Adherence to Venous Blood Specimen Collection Practice Guidelines Among Nursing Students and Healthcare Staff

Karin Nilsson
‘Knowing is not enough; we must apply. Willing is not enough; we must do’.
Johann Wolfgang von Goethe (1749—1832)
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Abstract

Background Patient safety is an undisputable part of healthcare. The use of clinical practice guidelines, usually based on evidence-based practice/best practice, promotes patient safety and high quality care, reduces unnecessary patient suffering, and healthcare costs. Analysing results from venous blood specimen collection is one of the most commonly used services within healthcare, and a substantial number of decisions on diagnosis, treatment, and treatment evaluation are based on the results. Hence, the accuracy of these tests are vitally important. Earlier research has demonstrated that healthcare staff report suboptimal adherence to venous blood specimen collection guidelines together with the need for improved practices. Blood sample collection is carried out by several professionals, among them registered nurses and, as a consequence, nursing students too. University nursing students learn and practice venous blood specimen collection in one of their first semesters. After initial skill training at clinical skill laboratories, they continue to perform the task during clinical placements in various clinical settings. Few or no studies have been performed on nursing students, hence it seemed important to assess guideline adherence to venous blood specimen collection among university students as well as to further explore adherence to guidelines among healthcare staff. Therefore, the overall aim for this thesis was to explore adherence to, and factors influencing venous blood specimen collection guidelines practice among university nursing students and healthcare staff.

Methods The thesis includes four studies. Study I-III had a quantitative, cross-sectional design, study IV had a qualitative approach. Study I included 164 healthcare staff from 25 primary healthcare centres. Study II included 101 nursing students in their 5th and 6th semesters, and study III included 305 nursing students in their 2nd, 4th, and 6th semesters. To assess adherence to venous blood specimen collection guidelines, data were collected using the Venous Blood Specimen Questionnaire, completed with background variables (I, II, III) and additional scales (III). Descriptive statistics, multilevel and multiple logistic regression analyses were used to analyse the data. In study IV, data were collected through five focus group interviews among 6th semester nursing students (n=26). Data were analysed using qualitative content analysis.

Results Workplace affiliation was found to explain variances in reported adherence between different primary healthcare centres. Associations between reported venous blood specimen collection practices and individual as well as workplace factors were revealed. Nursing students were found to increasingly deviate from guideline adherence during their education. Also among students, several associations between guideline adherence and other
factors were revealed. Reported research use at clinical practice was associated with higher levels of adherence, as were higher capability beliefs regarding both evidence-based practice and academic ability. Analyses from focus group interviews summarised students’ reflections on deviations from VBSC guidelines in the overall theme ‘Striving to blend in and simultaneously follow guidelines’.

**Conclusion** Both healthcare staff at primary healthcare centres and nursing students demonstrate decreasing levels of guideline adherence with time. Factors influencing adherence are both individual as well as contextual. This indicate that both students and staff are subjected to socialisation processes that influences levels of adherence. In order to enhance venous blood specimen collection practices and thereby patient safety, actions must be taken - both in healthcare clinical contexts and by educators. The use of models in practical skill training, and in the ambition to bridge the theory-practice gap may be the path to success. It is reasonable to assume that collaboration between, on the one hand, education representatives and on the other, supervising RNs in clinical settings, will be fruitful. Finally, by empowering students their self-efficacy may be strengthened, and hence their ability to maintain guideline adherence.

**Keywords**
Adherence, Clinical practice guidelines, Experiences, Nursing student, Patient safety, Pre-analytical errors, Primary healthcare, Questionnaires, Venous blood specimen collection
Original papers

The thesis is based on the following papers, and each paper will be referred to in the text by its Roman numeral.


IV. Nilsson, K., Brulin, C., Grankvist, K., Juthberg, C. Senior Nursing Students' Reflection on Deviations from Guideline Adherence regarding Venous Blood Specimen Collection Practice: A qualitative study. *In manuscript.*

The papers have been reprinted with the kind permission of each journal.
## Abbreviations

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<tr>
<td>CI</td>
<td>Confidence interval</td>
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<tr>
<td>CPG</td>
<td>Clinical practice guidelines</td>
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<td>EBP</td>
<td>Evidence-based practice</td>
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<tr>
<td>ID</td>
<td>Identification</td>
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<td>LANE</td>
<td>Longitudinal Analysis of Nursing Education</td>
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<tr>
<td>MOR</td>
<td>Median odds ratio</td>
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<td>OR</td>
<td>Odds ratio</td>
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<tr>
<td>PHC</td>
<td>Primary healthcare centre</td>
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<tr>
<td>RN</td>
<td>Registered nurse</td>
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<td>VBSC</td>
<td>Venous blood specimen collection</td>
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<td>VBSQ</td>
<td>Venous blood specimen questionnaire</td>
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Enkel sammanfattning på svenska


**Resultat** Variationen av självskattad följsamhet till riktlinjer mellan olika hälsocentraler förklarades till viss del av arbetsplats. Resultatet visade också på samband mellan självskattad följsamhet till riktlinjer och individuella samt arbetsplatsrelaterade faktorer. Sjuksköterskestudenter visade på minskad följsamhet till riktlinjer med varje avklarad termin. Dessutom fanns ett positivt samband mellan följsamhet och 1) användning av forskning under verksamhetsförlagd utbildning, 2) högre tilltro till evidensbaserad vård, och
3) högre tilltro till akademisk förmåga. Data från fokusgruppsintervjuer utmynnade i det övergripande temat ‘Att försöka smälta in och samtidigt följa riktlinjer’.


**Nyckelord**
Enkäter, Erfarenheter, Följsamhet, Patientsäkerhet, Preanalytiska fel, Primärvård, Riktlinjer, Sjuksköterskeutbildning, Venprovtagnings.
Preface

In my work as a registered nurse (RN) I have come across and performed venous blood specimen collection (VBSC) on countless occasions. After some twenty years in clinic, I had the opportunity to lecture on the nursing programme. I was, among other tasks, assigned to teach VBSC, theoretically as well as skill training at the clinical skills laboratory. In this regard, I reviewed the literature and the guidelines and realised first, that I had not checked the guidelines for a very long time, and second, that my VBSC routine was not exactly in line with national guidelines. This experience gave me several insights: procedures performed on a daily basis such as VBSC might become second nature, you consider yourself to know how it is supposed to be done. Second, that it might not be common to reflect on matters of guideline adherence.

My entry into doctoral studies was through the ongoing research project on correct VBSC practice for increased patient safety, an interdisciplinary collaboration between the Department of Nursing and the Department of Medical Biosciences, Clinical Chemistry, Umeå University.

Introduction

The decision-making and management of healthcare procedures is often supported by clinical practice guidelines (CPG). They are usually a consensus statement on best available practice/evidence-based practice (EBP) in a certain area aiming to identify and maintain high quality care. Adherence to guidelines has been proven to both enhance patient safety by reducing improper variations in performance (Eccles, Grimshaw, Shekelle, Schünemann, & Woolf, 2012; Kennedy, Leathley, & Hughes, 2010), and to be cost effective (Green, 2013; Simon-Tuval, Neumann, & Greenberg, 2016) by, for example, reducing rates of hospitalisation (Sloan, Bethel, Lee, Brown, & Feinglos, 2004) as well as emergency department visits (Cloutier, Hall, Wakefield, & Bailit, 2005). However, it has been shown that CPG adherence in general may be poor (Asch et al., 2006; McGlynn et al., 2003), hence, it is a larger issue than merely adherence to a specific procedure.

One of the most common practical procedures within healthcare, VBSC, is a key element since a considerable number of decisions about diagnosis, treatment, and treatment evaluation are based on results from these analyses (Hallworth, 2011; Kalra, 2004; Lippi, Salvagno, Montagnana, Franchini, & Guidi, 2006; Plebani, 2006; Wians, 2009). Hence, the quality of testing and reporting of these analyses is of utmost importance (Forsman, 1996). The process from the point when an analysis is requested until the result of the analyse is returned, is referred to as the total testing process (TTP) (Figure 1)
(Lundberg, 1981) and covers three phases; the pre-analytical phase, the analytical phase, and the post-analytical phase (Hawkins, 2012; J. Kalra, 2004).

![Figure 1](image)

**Figure 1.** The total testing process, inspired by the “brain-to-brain loop” (Lundberg, 1981), and Lippi, Mattiuzzi, and Favaloro (2015).

The VBSC guidelines covers the pre-analytical phase, i.e. from the point when the analysis is requested to the point when the sample reaches the laboratory. One of the procedures during the pre-analytical phase, blood drawing, is carried out by phlebotomists (i.e. the person drawing the blood), who are staff from various professions for example RNs, and as a consequence also nursing students. To ensure correct analysis of results for decisions on diagnosis, treatment and evaluation, adherence to VBSC practice guidelines is essential. Earlier studies on VBSC practice guideline adherence among phlebotomy staff at hospital wards and in primary healthcare centres (PHC) demonstrate suboptimal performance (Bölenius, 2014; Söderberg, Wallin, Grankvist, & Brulin, 2010; Wallin et al., 2008). However, as far as I know, few studies have been performed on nursing students. The accuracy of VBSC analysis results is essential to meet the demands of high quality care. In this regard, this thesis will further explore adherence to VBSC guidelines among nursing students and healthcare staff.
Background

Although the issue of suboptimal adherence to CPGs within healthcare is general, this thesis solely addresses adherence to VBSC practices guidelines. The background section covers the core concepts adherence, patient safety, and adherence to clinical practice guidelines.

Adherence

Within healthcare, there are several concepts describing the willingness to follow, for example a suggested treatment, but also the ambition to follow a suggested procedure among both patients and staff. ‘Adherence’ is related to the verb adhere, meaning “to stick” and describes the willingness to stick or be faithful to, for example, laws or obligations. ‘Compliance’ originates from Latin meaning to fill up and hence to complete an action, transaction, or process and to fulfil a promise. Both ‘compliance’, ‘adherence’ and to some extent ‘concordance’ have been widely used in medical and pharmaceutical literature. The term ‘compliance’ has been utilised since the 1950s, mainly to describe a patient–physician relationship. The most commonly used definition of ‘compliance’ is the one put by Haynes, Taylor, and Sackett (1979): ‘The extent to which the patient’s behaviour matches the prescriber’s recommendations’. The term has been criticised because of the negative connotations implying lack of patient involvement (Stimson, 1974), and the underlying suggestion that compliance implies obedience without consideration of the patients’ independence (Robinson, Callister, Berry, & Dearing, 2008), and the use is therefore declining. In the 1990s, terminology in the literature began to shift to adherence rather than compliance (Vrijens et al., 2012). The term was adopted by many, particularly within the psychological and sociological literatures, as an alternative to compliance. A commonly used definition of ‘adherence’ is ‘The extent to which the patient’s behaviour matches agreed recommendations from the prescriber’ (Barofsky, 1978), which again implies a patient–physician relationship.

Adherence is also used when addressing healthcare workers obedience to rules and guidelines, which is the outcome variable in this thesis. Factors influencing healthcare workers adherence to guidelines are presented under the section ‘Adherence to Clinical Practice Guideline’.

