6 ('Maybe I can manage'), 11 ('Yes, I can manage')</p>
<p>EBP capability beliefs (6 items)  Students' capability beliefs according to the conceptualization of EBP by Sackett et al (2000), i.e. the ability to: formulate questions, use databases, use other information sources, appraise research reports, contribute to change in clinical practice and participating in evaluating clinical practice (Boström et al. 2009, Florin et al. 2011).</p>	<p>Used as summated scale, Cronbach's <math>\alpha = 0.88</math>  Response scale ranging from 1 to 11: 1 ('No, I can't manage'), 6 ('Maybe I can manage'), 11 ('Yes, I can manage')</p>
<p>Educational gains (5 items)  Critical and analytical thinking, independently seeking knowledge, analyzing problems, using computer and information technology, taking responsibility for own knowledge development (Kuh 2004).</p>	<p>Used as summated scale, Cronbach's <math>\alpha = 0.82</math>  Response scale: 1 ('To a very small degree') 2 ('To a small degree') 3 ('To a high degree') 4 ('To a very high degree')</p>
<p>Educational experiences (3+3 items)  Support from campus and clinical education in: following research-/knowledge development within own area of interest, use of research-based knowledge and acquiring knowledge on how change can be pursued in clinical practice (Florin et al. 2011).</p>	<p>Used as summated scale, Cronbach's <math>\alpha = 0.75</math> (clinical), 0.76 (campus)  Response scale: 1 ('To a very small degree') 2 ('To a small degree') 3 ('To a high degree') 4 ('To a very high degree')</p>