In summary, the literature covering guideline adherence uses both ‘adherence to’ and ‘compliance with’ interchangeably (Gardner, 2015). In this thesis, I will use ‘adherence to’ when addressing this issue. Furthermore, the underlying idea of the concept of ‘adherence’ implies that there are benefits with adhering. Hence, the rules or regimes to adhere to are assumed to be of good quality and to promote safety.
Patient safety

Patient safety is one of several nursing core competencies (The Swedish Society of Nursing), important in education as well as in daily care. In this regard, patient safety is also one of several elements in the nursing care model, developed at the Department of Nursing, Umeå University (2015). The model states that nursing is understood from a relational aspect, as well as a care task aspect that are intertwined into an inseparable whole. The relation is always mutual and dependent on the care tasks to be performed, e.g. procedures such as VBSC (Department of Nursing, Umeå University, 2015).

The World Health Organisation (WHO) describes that ‘the discipline of patient safety is the coordinated effort to prevent harm, caused by the process of health care itself, from occurring to patients’, and defines patient safety as ‘the absence of preventable harm to a patient during the process of health care’ (World Health Organization, 2016). The US Institute of Medicine (IOM) considers patient safety ‘indistinguishable from the delivery of quality health care’ and defines the concept as ‘the prevention of harm to patients’ (Aspden, Corrigan, Wolcott, & Erickson, 2004).

Within healthcare, and in contrast to other areas such as aviation, adverse events and errors have historically been considered as inevitable consequences of care (Sharpe & Faden, 1998). In the 1960s, and for the first time in modern professional literature on the subject, researchers included the negative consequences of medical and nursing healthcare errors, for instance in the studies by Reichel (1965) and Ogilvie and Ruedy (1967). However, the last decades, ever since the IOM report ‘To err is human’ revealed figures of nearly 100,000 possible deaths yearly due to healthcare errors in a US context (Kohn, Corrigan, & Donaldson, 2000), the patient safety issue has been targeted and is now an undisputable ingredient in healthcare (Grol & Grimshaw, 2003; World Health Organization, 2011). In this regard, and to underline the importance of patient safety as a global healthcare issue, the WHO Member States agreed on a World Health Assembly resolution on patient safety in 2002 (Donaldson & Philip, 2004). More recent US figures suggest that preventable medical harm events may be ten times higher than in the IOM-report, which implies an unimaginable total cost of nearly $1 trillion (Andel, Davidow, Hollander, & Moreno, 2012). In Sweden, recent statistics shows decreasing numbers of deaths and injuries due to healthcare errors. Still, approximately 1,400 deaths stem from errors in healthcare, and every 10th patient is injured – of which some 3,000 suffer permanent damage (Swedish Board of Health and Welfare, 2015).

The term medical error is defined by the IOM as ‘the failure of a planned action to be completed as intended (i.e., error of execution) or use of a wrong plan to achieve an aim (i.e., error of planning)’. Furthermore, that ‘some medical
errors might lead to an adverse event, such as an injury resulting from a medical intervention, but not due to the underlying condition of the patient’ (Kohn et al., 2000). Medical errors might originate from a variety of subjects including mistakes by humans, medical technology, and systems, which occur during processes within a health care system. Hence, medical errors may occur through failures of systems and processes such as safety leadership, safety culture, and safety initiatives (McFadden, Henagan, & Gowen, 2009) as well as corrective systems (Lee, Hong, & Kim, 2014). Moreover, errors may occur during interactions between medical staff and medical equipment and/or systems (Garrouste-Orgeas et al., 2012; Reason, 2000).

The recognition of the patient safety concept, preventable adverse events, and errors have created a desire to focus on prevention, primarily to avoid patient suffering but also to enhance healthcare finances (Brilli et al., 2013). Isolated interventions are unlikely to reduce the underlying causes of hospital errors (Singer & Vogus, 2013). However, improved patient safety using various quality improvement strategies, such as implementing culture and system changes have been demonstrated to be efficient (Brilli et al., 2013; Morello et al., 2013; Muething et al., 2012). Hence, in order to effectively create and sustain a safety culture and reduce errors, systemic interventions that address the interrelated processes of a safety culture in a balanced manner are required (Singer & Vogus, 2013). An example of such actions was revealed in a recently published Dutch review on preventable adverse events, where it was concluded that a national “Prevent harm, work safely” programme reduced the frequency of preventable adverse events (Baines, Langelaan, de Bruijne, Spreeuwenberg, & Wagner, 2015). Other, more direct and hands-on actions to promote patient safety include the use of CPGs, which are often based on evidence-based practice (EBP).

**Clinical practice guidelines**

The taxonomy in this area contains several expressions. A ‘Guideline’ is a statement that determines a course of action and aims to streamline particular processes according to sound practice in line with best practice. ‘Best practice’ is described as a technique or a method that is believed to be more effective at delivering a particular outcome than any other techniques or methods. ‘Evidence-based practice’ (further described later) involves a technique or method tested by means of best practice which can be adopted as a standard process and be used as a guideline. By definition, following a guideline is never mandatory. However, by following, maintenance of best practice is kept without jeopardising its quality (Department of Veterans Affairs, 2016).

According to the Institute of Medicine, “Clinical practice guidelines are statements that include recommendations intended to optimise patient care
that are informed by a systematic review of evidence and an assessment of the benefits and harms of alternative care options” (Field, Lohr, Guidelines, & Medicine, 1992; Steinberg, Greenfield, Mancher, Wolman, & Graham, 2011). In an early review covering publications from 1985 up to June 1997, Shaneyfelt, Mayo-Smith, and Rothwangl (1999) concluded that CPG developers did not fully adhere to the established methodological standards in the synthesis of scientific evidence. In parallel, during the same period, the term evidence-based practice (EBP) emerged, defined as ‘the integration of best research evidence with clinical expertise and patient values’ (Sackett, 2000). Ever since, for some twenty years, it has been used and is now an undisputable part of both healthcare and healthcare education (Eddy, 2011). EBP is also considered a nursing core competence (The Swedish Society of Nursing) aiming to incorporate science into practice and enhance safety. Based on the intention in the definitions described above, tools and methods for guideline development have been drafted; the Guideline International Network (G-I-N) Standards (www.g-i-n.net), the Institute of Medicine (IOM) Standards (Graham, Mancher, Wolman, Greenfield, & Steinberg, 2011), the Appraisal of Guidelines for Research & Evaluation (AGREE) II (Brouwers et al., 2010), and Guidelines 2.0 (Schunemann, Fretheim, Oxman, & Research, 2006). In this regard, CPGs are usually, or should be, consensus statements based on EBP or best practice, developed to ascertain professional and scientific-based care (Eddy, 2011; Grol & Grimshaw, 2003; Qaseem et al., 2012; Steinberg et al., 2011). However, as the cost of guideline development can be capped at $200,000 per guideline (the US) (Graham et al. 2011), the process has been questioned as regards just when guidelines are “good enough” (Browman, Somerfield, Lyman, & Brouwers, 2015).

The use of CPGs enhances the quality of care and promotes patient safety through evidence-based practice (Harrison, Légaré, Graham, & Fervers, 2010). Areas improved by the use of guidelines or care bundles are for example, decreased catheter associated blood-stream infections as a result of enhancing hygiene routines (Ista et al., 2016; Marschall et al., 2014; Miller et al., 2010; Pérez-Granda, Guembe, Rincón, Muñoz, & Bouza, 2015; Wilson, 2015), decreased ventilator associated pneumonia due to enhancing oral health (El-Rabbany, Zaghlool, Bhandari, & Azarpazhooh, 2015; Eom et al., 2014; Kaneoka et al., 2015; Klompas et al., 2014; Speck et al., 2016; Zuckerman, 2016), and decreased incidence of pressure ulcers by relieving the pressure (Niederhauser et al., 2012; Reddy, Gill, & Rochon, 2006; Sullivan & Schoelles, 2013).

Since CPGs aim to transform evidence into practice, adherence to CPGs among healthcare staff is urged by healthcare organisations as a path to enhancing patient safety.
Background

Adherence to clinical practice guidelines

Guideline adherence in general, as assessed in recent reviews, demonstrates divergent results, as does the sustainability of adherence over time showing both improved adherence (Luangasanatip et al., 2015), and decreased levels after intervention (Ament et al., 2015). One of the most studied practices is infection control by adhering to hand hygiene guidelines, and may therefore serve as an example. Healthcare related infections within Swedish healthcare are one of the most common injuries, alone causing about 750,000 extra hospital days yearly and an extra cost of more than $700 million, not to mention the unnecessary patient suffering (Swedish Board of Health and Welfare, 2015). European statistics reveal about 37,000 deaths yearly due to healthcare related infections (Zingg et al., 2015). The concept of cleaning hands more thoroughly, together with using an antiseptic agent in order to prevent infections, emerged in the early 19th century. The most famous pioneer in this area was probably Ignaz Semmelweis, a young physician at the General Hospital of Vienna, who in 1847, found dramatically reduced maternal mortality rates with the use of an antiseptic handwashing solution (Carter, 1983). Although these findings were not fully accepted by the contemporary establishment, the result of the seminal studies by Semmelweis and others meant that handwashing gradually became accepted as one of the most important measures for preventing transmission of pathogens in healthcare facilities. Ever since, numerous recommendations and guidelines on hand hygiene have been published worldwide (Public Health Agency of Sweden, 2013; Tacconelli et al., 2014; Us Centers for Disease Control and Prevention, 2002; World Health Organization, 2013).

Even though hand hygiene has been an issue for some 170 years, guideline adherence still needs to be targeted. In a review of 96 studies by Erasmus et al. (2010) on adherence to hand hygiene guidelines, an overall median adherence rate of 40% was found. Adherence was further studied in a review covering only qualitative studies where it is concluded that the problem of low hand hygiene guideline adherence is best targeted by using theories that underpin work environment and behaviour motivation issues to gain a better understanding of factors influencing guideline adherence (Smiddy, O’Connell, & Creedon, 2015). Studies on nursing students’ adherence to hand hygiene guidelines have also been performed, for example by Cruz, Cruz, and Al-Otaibi (2015) who revealed gender differences regarding hand hygiene guideline adherence where women demonstrated higher levels than men. Moreover, Shinde and Mohite (2014) found nursing students to report significantly higher levels of adherence to hand hygiene guidelines compared to the nurses in their study.
Studies on guideline adherence regarding other clinical practice procedures, for example on peripheral venous catheters handling guidelines explored by Förberg et al. (2014), show varying but suboptimal levels of adherence. Furthermore, knowledge about pressure ulcer prevention guideline content has been shown to be poor, approximately 50%, among nursing students (Simonetti, Comparcini, Flacco, Di Giovanni, & Cicolini, 2015).

Research use, which is defined as the intention to use EBP in practice (Groot, Wouden, Hell, & Nieweg, 2013), for example by adhering to CPGs, varies. Studies conducted among Swedish RNs showed overall low research use one year after graduation and even lower levels after three years (Forsman, Gustavsson, Ehrenberg, Rudman, & Wallin, 2009). The same research team identified a number of factors associated with low research use, for example clinical setting (psychiatric care), role ambiguity, being male, and low student activity during undergraduate education among RNs two years post-graduation (Forsman, Rudman, Gustavsson, Ehrenberg, & Wallin, 2012). Furthermore, about half of the graduating nursing students in Forsman, Wallin, Gustavsson, and Rudman (2012) study reported the intention to use research on at least half of all work shifts, which also predicted research use one year post graduation. Adherence to CPGs are in line with high levels of research use, provided that the CPG are based on EBP/best practice. In this thesis I will consider adherence to CPG as a possible confirmation of high research use.

In summary, studies addressing nursing students’ guideline adherence are numerically fewer compared to studies among healthcare staff. In this regard, further studies on guideline adherence as well as factors influencing guideline adherence among both healthcare staff and nursing students are of great interest in order to optimise care.

Factors influencing guideline adherence

Various barriers to healthcare workers’ adherence to guidelines have been reported in the literature. The barriers are both connected to individual, contextual, and CPG characteristics. In a review by Travers, Martin-Khan, and Lie (2009) on barrier to CPG use among physicians in primary care, factors such as the awareness, familiarity, agreement, self-efficacy, and outcome expectancy of CPG adherence were shown to be of importance. Furthermore, ability to overcome the inertia of previous practice, and absence of external barriers to perform recommendations (Cabana et al., 1999; Kochevar & Yano, 2006) are also important. Meijers et al. (2006), identified six context factors in their review of ten studies in the nursing field: role, access to resources, organisational climate, support, education and time to participate in research. In other nursing reviews, some of these ‘context’ factors (e.g. role, education) are also identified as individual factors important to knowledge acquisition.
(Estabrooks, Floyd, Scott-Findlay, O’Leary, & Gushta, 2003; Squires et al., 2011). Also, guideline characteristics such as relevance, easy/difficult to follow, compatible with existing norms and values etc., are of major importance for adherence (Burgers et al., 2003). Factors influencing nursing students’ adherence to CGP are for example knowledge of CPGs, perceived barriers, adequacy of training, management support, influence of nursing staff (Cheung et al., 2015), and the perceived social climate at the setting (Chan, 2002).

**Adherence to venous blood specimen collection guidelines**

Adherence to VBSC guidelines is essential to maintain high quality. The Swedish VBSC guidelines are available online in the Handbook for Healthcare and are almost identical to the international guidelines (CLSI, 2010), and cover areas relevant to the pre-analytical phase (Figure 1). In a recently published observation study by the European Federation of Clinical Chemistry and Laboratory Medicine Working Group for the Pre-analytical Phase aiming to assess the level of adherence to the international CLSI H3-A6 guidelines in 12 European countries, the overall level was found to be unacceptably low (Simundic et al., 2015). Furthermore, it was found that patient identification and tube labelling practices were the most critical parts needing immediate attention. Also, in Swedish contexts, studies on VBSC guideline adherence demonstrate suboptimal levels among both hospital ward staff (Wallin et al., 2008; Wallin et al., 2010) and PHC staff (Bölenius et al., 2013; Söderberg, Brulin, Grankvist, & Wallin, 2009). Chemistry laboratory staff, however, reported higher levels of adherence compared to other healthcare staff categories performing phlebotomy (Melkie, Girma, & Tsalla, 2014; Wallin et al., 2008).

The overall laboratory error rate ranges from <0.05-10% depending on definitions and the methods used to identify frequencies (Lippi & Guidi, 2007). Apart from the unnecessary patient suffering, the cost for pre-analytical errors has been estimated to represent on average between 0.23% and 1.2% of total hospital operating costs (Green, 2013). In a recently published review, Giuseppe Lippi et al. (2015) concluded that the pre-analytical phase is undeniably the most vulnerable to a variety of errors impairing the reliability of test results. With the vast majority of all laboratory errors occurring in the pre-analytical phase (Bonini, Plebani, Ceriotti, & Rubboli, 2002; G. Lippi et al., 2015; Simundic & Lippi, 2012), this phase needs to be targeted as regards quality improvement. Errors in the pre-analytical phase are for example identification errors, which are considered the most serious (Kalra, 2004; Lippi et al., 2009) ranging between 0.2% and 6% for outpatients, and 1% to 2% for inpatients (Lippi & Guidi, 2007). Identification errors are for example if the patient is not asked to state name and national
registration number, if coherence between test request, test tube labels and patient ID is not checked, or the miss-labelling of test tubes occurs (Lippi, Sonntag, & Plebani, 2011). Furthermore, passive agreement, i.e. when a patient just agrees with the name and national registration number suggested by the phlebotomist, is not considered as guideline adherence (Grissinger, 2014).

Studies on nursing students’ adherence to VBSC practice guidelines are few. However, in a recent Swedish observation and questionnaire study, 98% of the students successfully performed correct patient identification, and 96% labelled the test tubes correctly. No significant associations between performance and self-efficacy were found (Ahlin, Löfmark, Klang-Söderkvist, & Johansson, 2012). The conviction that errors in the pre-analytical phase can be detected and prevented (Kaushik & Green, 2014) gives the incentive to further address this issue.

**Rationale for the thesis**

The use of CPGs is crucial to guarantee high quality healthcare and patient safety. Adherence to VBSC practice guidelines ensures the safety when relying on results from VBSC analyses, which is essential in healthcare, since a great deal of decisions are made based on these results. Suboptimal adherence to VBSC guideline practice has been demonstrated among both healthcare staff on hospital wards as well as among staff in PHCs. Of all errors, non-adherence or suboptimal adherence to patient identification guidelines are considered the most serious, since decisions about diagnosis, treatment and evaluation of treatment might be based on results from the wrong patient if correct procedure is not followed. This might cause the patient unnecessary suffering due to the need for supplementary blood sampling, the feeling of being unsafe, and also an unwanted extra cost for society.

Earlier research found suboptimal adherence to VBSC guidelines among phlebotomy staff. However, no or few studies have explored to what extent workplace affiliation explains variation in reported adherence. With the assumption that students learn correct VBSC practice in line with guidelines in one of their first semesters at university, together with earlier findings revealing that RNs deviate from guidelines, the need to further explore both nursing students’ VBSC practice during their training as well as their reflections on VBSC practices, is warranted. There is also a need to further explore the extent to which workplace affiliation explains variation in VBSC guideline adherence. We hypothesised work context to impact levels of adherence to VBSC guidelines, and nursing students to be influenced by contextual factors when attending clinical practice. To the best of our knowledge, few studies have explored nursing students’ adherence to VBSC
guidelines and factors associated with guideline adherence, and no or few studies have explored workplace affiliation in relation to VBSC guideline adherence.

Aim

The overall aim of this thesis was to explore adherence to, and factors influencing, venous blood specimen collection practice guidelines among university nursing students and healthcare staff.

Specific aims

Study I: To explore to what extent workplace affiliation explains variation of self-reported adherence to VBSC practices regarding patient ID and test request handling, taking into consideration fixed PHC workplace and individual phlebotomist characteristics.

Study II: To investigate senior nursing students’ adherence to the national VBSC guidelines regarding patient identification, test request handling, and test tube labelling.

Study III: To explore nursing students’ adherence to venous blood specimen collection practice guidelines regarding patient identification and test-request management in association with clinical experience, capability beliefs, research use, and the impact of perceived social climate in clinical contexts.

Study IV: To describe senior nursing students’ perceptions of deviations from venous blood specimen collection practice guidelines.
Materials and methods

This thesis applied both quantitative and qualitative methods in order to obtain a more comprehensive picture of the phenomenon under investigation. An overview of the studies is presented in Table 1.

Table 1. A schematic overview of Studies I – IV

<table>
<thead>
<tr>
<th>Study Status</th>
<th>Design</th>
<th>Participants</th>
<th>Data collection Year</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Published</td>
<td>Cross sectional</td>
<td>164 phlebotomy staff from 25 PHCs</td>
<td>VBSQ 2006-2007</td>
<td>Multilevel logistic analyses</td>
</tr>
<tr>
<td>II Published</td>
<td>Cross sectional</td>
<td>101 nursing students in their 5th and 6th semester</td>
<td>VBSQ 2007</td>
<td>Multiple logistic regressions</td>
</tr>
<tr>
<td>III Re-submitted</td>
<td>Cross sectional</td>
<td>305 nursing students in their 2nd, 4th, and 6th semester</td>
<td>VBSQ Capability beliefs regarding EBP Research use Capability beliefs regarding academic ability QPS Nordic CS 2012</td>
<td>Multiple logistic regressions</td>
</tr>
<tr>
<td>IV In manuscript</td>
<td>Qualitative</td>
<td>26 nursing students in their 6th semester</td>
<td>Focus group interviews 2015</td>
<td>Qualitative content analysis</td>
</tr>
</tbody>
</table>

PHC: Primary healthcare centre, VBSQ: Venous blood sampling questionnaire, QPS: General Nordic Questionnaire for Psychological and Social Factors at Work, CS: Climate scale

Student context

VBSC is one of several practical nursing skills in the Swedish nursing programme curriculum. It is usually learnt in one of the first semesters and contains both theoretical and practical training in line with current guidelines. Theory and skill training usually take place on campus under the supervision of an education representative (teacher/lecturer). During clinical placement in different healthcare settings such as on hospital wards and in primary healthcare, the students continue VBSC skill training under the supervision of their assigned supervisors or other healthcare staff.

The students in this thesis participated in VBSC training in their second semester out of six. Prior to practical skill training at clinical skills laboratories, the students were urged to study the national guidelines. Practical training was then carried out in groups of 8-12 students by several university lecturers. The students initially practiced on dummy arms, after which they had the opportunity to proceed on to practicing on each other. The
training sessions lasted approximately 180 minutes. All utensils used, such as vacutainer tubes, needles, test requests and labels, were the same or similar to the types used in the clinical settings, to which the students were assigned later on. After the VBSC training and prior to clinical placement, students had the opportunity to further practice by signing up for training sessions with amanuensis, or by practicing on their own at the clinical skills laboratory. Finally, VBSC was examined, both theoretically and the actual skill. In order to pass, the students must demonstrate VBSC in line with the guidelines, as well as deliver correct answers to questions. The students always had online access to the guidelines, provided they had necessary devices and access to the Internet.

**Participants and settings**

In study I, participants were drawn from a sample consisting of 298 phlebotomists from 70 PCHs (response rate 93%). Only participants from PHCs with a minimum of five respondents were included. The final sample consisted of 164 phlebotomists (registered and enrolled nurses) from 25 PHCs. The PHCs were situated in two county councils in northern Sweden, in both urban and rural areas, and were either privately or publicly run. Small PHCs were significantly more often located in rural areas than large ($p<.001$). Participant and, PHC characteristics are presented in Table 2 and 3.

---

1. Result from additional analysis
### Materials and methods

#### Table 2. Participant characteristics, study I

<table>
<thead>
<tr>
<th>Variable</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>155 (95)</td>
</tr>
<tr>
<td>Male</td>
<td>9 (5)</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td></td>
</tr>
<tr>
<td>Enrolled nurses</td>
<td>64 (39)</td>
</tr>
<tr>
<td>Registered nurses</td>
<td>100 (61)</td>
</tr>
<tr>
<td><strong>Years in profession</strong></td>
<td></td>
</tr>
<tr>
<td>m (Sd)</td>
<td>19.6 (10.1)</td>
</tr>
<tr>
<td>Md (Q1; Q3)</td>
<td>20 (11;27)</td>
</tr>
<tr>
<td><strong>Participants’ years employed at worksite</strong></td>
<td></td>
</tr>
<tr>
<td>&lt;5 years</td>
<td>53 (34)</td>
</tr>
<tr>
<td>5-15 years</td>
<td>52 (34)</td>
</tr>
<tr>
<td>&gt;15 years</td>
<td>49 (32)</td>
</tr>
<tr>
<td><strong>Participants’ workplace county</strong></td>
<td></td>
</tr>
<tr>
<td>County A</td>
<td>93 (57)</td>
</tr>
<tr>
<td>County B</td>
<td>71 (43)</td>
</tr>
<tr>
<td><strong>Participants’ workplace size</strong></td>
<td></td>
</tr>
<tr>
<td>(tot # employees)</td>
<td></td>
</tr>
<tr>
<td>Small (&lt;20)</td>
<td>38 (23)</td>
</tr>
<tr>
<td>Medium (20-34)</td>
<td>70 (43)</td>
</tr>
<tr>
<td>Large (&gt;34)</td>
<td>56 (34)</td>
</tr>
<tr>
<td><strong>Participants’ workplace setting</strong></td>
<td></td>
</tr>
<tr>
<td>urban/rural</td>
<td></td>
</tr>
<tr>
<td>Urban*</td>
<td>78 (48)</td>
</tr>
<tr>
<td>Rural*</td>
<td>86 (52)</td>
</tr>
<tr>
<td><strong>Governance</strong></td>
<td></td>
</tr>
<tr>
<td>Federally run</td>
<td>154 (94)</td>
</tr>
<tr>
<td>Privately run</td>
<td>10 (6)</td>
</tr>
<tr>
<td><strong>VBSC frequency</strong></td>
<td></td>
</tr>
<tr>
<td>Every workday</td>
<td>89 (56)</td>
</tr>
<tr>
<td>Every week or less</td>
<td>70 (44)</td>
</tr>
<tr>
<td><strong>Age years</strong></td>
<td></td>
</tr>
<tr>
<td>m (Sd)</td>
<td>49.1 (9.34)</td>
</tr>
<tr>
<td>Md (Q1;Q3)</td>
<td>50 (43;56)</td>
</tr>
</tbody>
</table>

*: Defined by the Swedish National Rural Development Agency (2007)
  Urban= settings with >3000 inhabitants
  Rural= settings with <3000 inhabitants

#### Table 3. Primary healthcare centre characteristics study I

<table>
<thead>
<tr>
<th>Variable</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PCHs location, county</strong></td>
<td></td>
</tr>
<tr>
<td>County A</td>
<td>13 (52)</td>
</tr>
<tr>
<td>County B</td>
<td>12 (48)</td>
</tr>
<tr>
<td><strong>PHC’s location</strong></td>
<td></td>
</tr>
<tr>
<td>urbane/rural setting</td>
<td></td>
</tr>
<tr>
<td>Urban*</td>
<td>12 (48)</td>
</tr>
<tr>
<td>Rural*</td>
<td>13 (52)</td>
</tr>
<tr>
<td><strong>Governance</strong></td>
<td></td>
</tr>
<tr>
<td>Federally run</td>
<td>23 (92)</td>
</tr>
<tr>
<td>Privately run</td>
<td>2 (8)</td>
</tr>
<tr>
<td><strong>Size of PHC</strong></td>
<td></td>
</tr>
<tr>
<td>(tot # employees)</td>
<td></td>
</tr>
<tr>
<td>Small (&lt;20)</td>
<td>6 (24)</td>
</tr>
<tr>
<td>Medium (20-34)</td>
<td>11 (44)</td>
</tr>
<tr>
<td>Large (&gt;34)</td>
<td>8 (32)</td>
</tr>
</tbody>
</table>

*: Defined by the Swedish National Rural Development Agency (2007)
  Urban= settings with >3000 inhabitants
  Rural= settings with <3000 inhabitants
Study II included a sample of 101 nursing students out of 178 possible (response rate 57%) in their penultimate (5th) and final (6th) semesters, attending both campus and web-based education programmes at a medium sized Swedish university. They were mostly women (86%) and attending the campus based programme (68%). The median age was 26 years (min 22, max 49). The majority (n=64, 64%) had no formal healthcare education prior to university studies.

In study III, 305 university nursing students out of 411 possible (response rate 74%), were included. The students attended their 2nd, 4th, and 6th semester (out of six) at a campus based programme at the same medium sized Swedish university described above (II). The median age was 23 years (min 19, max 47). The majority (n=164, 57%) had no formal healthcare education prior to university studies.

In study IV, a purposive sample of 26 nursing students (21 women, 5 men) attending their final (6th) semester at the same medium sized Swedish university described above (II) was used. The median age was 25.5 years (min 22, max 50).

A summary of participant background characteristics in study II-IV is presented in table 4.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Study II</th>
<th>Study III</th>
<th>Study IV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=101</td>
<td>n=305</td>
<td>n=26</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>m (Sd)</td>
<td>28.5 (6.84)</td>
<td>24.9 (4.87)</td>
<td>26.6 (5.41)</td>
</tr>
<tr>
<td>Md (Q1;Q3)</td>
<td>26 (22;30)</td>
<td>23 (22;26)</td>
<td>25.5 (24;27)</td>
</tr>
<tr>
<td>Sex n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female (%)</td>
<td>87 (86)</td>
<td>251 (83)</td>
<td>21 (81)</td>
</tr>
<tr>
<td>Male (%)</td>
<td>14 (14)</td>
<td>52 (17)</td>
<td>5 (19)</td>
</tr>
<tr>
<td>Semester n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd camp</td>
<td>–</td>
<td>107 (35)</td>
<td>–</td>
</tr>
<tr>
<td>4th camp</td>
<td>–</td>
<td>82 (27)</td>
<td>–</td>
</tr>
<tr>
<td>5th web</td>
<td>32 (32)</td>
<td>non existing</td>
<td>non existing</td>
</tr>
<tr>
<td>5th camp</td>
<td>42 (41)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>6th camp</td>
<td>27 (27)</td>
<td>116 (38)</td>
<td>26</td>
</tr>
<tr>
<td>Former healthcare work experience n (%)</td>
<td>–</td>
<td>79 (60)</td>
<td>–</td>
</tr>
<tr>
<td>Former healthcare education n (%)</td>
<td>36 (36)</td>
<td>122 (43)</td>
<td>–</td>
</tr>
</tbody>
</table>

Non-existing: No available web-based students at the time of data collection
Data collection and analysis

Study I

Data collection and instruments
Data were collected between November 2006 and January 2007 by one of the research team members. Permission to perform the study was obtained by the head of each unit. Each head also provided the research team with a list of all available VBSC staff, their professional status, sex and working hours. The coded questionnaires were delivered by postal mail to each PHC, where an assigned staff member assisted in the distribution and collection of the questionnaires. Each questionnaire was accompanied by an information letter describing the purpose of the study together with the information that participation was voluntary, with the right to withdraw at any point without giving a reason why. The participants who chose to participate completed a paper version of the questionnaire, which was considered informed consent. After having completed the questionnaire, the participants were asked to put it in an anonymous reply envelope, seal it, and hand it in to the staff member responsible for collecting the questionnaires. Completed surveys were then returned by postal mail to the research team. A reminder mail was sent after 2-4 weeks.

The Venous Blood Specimen Questionnaire (VBSQ), developed within the project, shows acceptable face and content validity (Bölenius, Brulin, Grankvist, Lindkvist, & Söderberg, 2012; Wallin et al., 2008) and reliability (Bölenius et al., 2012). The VBSQ consists of 13 questions addressing VBSC practices out of which 9 have underlying items. In total, respondents are asked to consider 41 items/statements based on the national VBSC guidelines (Handbook for Healthcare) as recommended by the Swedish National Board of Health and Welfare. Each item is responded on a 4-point Likert scale (‘never’, ‘seldom’, ‘often’, and ‘always’) where usually only one alternative is considered correct. It was clearly pointed out that the participants should mark alternatives in line what they usually did, not how the task was supposed to be done according to guidelines. The questionnaire was complemented with questions on background data.

Analysis
Multilevel logistic regression analysis considers the individual probability of a specific action to also be statistically dependent on the contextual circumstances (cluster) of the subjects, in this study, the workplaces (PHCs). Moreover, that the dependence on the context needs to be accounted for to obtain correct regression estimates (Rodriguez & Goldman, 1995). The median odds ratio (MOR) (Larsen & Merlo, 2005; Larsen, Petersen, Budtz-
Jorgensen, & Endahl, 2000) quantifies cluster variance, and is directly comparable with the commonly used odds ratio (OR) (Merlo et al., 2006). In this study, the MOR represents the median value of the odds ratio between a PHC at the highest probability of adherence and a PHC at the lowest probability of adherence. Thus, the MOR demonstrates the extent to which the phlebotomist’s probability of adherence to VBSC guidelines is determined by workplace affiliation. For example, if the MOR is equal to 1, there are no differences between workplaces in the probability of guideline adherence. If the MOR is equal to 1.5, the heterogeneity between workplaces increases by 1.5 times the individual odds of adhering to guidelines. Hence, if a participant would change workplace and start working at a workplace with higher probability of adherence, the chance for the individual to adhere to guidelines will (in median) increase 1.5 times. The intra class correlation (ICC), calculated according to the latent variable method, represents the percentage of reporting in line with guidelines accounted for by the cluster (PHC) level (Merlo et al., 2006).

Prior to statistical analysis, data were dichotomised into correct/incorrect procedure, with only one alternative out of four considered to be correct. Dependent variables were Always ask patient to state name and national registration number (item 1), Never neglect asking for ID with the reason “known” (item 2), Always compare patient ID with ID on test request (item 3), and Always make sure test request and test tube label ID numbers are consistent (item 4). In order to quantify the variation between different workplaces, three models with independent variables were created for each item to apply to our data: 1) The empty model containing estimates only for the workplace-level (PHC) random intercept of adherence with VBSC guidelines and intended to act as a baseline for comparison with the full and adjusted models that take into account both fixed variables and random effect terms. 2) The full model containing both workplace (PHC size, urban/rural setting, and governance) and individual (age, sex, occupation, years of employment at site, and VBSC frequency) characteristics. 3) The adjusted model was created in a manual stepwise backward elimination procedure starting with the full model and then deleting variables one at a time until only significant variables were left. ICC and MOR were used for evaluation of random effects for the different models.

Furthermore, to investigate the impact of individual and workplace characteristics on the outcome reporting in accordance with guidelines, ORs and their corresponding 95% confidence intervals (CI) from the logistic regression analyses were used. Descriptive statistics were assessed by using SPSS (IBM SPSS Statistics 20, IBM, New York, US). The R-package ‘eha’ was used to estimate the multilevel logistic regression models.
Study II

Data collection and instruments
Study II was carried out with data collected in 2007 using an adjusted version of the VBSQ (described under study I) to fit students, and complemented with questions on background data, such as sex, age, educational background, semester, and campus. All students in the 5th and 6th semester attending the campus education programme were invited personally in class by two of the research team. Before handing out the questionnaires, the students were informed of their voluntary participation, and that they could withdraw at any time without declaring any reason and, furthermore, that data would only be presented at group level. Those who chose to participate filled in the questionnaire and handed it to the researchers. Participation was considered informed consent. The 5th semester students attending the web-based programme were invited and informed about the study in writing on the learning platform used for their education. The web-students completed an exactly worded online version. The survey was both delivered and collected anonymously by a test tool within the platform. It was clearly pointed out that the participants should mark alternatives in line with what they usually did, not how the task was supposed to be done according to guidelines.

Analysis
Multiple logistic regression analyses were used to study associations between the background characteristics and reported practices. Categorical variables were compared by using chi-squared test or Fisher’s exact test, continuous data were presented using mean and standard deviation. Only variables with a p-value <0.05 in the univariate analyses were included in the multiple logistic regression. Dependent variables were 1) labelling the test tube before entering the patient’s room, 2) comparing patient ID with the test request/tube label, and 3) identifying the patient by checking his/her healthcare card. Independent variables for the respective models were campus/-web-based, semester, other healthcare education prior to present university studies, age, and sex. To measure association, ORs and their corresponding 95% CI were used. Statistics were assessed by using SPSS (IBM SPSS Statistics 20, IBM, New York, US).
Study III

Data collection and instruments

Study III was carried out with data collected in June 2012. All students in the 2nd, 4th, and 6th semester were invited personally in class at campus by KN. They were informed about the purpose of the survey both orally and in writing and, furthermore, that only the researcher (KN) had access to the codes and the corresponding names, that data would only be presented at group level, and finally that they could withdraw from the study at any time without giving a reason why. Finally, the assurance that participation would not affect their education or assessments in any way. Students who chose to participate gave their written informed consent prior to filling in the surveys. Completed surveys were collected by KN or, in a few cases, by a lecturer who handed them to KN. An e-mail was sent to students who were absent from class at the time of invitation.

In addition to demographic questions on sex, age, semester, previous healthcare work experience, previous healthcare education, and most recent clinical placement, the questionnaire consisted of a compilation of items from five existing tools:

VBSQ (described under study I). Adjusted version to fit students.

Capability beliefs regarding EBP scale (Wallin, Boström, & Gustavsson, 2012) based on the conceptualisation of EBP by Sackett (2000) and examined for item-content validity by Boström, Ehrenberg, Gustavsson, and Wallin (2009). The scale consists of six items developed for use in the Longitudinal Analysis of Nursing Education (LANE) study. Participants respond on a scale from 0 (cannot) to 10 (definitely can). A mean across all six items is then computed for each individual, reflecting the individual’s overall score on the scale. Hence, the possible value of the mean score ranges from 0 to 10.

Research use (RU), measured as three single items, originally developed by Estabrooks (1999), translated and adapted for use in a Swedish context by Rudman, Omne-Pontén, Wallin, and Gustavsson (2010). Participants respond on a scale from 1 (never) to 5 (on almost every shift).

Capability beliefs regarding academic ability scale developed for use in the LANE study by Rudman et al. (2010). The questionnaire consists of six items responded on a scale from 0 (cannot) to 10 (definitely can). A mean across all six items is then computed for each individual, reflecting the individual’s overall score on the scale. Hence, the possible value of the mean score ranges from 0 to 10.
Social climate section from the General Nordic Questionnaire for Psychological and Social Factors at Work (QPSNordic) (Dallner, 2000) developed to measure psychological, social, and organisational conditions in the analysis of work organisations. The social climate section consists of three items, and participants respond to statements on a 5-point Likert scale from 1 (to a very low extent or not at all) to 5 (very much). A mean across all three items is then computed for each individual, reflecting the individual’s overall score on the scale. Hence, the possible value of the mean score ranges from 1 to 5.

The students who chose to participate completed a paper version of the questionnaire. It was clearly pointed out that the participants should mark alternatives in line what they usually did, not how the task was supposed to be done according to guidelines.

Analysis

Multiple logistic regressions were used to estimate the association between VBSC adherence regarding patient ID procedure and test-request handling as the dependent variables, and age, sex, healthcare work experience prior to present university studies, semester, VBSC frequency, perceived value of VBSC practice at clinical placement, research use at clinical placement, capability beliefs regarding EBP, capability beliefs regarding academic ability, and perceived social climate at clinical placement as the independent variables. Prior to statistical analysis, ordinal data from the VBSQ were dichotomised into correct (1) or incorrect procedure (0), with only one alternative out of four considered to be correct. Comparisons between groups were made by chi-square test for categorical variables and by Student’s t-test for continuous variables. Continuous data were presented as means and standard deviations, and categorical data were presented as absolute numbers and percentages. Of the associations in the univariate analyses, only variables with a $p$-value <0.05 were included in the multiple logistic regression. Associations are presented as ORs and their corresponding 95% CI. Statistics were assessed by using SPSS (IBM SPSS Statistics 20, IBM, New York, US).

Study IV

Data collection

Focus groups were used for data collection. According to Morgan (1996) a focus group is ‘a research technique that collects data through group interaction on a topic determined by the researcher’. The method has increasingly been used in healthcare research as a useful and effective mechanism in which a group jointly constructs meaning about a topic (Shaha, Wenzel, & Hill, 2011), and is considered suitable for nursing research
Materials and methods

Several studies (Jonsén, Melender, & Hilli, 2013; Kenny, 2002; Sharif & Masoumi, 2005) have also used focus groups within nursing education to embrace the students’ perspective and experiences of teaching and learning. This study used focus group discussions to shed light on quantitative data already collected and analysed (cf Krueger & Casey, 2014).

Five focus group interviews, four with both men and women and one with solely women, were carried out on campus by the first author (moderator) and the last author (assistant moderator) in September 2015 using an interview guide developed and agreed on in the research team. The moderator gave information on the purpose of the focus group, and the students had the opportunity to ask questions. The assistant moderator made sure that the subject had been fully covered, and that all participants had the opportunity to speak. First, two questions about the learning process in clinical skills laboratories and during clinical placement were asked: “Could you please tell me what it was like to learn how to perform VBSC at the clinical skills laboratory?” and “What was it like to continue practicing VBSC during clinical placement?”. Thereafter, the core question/statement, which the students were asked to reflect on, was presented: “Earlier research has found senior nursing students increasingly deviate from VBSC guidelines with every completed semester. Can you please reflect on this finding?” If necessary, additional probing questions were asked in order to have the students clarify or elaborate what they were sharing.

Analysis

Qualitative content analysis was used to analyse the interviews. The method aims to systematically analyse written or verbal communication (Krippendorff, 2004). The interpretation focuses on differences and similarities between various parts of the text, resulting in the organisation of data into categories or themes. The audio recorded focus group interviews were transcribed verbatim by the first author and subjected to qualitative content analysis. The process of analysis was inspired by the steps described by Graneheim and Lundman (2004). First, the text was read through a couple of times to gain an understanding of the whole. Second, units of text addressing the aim of the study were chosen, condensed and coded. Third, codes with similar content were grouped into subthemes, which were further abstracted into themes. After further analysis, an overall theme emerged capturing the essence of the data.

The first steps of the analysis were undertaken using the R-package ‘RQDA’.
Materials and methods

Ethical considerations

Studies I, II, and III took a quantitative approach using questionnaires. The information letters contained information about the studies, the assurance of confidentiality, as well as the information that participation was voluntary, and that they had the right to withdraw at any point without giving reasons why. In order to avoid identification of individuals, the results were presented at group level. In study I and II, the decision to fill in the questionnaire and thus participate was considered accepted informed consent. In study III, participants gave their written informed consent to participate. The students participating in study II and III were informed that participation would not affect their education in any way.

In study IV, focus group interviews were used for data collection. Prospective participants were informed both orally and in writing, and those who chose to participate gave their written informed consent. There is always a risk that participants do not feel comfortable in a focus group and hence remain silent, which may influence the result. With the ambition that all participants should feel involved, the interviewer paid attention to this and addressed these participants directly, when/if the situation arose. The fact that participants were free to choose any group may have influenced the results, since there is a risk that they chose a group with friends who share the same values, a scenario that may have interfered with the variation sought.

The studies in this thesis conform to the principles in the Declaration of Helsinki (World Medical Association, 2013). All studies were approved by the Regional Ethical Review Board in Umeå with the following references: Study I and II (Dnr 06-104M), study III and IV (Dnr 2013-270-31M).
Results

The presentation of results is based on the aims and findings from each study. First, I describe the impact of workplace affiliation together with specific workplace and individual factors on VBSC guideline practice adherence (Study I). Second, I describe VBSC guideline practice adherence, together with factors associated with guideline adherence among university nursing students (Studies II and III), and third, perceptions on deviations from VBSC practice guideline adherence among university nursing students (Study IV).

The impact of workplace affiliation on venous blood specimen collection guideline adherence

In study I, the aim was to explore to what extent workplace affiliation explains variation of self-reported adherence to VBSC practices regarding patient ID and test request handling, taking into consideration fixed PHC workplace and individual phlebotomist characteristics.

The main finding in study I was that workplace affiliation largely explains variance in levels of adherence to VBSC practice guidelines in three out of four guideline practices. The results from the adjusted models, taking also individual and workplace factors into consideration, show that the MOR values were between 3.20 and 4.21 regarding three out of four of the selected guidelines practices, namely: Always ask patient to state name and national registration number (item 1), Never neglect asking for ID with the reason ‘known’ (item 2), and Always make sure test request and test tube label ID numbers are consistent (item 4). Furthermore, they show that workplace affiliation significantly explained 31 % to 41 % of the total variation between workplaces in self-reported adherence regarding these items (Table 5).

The adjusted models revealed a few associations between guideline adherence and individual and workplace characteristics in item 1, 2 and 3:

Regarding the guideline practice to Always ask patient to state name and national registration number (item 1), adherence was reported by 53%. Staff working at large PHCs were more likely to adhere to guideline practice (OR: 9.32) than staff at small PHCs.

Regarding guideline practice to Never neglect asking for ID with the reason ‘known’ (item 2), adherence was reported by 38%. Staff working at medium or large PHCs were more likely to report adherence to guidelines (OR: 9.87 and OR: 28.36 respectively) than staff working at small PHCs.
Table 5 Measures of association between primary healthcare centre, and participant characteristics and the outcomes in primary healthcare centres in two counties in northern Sweden, 2007, adjusted for age, occupation, setting (urban/rural), and governance (private/public). Bold characters represent significant ($p < 0.05$) values.

<table>
<thead>
<tr>
<th>Measures of workplace variation</th>
<th>1. Always ask patient to state name and national registration number</th>
<th>2. Never neglect asking for ID with the reason “known”</th>
<th>3. Always compare patient ID with ID on test request</th>
<th>4. Always make sure test request and test tube label ID numbers are consistent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjusted model*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MOR</td>
<td>3.49</td>
<td>3.20</td>
<td>1.93</td>
<td>4.21</td>
</tr>
<tr>
<td>Sd (SE), p</td>
<td>1.31 (0.38), &lt;0.001</td>
<td>1.22 (0.41), 0.002</td>
<td>0.69 (0.42), 0.14</td>
<td>1.51 (0.42) &lt;0.001</td>
</tr>
<tr>
<td>ICC</td>
<td>0.34</td>
<td>0.31</td>
<td>0.13</td>
<td>0.41</td>
</tr>
<tr>
<td>OR (95% CI)</td>
<td></td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
<td></td>
<td>5.42 (1.12-26.20)</td>
</tr>
<tr>
<td>Employed at worksite (yrs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;15</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>5-15</td>
<td></td>
<td></td>
<td></td>
<td>1.39 (0.44-4.36)</td>
</tr>
<tr>
<td>&lt;5</td>
<td></td>
<td></td>
<td></td>
<td>4.66 (1.41-15.39)</td>
</tr>
<tr>
<td>PHC size (tot # staff)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small, ≤19</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Medium 20-34</td>
<td></td>
<td></td>
<td></td>
<td>5.06 (0.87-29.47)</td>
</tr>
<tr>
<td>Large, ≥35</td>
<td></td>
<td></td>
<td></td>
<td>9.32 (1.35-64.30)</td>
</tr>
<tr>
<td>VBSC frequency</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Every day</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>≤ Every week</td>
<td></td>
<td></td>
<td></td>
<td>2.76 (1.04-7.29)</td>
</tr>
</tbody>
</table>

Adjusted model*: random intercept of adherence with VBSC guidelines in combination with remaining significant variables after stepwise backward elimination procedure. MOR: median odds ratio; CI: confidence interval; OR: odds ratio; ID: identification; EN: enrolled nurse; RN: registered nurse. Urban/Rural: defined by the Swedish National Rural Development Agency (2007)
Staff employed less than five years at the site were more likely to report in accordance with guideline (OR: 4.66) compared to staff employed more than 15 years. Finally, staff who performed VBSC every week or less often were more likely (OR: 2.76) to report in line with guidelines compared to staff who drew blood on a daily basis.

Regarding *Always compare patient ID with ID on test request* (item 3), adherence was reported by 79%. Females were found to be more likely to report in line with guidelines (OR: 5.42) than men, and staff employed less than five years at site more likely to report guideline adherence (OR: 3.35) than staff employed more than 15 years (Table 5).

Regarding *Always make sure test request and test tube label ID numbers are consistent* (item 4), adherence was reported by 59%. No significant associations were found

**Adherence to venous blood specimen collection practice guidelines and factors associated with adherence among nursing students**

The main finding was that the students were more likely to deviate from VBSC practice guidelines with every completed semester (II, III). Associations were found between reported practice and type of education programme (II), individual factors such as capability beliefs (III), as well as perceived social climate at the clinical placement, and also the extent of research use during clinical practice (III). Moreover, the desire to blend in was perceived to influence practice (IV).

**Table 6** Multiple logistic regression analyses of factors associated with guideline adherence in study II between participant characteristics and the outcomes among nursing students (n = 101) at a medium sized Swedish university, 2007, adjusted for age and sex. Significant values (p <0.05) in bold.

<table>
<thead>
<tr>
<th>Programme</th>
<th>Patient identification</th>
<th>Test tube labelling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
</tr>
<tr>
<td></td>
<td>Never checking patient ID by using health care card</td>
<td>Always comparing name and national registration number with test request and label</td>
</tr>
<tr>
<td>Camp 6th</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Web 5th</td>
<td>11.32 (2.42-52.97)</td>
<td>41.81 (4.30-406.22)</td>
</tr>
<tr>
<td>Camp 5th</td>
<td>3.87 (1.18-12.69)</td>
<td>2.32 (0.67-8.07)</td>
</tr>
<tr>
<td>Former HCE</td>
<td>No</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>1.16 (0.36-3.73)</td>
</tr>
</tbody>
</table>

Camp: campus based programme; Web: web-based programme; sem: semester; HCE: healthcare education;
Results

Regarding the guideline practice to *Always ask patient to state name and national registration number*, the majority of the students in both study I and II (81% and 82%, respectively) reported in line with guidelines. However, the analyses of semester groups revealed decreasing levels of adherence over time (II, III). In the multiple logistic regression analysis, 2nd semester students were more likely to report guideline adherence (OR: 3.16) than 6th semester students (III), as were students reporting research use ‘on at least half of the work shifts’ (OR: 2.38) compared to those reporting ‘never/on a few shifts’ (III) (Table 7).

Regarding the guideline practice to *Always compare patient ID with ID on test request*, the majority of the students reported in line with guidelines; 74% (II) and 80% (III). Analyses of semester groups, however, revealed decreasing levels of adherence over time (II, III). The multiple logistic regression analyses showed that 5th semester students attending the web-based programme (II) were more likely to report in line with guidelines (OR: 41.81) than 6th semester campus students² (Table 6). Students with previous healthcare work

<table>
<thead>
<tr>
<th>Table 7. Multiple logistic regression analyses of factors associated with guideline adherence in study III between participant characteristics and the outcomes among nursing students (n = 305) at a medium sized Swedish university, 2012, adjusted for age, sex, and VBSC frequency. Significant values (p &lt; 0.05) in bold.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient identification and test request handling</strong></td>
</tr>
<tr>
<td><strong>Always ask the patient to state name and national registration number</strong></td>
</tr>
<tr>
<td><strong>OR (95% CI)</strong></td>
</tr>
<tr>
<td><strong>Semester</strong></td>
</tr>
<tr>
<td>6th</td>
</tr>
<tr>
<td>4th</td>
</tr>
<tr>
<td>2nd</td>
</tr>
<tr>
<td><strong>Former healthcare work experience</strong></td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td><strong>VBSC is highly valued at clinical placement site</strong></td>
</tr>
<tr>
<td>Totally disagree</td>
</tr>
<tr>
<td>Agree to some extent</td>
</tr>
<tr>
<td>Totally agree</td>
</tr>
<tr>
<td><strong>Students’ RU at clinical placement site</strong></td>
</tr>
<tr>
<td>Never/on a few shifts</td>
</tr>
<tr>
<td>On at least 50% of the shifts</td>
</tr>
<tr>
<td><strong>Cap beliefs of EBP scale</strong></td>
</tr>
<tr>
<td><strong>Cap beliefs of academic ability scale</strong></td>
</tr>
<tr>
<td><strong>Social climate scale</strong></td>
</tr>
<tr>
<td><strong>RU</strong>: research use; <strong>EBP</strong>: evidence-based; <strong>Cap</strong>: capability</td>
</tr>
</tbody>
</table>

² Result from additional analysis
experience (III) were less likely (OR: 0.49) to report in line with guidelines than those without. Furthermore, 2nd and 4th semester students were more likely to report guideline adherence (OR: 6.37 and 3.19, respectively) compared to 6th semester students (III) (Table 7). Finally, students reporting higher capability beliefs of EBP and academic ability were more likely (OR: 1.24 and 1.34, respectively) to report in line with guidelines (Table 7).

Regarding the guideline practice to Never check patient ID using the patient’s healthcare card, adherence levels decreased with semester (III). In the multiple logistic regression analysis, both 5th semester students attending the web-based programme and 5th semester students attending the campus programme were more likely to report in line with guidelines (OR: 11.32 and 3.87, respectively) compared with 6th semester campus students (II) (Table 6).

Regarding the guideline practice to Always label the test tube alongside the patient prior to phlebotomy only 2% of the students in study II reported guideline adherence. No significant associations with independent variables were found.

Table 8. Overall theme, theme, and subthemes from analyses in study IV

<table>
<thead>
<tr>
<th>Overall theme</th>
<th>Striving to blend in and simultaneously follow guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Themes</td>
<td>Being in a position of dependency</td>
</tr>
<tr>
<td>Subthemes</td>
<td>Feeling uncomfortable about commenting on practical performance</td>
</tr>
</tbody>
</table>

Students’ perceptions about deviations (IV) from, for instance correct ID procedures such as always asking patients to state name and national registration number, revealed reasons of, for example the impact of experiences at clinical placements. Students observed staff occasionally skip the procedure giving the reason ‘I know this patient – I have cared for him for days’. As students were worried about their assessments, they sometimes did not want to risk it by commenting on suboptimal practice, although they were well aware of the incorrectness. This emerged in the theme Being in a position of dependency, and furthermore in the theme Striving to fit in since students talked about the fact that it was very important to be a group member, even though it may effect practice and as a consequence also guideline adherence.
Results

It was perceived that doing as everyone else, and thereby fitting in, was sometimes more important than adhering to guidelines, although they strived to follow them. Furthermore, the students reflected on the fact that after repeatedly having asked for name and national registration number, you often know it by heart. In this regard, the students eventually sometimes asked themselves if it is reasonable to always ask for ID, especially when you have met and cared for a certain patient for days. This was shown in the theme Questioning guideline content. Students’ reflection on the decreasing levels of adherence with every completed semester was formulated in the overall theme Striving to blend in and simultaneously follow guidelines (Table 8).

Summary of studies regarding ‘Always ask the patient to state name and national registration number’

In an attempt to gain an overview regarding guideline adherence to one of the most important practices ‘Always ask the patient to state name and national registration number’ (Kalra, 2004; Lippi et al., 2009), the results3 from all four studies were merged and presented in figure 2. The overview demonstrates decreasing levels of adherence with time within the nursing programme (II, III). Furthermore, it also shows a continuing decrease after graduation (I). The experiences of a need to ‘blend in’ with practice performance was revealed among final semester students in study IV. The blue arrow indicating the phenomenon of ‘blending in’ fades after graduation, which indicates the absence of data among participants in study I.

![Blending in](image)

**Figure 2.** Guideline adherence regarding ‘Always ask the patient to state name and national registration number’ from education start to graduation, and post-graduation at <5 years of employment, 5-15 years of employment, and >15 years of employment

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3 In part, result from additional analysis
Discussion

The overall aim of this thesis was to explore adherence to, and factors influencing, venous blood specimen collection guideline practices among university nursing students and healthcare staff. The main findings show that nursing students tend to increasingly deviate from VBSC guideline adherence with every completed semester (II, III), which partly can be understood through the findings in study IV, where students perceived an unspoken demand to blend in into the culture at the clinical practice setting in order to be liked. The different cultures at clinical settings might originate from different agendas regarding VBSC procedures, which the findings in study I indicates, to which both students (II, III) and employees (I) at the setting adapt (Figure 2).

In order to deepen the understanding of the findings in this thesis, the results will be discussed in relation to a model of professionalisation (Figure 3) adapted after Weidman et al. (2001). According to Weidman et al. (2001), socialisation among students refers to the process through which individuals gain knowledge, skills, and values needed for a successful entry into a professional career, in which advanced levels of specialised knowledge and skills are required. The process is nonlinear, which implies that socialisation processes are dynamic and ongoing, without a definite beginning or end, and present both on campus (university institutional culture), as well as at clinical placements (clinical institutional culture), which is illustrated in figure 3. The ellipses have broken lines to point out the permeable and shifting boundaries among the concepts in the model. The adapted model (Figure 3) covers the professional socialisation process of nursing students as well as those newly graduated and comprises knowledge, skills, and values needed for a successful entry into a professional career of an RN. The prospective student possess individual abilities and capabilities (predisposition) prior to entering the university context. At university, they are subjected to new cultures, to socialisation processes, changing both their personal and professional communities, with new friends and registered nurses as supervisors in clinics. Both in the university institutional culture, as well as in the clinical institutional culture, knowledge acquisition is expected and sought. Thus, nursing students are socialised into both university contexts, as well as in to the professional context which they are aiming at (cf Dimitriadou, Pizirtzidou, & Lavdaniti, 2013). In the discussion below, the different aspects from the professionalisation model will be highlighted in italics for clarifications.
Patient identification practices

The results demonstrated decreasing levels of adherence regarding the vitally important practice of ‘Always ask the patient to state name and national registration number’ among nursing students throughout the programme (II, III), and even beyond graduation (I) (Figure 2). Earlier studies have demonstrated suboptimal levels of guideline adherence both among hospital ward staff (52.5%-83%) (Melkie et al., 2014; Simundic et al., 2015; Wallin, Söderberg, Van Guelpen, Brulin, & Grankvist, 2007), and among PHC staff (54%) (Söderberg et al., 2010). Although, adherence to guidelines among the nursing students was not total, it was found to 88% and 85%, respectively in 2nd and 4th semesters (III). The 5th semester did not contain clinical practice, whereas the 2nd, 3rd, 4th, and 6th semester did. It is notable that there is a substantial difference between the 4th semester levels of adherence and the 6th semester, from 85% to 74% (Figure 2). As nursing students’ professional communities include institutional cultures at universities/clinical settings (Figure 3), students are subjected to socialisation processes both in the on campus context, as well as in the clinical setting context (Bisholt, 2012; Weidman et al., 2001). The awareness of guideline content might have faded in favour of other tasks during theory periods in the 5th semester. When the
students encounter clinical settings again after theory periods, and with the perceived need to blend in (IV), they might have abandoned guideline adherence in favour of the local agenda on how VBSC should be performed, which occasionally is not in line with guidelines (Bölenius et al., 2013; Söderberg et al., 2009; Wallin et al., 2007). This is in line with the findings in Henderson, Cooke, Creedy, and Walker (2012) review revealing students to adopt survival strategies such as ‘learning the rules’ and focusing on ‘fitting in’ to practice environment rather than adopting a critical reflective stance.

In study I, 53% reported guideline adherence regarding ‘Always ask the patient to state name and national registration number’, which in itself is a remarkably low proportion, and only 38% regarding ‘Never neglect asking for patient ID with the reason ‘known’, which is even more remarkable. Furthermore, the MOR values concerning the two items in the adjusted model, 3.49 and 3.20, indicate that workplace affiliation have a substantial influence on VBSC practice. Regarding ‘Never neglect...’, earlier findings demonstrate suboptimal levels of guideline adherence among hospital ward staff (54%) (Wallin et al., 2007), and PHC staff (41%) (Söderberg et al., 2010) which is similar to our findings. Positive patient identification is undoubtedly essential in all aspects of care, but failure to accurately identify patients during blood sampling can lead to serious adverse events, in the worst scenario death (Bolton-Maggs, Wood, & Wiersum-Osselton, 2015). Theoretically, nothing but total adherence should be accepted, an unquestionable goal. However, as Giuseppe Lippi et al. (2015) concluded; in order to achieve total quality, it is necessary to look beyond analytical quality, and realise that a pre-analytical culture is the key to promoting quality and disseminating worldwide. In this regard, safe VBSC practice training at university may encourage guideline adherence and promote a high quality pre-analytical culture. Students who are well aware of guideline content and consequences of non-adherence and also trained to keep to adherence, might in the long term positively influence VBSC practice at their forthcoming workplaces and thereby reduce variations in performance.

The literature demonstrates identification adverse events as the most serious, and a substantial body of literature stresses the importance of improving patient identification procedures to enhance patient safety (Bölenius, 2014; Kaushik & Green, 2014; Kim, Dotson, Thomas, & Nelson, 2013; Lippi et al., 2009; Salinas et al., 2013). Adherence to guidelines regarding ‘Always ask...’ should reasonably be accompanied by adherence to ‘Never neglect...’, since they clearly have aspects in common. The participants in study I only asked approximately every second patient to state name and national registration number, and at the same time, they neglected to ask about 2 out of 3 patients to state name and national registration number with the reason that they ‘knew’ them. Participants working at large PHCs were more likely to adhere to
guidelines both regarding ‘Always ask...’ and ‘Never neglect...’ than staff working at small PHCs (Table 5). Thus, larger PHCs seem to provide safe identification practices to a higher extent compared to small. Small PCHs were mostly situated in rural areas where people tend to know/know about each other to a greater extent than in urban areas. In Desjarlais-deKlerk and Wallace (2013) study on the doctor-patient interaction, it was demonstrated that knowing patients outside the clinic seemed to change the nature of the interaction, and, in turn, the doctor-patient relationship itself. Interactions between rural doctors and their patients tended to be highly interpersonal, often involving considerable socioemotional communication and relationship building (Desjarlais-deKlerk & Wallace, 2013). It is reasonable to believe that nurses and other healthcare staff working at rural PHCs in our study too were involved in such relations. The relationships in rural areas, as described by Desjarlais-deKlerk and Wallace (2013) may have been one reason for the staff in study I, working at small PHCs and likely to be familiar with most patients encountered at the PHC, to neglect asking for patient ID. In this regard, students in study IV described how they eventually questioned the practice of ‘Always ask...’ when you have cared for a patient for several days. As a consequence, they often remembered the patient’s name and even their national registration number, and therefore sometimes abandoned guideline practice.

Decreasing levels of adherence to guidelines were found also among phlebotomy staff with years of employment at the site (I) (Figure 3). Thus, students report, if not total adherence, higher levels regarding ‘Always ask...’ compared to the healthcare staff in study I. To conclude, staff working at small PHCs in rural areas were more likely to deviate from identification guidelines. This might be interpreted as hazardous practice, however, as long as the sample is associated with the correct information, practice is safe. The main issue is whether it is good enough to know the patients name and national registration number by heart, or, if it should be mandatory praxis to always ask for ID even if you are certain about name and national registration number. The only reasonable answer taken for granted is of course ‘no, you always have to ask for patient ID’. Our results indicate that guideline practice may decrease with time, therefore, a simple and safe solution might be to never abandon safe patient ID practice. Moreover, the patient might feel safer and more secure if staff ask for ID, hence, also an incitement for asking. Staff employed less than five years at the site were more likely to adhere to ‘Never neglect...’ than staff employed more than 15 years. To my knowledge, there are no previous results on VBSC practices to compare this finding. However, regarding the advice to smokers for decreasing tobacco use, and in opposite to our findings, Hung, Leidig, and Shelley (2014) found no significant associations with years employed at the primary healthcare clinic and
frequency of advice given. To speculate, the staff employed less than five years at site had not observed the VBSC routines of their peers for as long as those employed longer. Neither had they encountered as many patients as those employed more than 15 years. Hence, the longer staff are employed, the more opportunities to familiarize themselves with the patients. As a consequence, and in line with our findings, staff employed shorter time might be less likely to abandon the guideline practice to ‘Never neglect…’, as they have had less opportunities to get acquainted with the patients.

To conclude, the issue of enhancing patient identification practices is still very topical and will certainly remain so. Reasons why staff deviate from patient identification guidelines are probably several. However, as previously mentioned, it is reasonable to assume that one is the opinion that it is considered not needed, and even embarrassing when the patient is familiar. However, it is not the ‘I know the patient’ part that is critical for VBSC safety, it is the assurance that test tubes are affiliated with correct test request and labelled with the correct ID (cf Lippi et al., 2011).

Test tube labelling and test request handling practices

In study II, an extremely low proportion, only 2%, of the students reported guideline adherence regarding labelling of test tubes, which is similar to the levels of adherence demonstrated among hospital ward staff (2.4%-4%) (Wallin et al., 2007; Wallin et al., 2008; Wallin et al., 2010). The Swedish guidelines suggested that test tubes should to be labelled prior to phlebotomy. This has been questioned, for example by Hawkins (2011) who argues that labelling directly after collection must be considered acceptable practice. Considering international protocols, the practice to label after collection is actually not in opposition to guidelines (CLSI, 2010; World Health Organization, 2010), as long as tubes are labelled alongside the patient, it is considered safe practice. As data on whether the students labelled the tubes directly after collection were not available, checking this possibility was not present in this study. However, to speculate, it is reasonable to assume that a vast majority of the students labelled the tubes afterwards, which hence may be considered acceptable practice according to current international standard. Labelling tubes prior to collection may cause additional work if the phlebotomy is not successful, since the label must then be removed and attached to another tube. This might have been one reason why the students most likely labelled the tubes afterwards. In order to successfully enhance VBSC guideline adherence regarding both labelling and other practices, the guidelines must be worded succinctly and concisely with the minimum of bullet points. The current guidelines are extensive with numerous practice steps, and hence often difficult to remember (Simundic et al., 2015).
Therefore, efforts to reduce them to a minimum should be initiated with the mantra ‘less is more’.

Guideline adherence regarding ensuring the coherence between patient ID and test request, and the coherence between test request and test tube labels were demonstrated by the vast majority, 74%-80% (I, II, III). Earlier findings demonstrate 90% of the hospital ward staff (Wallin et al., 2008), and 68%-80% of the PHC staff (Söderberg et al., 2009) to report guideline adherence. Since the two are closely linked, safe practice in one depends on the other, by means of the ‘wrong blood in tube’ risk. The expression ‘wrong blood in the tube’ addresses the issue of mislabelling test tubes and includes when blood is taken from the wrong patient and is labelled with the intended patient’s details (in other words ‘miscollected’ or when blood is taken from the intended patient, but labelled with another patient’s details (in other words ‘mislabelled’) (Bolton-Maggs, 2013). Earlier findings demonstrate the incident of mislabelled tubes 0.3-0.5% (Hill et al., 2010; Quillen & Murphy, 2006). The human factor is considered as problematic considering safe test tube labelling. Hence, with the mission to enhance patient safety by reducing specimen identification errors, technical solutions (Snyder et al., 2012; Strobel, 2013) as well as campaigns and education (Cottrell et al., 2013) have been proposed. There are no data on ‘wrong blood in tube’ in this thesis.

To conclude, the students in study II reported similar levels of guideline adherence, as those of staff at hospital wards and PHCs. In the light of the model (Figure 3) adapted after Weidman et al. (2001), this finding might originate from the students’ interaction with practitioners, such as supervisors, in the professional communities at the clinical setting during clinical placement (clinical institutional culture). After having acquired sufficient cognitive knowledge (knowledge acquisition in the university institutional culture), the student must acquire knowledge such as normative expectations associated with the professional role sought (knowledge acquisition in clinical institutional culture). However, guideline content has been questioned and international guidelines are contradictive. To address this issue, the mantra ‘the right test at the right time on the right patient’ (cf Thomas, 2014) (preferably with the addition ‘tube labelled alongside patient’), is now expressed to meet the demands of reducing adverse events, and should definitely be used in skill training sessions at the clinical skills laboratories, and also stressed at clinical settings.
Incongruence between training on campus and training at the clinical setting

Students in this thesis experienced incongruence between training at clinical skills laboratories on campus and the practice at clinical placements (IV), a finding in line with other studies among both nursing students (Sharif & Masoumi, 2005; Zarshenas et al., 2014) and newly graduated nurses (Feng & Tsai, 2012). Clinical settings aim to offer nursing students the opportunity to improve their clinical skills, to socialise within a clinical context, to develop relationships with experienced nurses, and ultimately to promote the transfer of knowledge from the classroom into the clinical setting (Charleston & Happell, 2005; Severinsson & Sand, 2010). It is therefore reasonable to assume that encountering new contexts, as described above, influences students in several directions. The students in study IV described the dependency situation during clinical placement as problematic, since they occasionally deviated from guidelines and copied the supervisor's routines (master-apprentice relationship), just to please him/her although they knew it was incorrect. Hence, the norms among the students may have been influenced by their supervisors’ stated or unstated opinions. Merely observing repeated sessions of suboptimal VBSC procedures might have influenced the students to increasingly deviate from guideline adherence in favour of the practices at the clinical setting (cf Levett-Jones & Lathlean, 2009).

The students described how they followed role models, which meant learning experiences from both good and bad examples (cf Felstead & Springett, 2016) balancing the two, so as not to risk their assessment. This finding indicates that students perceive the supervisor’s role as evaluative more than teaching (cf Sharif & Masoumi, 2005), which might restrict the learning process in clinical practice (Bisholt, Ohlsson, Engstrom, Johansson, & Gustafsson, 2014). Such scenarios do not facilitate knowledge translation of best practice/EBP, since the prevailing truth reigns without being questioned. However, it might be extremely difficult to differentiate between organisational socialisation and students’ learning processes. The student’s knowledge acquisition is most likely a result of a combination of both students’ predispositions and the participation and interaction in social or professional communities (Figure 3). In this respect, it is possible that both students and newcomers adapted to the behaviours of a charismatic staff who had taken, or been given a leader role. The students in study IV confirm this by expressing “You tend to do as your supervisor does” and “You adapt to the practices at the setting”. Hence the overall theme in study IV, ‘Striving to blend in and simultaneously follow guidelines’, might describe, not only the perceptions of the students during training, but also the situation in work life situation.
The phenomenon of incongruence, commonly known as the theory-practice gap, implies that theoretical knowledge, such as research findings, does not automatically make it into practice, where it should be implemented (Upton, 1999). In line with those findings, the overall results in this thesis indicate that there is a gap between VBSC guidelines and the VBSC performance in clinical settings among both nursing students and healthcare staff. The ambition to close these gaps is often referred to as knowledge translation, ‘the methods for closing the gaps from knowledge to practice’ (Straus, Tetroe, & Graham, 2009), which nicely captures the circumstances within healthcare.

**Bridging the gap**

Development of knowledge translation interventions should include context factors (Wallin, 2009) and the use of theories (Grol, Bosch, Hulscher, Eccles, & Wensing, 2007), also context-specific theories (Estabrooks, Thompson, Lovely, & Hofmeyer, 2006), since context has been shown to be associated with levels of research use and adverse events (Cummings, Estabrooks, Midodzi, Wallin, & Hayduk, 2007). The overall findings in this thesis indicate that context may have a substantial impact on VBSC behaviour (I, III, IV). In this regard, efforts to enhance guideline adherence by targeting not only individuals, but also contextual factors are warranted (cf Jacobs, Weiner, & Bunger, 2014). Bölenius et al. (2013) revealed significant improvements in certain VBSC practices after a large scale education intervention programme among phlebotomy staff. Other studies suggest a combination of education, practical skill training and audio feedback for sustainable change (Ista, van Dijk, & van Achterberg, 2013). In this respect, interventions should target components such as enhancing staffs’ familiarity with guideline content, increasing the awareness of the importance of adhering to guidelines, but also the consequences of non-adherence (Hammerling, 2012). In the univariate analysis in study III, students who reported total or partial agreement with the statement ‘VBSC is highly valuated at clinical placement’ were more likely to ‘Always ask...’ than those reporting total disagreement. It is reasonable to believe that those students were subjected to a positive institutional culture when they interacted with the professional community, its practitioners and acquainted knowledge by learning and integration. Successfully adopted interventions among staff within a unit or organisation will entail these individuals becoming key stakeholders and acting as agents for successful implementation and sustainability. Therefore, it is important to encourage suitable individuals to act as internal implementation leaders, but so too should individuals in leader positions. Without organisational support, successful and sustainable implementation is unlikely. Individuals who might act as ‘local champions’ (Abrahamson, Fox, & Doebbeling, 2012) are – in order to be successful – those with natural positive qualities, who peers look up to
as role models. In addition, such trust in an employee probably increases the sense of responsibility which may have an additional positive effect on the implementation process among the peers.

Repetitive training has been shown to increase adherence over the course of studies (Scheithauer et al., 2012), which may be achieved by using a model for skill training, as suggested by Bölenius (2014). ‘The Model of Practical Skill Performance’ (Björk & Kirkevold, 2000) further developed by constructing an instrumental supplement (Nielsen, Sommer, Larsen, & Bjørk, 2013) aims to facilitate knowledge translation among nursing students, and is therefore a suitable alternative. The involvement of students in the development of skills learning material might also be an option. The nursing faculty staff may hold the key to what students should learn based on curricula and national guidelines, and the students may contribute by describing how their learning could be most constructively achieved (Haraldseid, Friberg, & Aase, 2016). However, as indicated in this thesis, the contextual impact on practice may be substantial, also other initiatives must be taken into consideration in supporting students to adhere to guidelines. This is challenging as the context where students spend a substantial amount of time (during clinical placement) is beyond the reach of educator impact. Thus, the responsibility to enhance guideline adherence within the clinical settings undoubtedly lies with the healthcare organisation itself. Nevertheless, as a possible path for sustainability among students, educators should act in order to empower students to keep up adherence. If students are aware of guideline content and, even more importantly, consequences of non-adherence, they have good prospects for success. Also, as students possess an up to date knowledge, the mere presence of students at the setting may enhance guideline adherence among staff, as demonstrated in Lymer, Richt, and Isaksson (2004) study – an optimal scenario. However, this implies that the staff at the settings welcome the students’ knowledge and are willing to reflect on these issues.

According to Bandura (1997), a self-efficacy belief is ‘the belief in one’s capabilities to organise and execute the courses of action required to manage prospective situations’. The findings in this thesis indicate that individual factors, such as self-efficacy (capability beliefs regarding EBP and academic ability), and research use at the clinical placement influenced guideline adherence (III). In study III, we assessed associations between EBP capability beliefs as well as capability beliefs regarding academic ability (both concepts based on Bandura’s work), and the dependent variables. In the univariate analyses, students reporting higher capability beliefs were more likely to act in line with guideline adherence. These findings indicate that educators should target actions to enhance capability beliefs among students, in order to encourage students to adhere to EBP, such as guidelines regardless of what is the prevailing truth at the clinical placement. Thus, if educators manages to
empower students, and strengthen their self-efficacy, which is obviously a very delicate matter, they may become strong enough to keep to VBSC guideline adherence.

In order to successfully target the issue of strengthen students’ self-efficacy, the CCARE model of clinical supervision (communication, collaboration, application, reflection, and evaluation) (Baxter, 2007), might be feasible. It focuses on the individuals, both within the culture of academe and the clinical setting. The purpose of this model is to enable both educators from the educational culture and practicing nurses from the clinical environment to understand the importance of relationships, behaviours and attitudes and how they are necessary to bridge the gap between the two cultures thereby decreasing the theory/practice gap. Hence, in line with the need to engage individual staff to act as internal implementation leaders when planning for interventions, there is also a need to engage suitable educator representatives as well as practicing nurses from the clinical settings in a collaborative team to enhance CPG practice among nursing students. Success is probably achieved only if stakeholders from both sides collaborate, which is a goal to aim for in the mission to enhance patient safety.

Nursing and medical curricula have been revealed to lack the expression ‘patient safety’ (Attree, Cooke, & Wakefield, 2008; Wakefield et al., 2005). In a more recent review, the concept was still not necessarily obvious (Tella et al., 2013). The university programme curriculum for the students in this thesis did not contain the expression ‘patient safety’, nor ‘safety’ or ‘safe’, an unfortunate fact according to the literature. Furthermore, the expression ‘evidence’ was not present, nor ‘evidence-based’. To my knowledge, no or very few studies have examined the relationship between ‘patient safety’ in education curricula and student practice performance, which should provoke further studies. Also studies using an observational design might be an alternative approach where nursing students are observed objectively by an observer to determine their VBSC guideline adherence (cf Ahlin, 2015). In addition, further research should be conducted to explore the phenomenon of influence of healthcare staff on nursing students in the clinical settings. Finally, as the power of habit has been proven to be strong (Lally & Gardner, 2013; Limayem, Hirt, & Cheung, 2007) and VBSC routines most likely are habitual, the collaboration with scientists within the habitual research area might shed further light on this issue.
Methodological considerations

Design
The use of several scientific theoretical approaches will shed further light on the research topic. The interviews in this thesis (Study IV) explored the results in studies II-III. In studies I-III, a cross-sectional design was used. One limitation with the cross-sectional design is that causality cannot be established as data concerning information concerning outcome and exposure are collected at the same time. Still, cross-sectional studies can give valuable information about ‘dose-response’ relationships, however, the results must be interpreted with some caution.

Participants
Regarding the phlebotomists at the PHCs, all staff performing VBSC and on duty at each PHC were invited. Regarding the nursing students, all students in the included semesters were invited. Both staff at PHCs and nursing students perform VBSC and were therefore suitable for the research question. Based on a staff population as well as a student population in northern part of Sweden, it is reasonable to assume that the results in this thesis are generalizable to both PHC staff as well as nursing students in a Swedish context. Reasons therefore, are the homogeneity in Swedish PHCs, they are all organised in a similar way with the same professions employed. Similarly, when considering nursing programmes, the organisation of nursing programmes is set by the government, and hence similar across Swedish universities.

The most prominent limitation in study I was the relatively small cluster size, where some clusters included only five participants. This fact indicates the risk for a type 1 error. During the analysis process, we conducted several analyses with both larger (10 participants/PHC) and smaller (2 participants/PHC) cluster size. The MOR values were found to be similar to those reported in this study I. However, large confidence intervals indicate small sample size, which indicate that the result should be interpreted with caution.

The response rate in study II (57%) is close to the rule of thumb (60%), and therefore considered acceptable (Johnson & Wislar, 2012). However, it is still a cause for concern as it indicates that there is a potential problem with non-response bias. Since no data to perform drop-out analysis were available, it was not possible to deduce the nature of any potential non-response bias. To compare, the response rate in study III was 74%. When comparing the results in study II and III, there are similarities, hence results from both studies may be trusted under the circumstances. Nevertheless, as no drop-out analysis was
performed in either of the studies, the results in both study II and III should be interpreted with caution.

In study IV, the included students were all in their final semester, at the same university, and attending the same university nursing programme. The students may have signed up to participate in a specific group together with friends, which may have contributed to less variation. A commonly suggested adequate group size ranges between six and ten participants, but with a minimum of three. Large groups place less responsibility on participants, but also provide less opportunities to talk. The group sizes in our study ranged from three to seven. As the amount of interest in the research topic influences the willingness to talk (Morgan & Krueger, 1998), smaller groups may also be valuable (Morgan & Bottorff, 2010). Regarding the number of focus groups, three to five groups are usually sufficient (Morgan & Krueger, 1998). We conducted five focus group interviews.

**Data collection**

In this thesis, data were collected using self-reported questionnaires and focus group interviews.

Self-reported questionnaires are beneficial in order to collect data from a large sample in order to use statistical analyses. However, the self-reported questions can be under- or overestimated due to different circumstances influencing the responders at that time (Polit & Beck, 2004). In addition, collecting data during a period of eight years will probably be influenced by changes over time. During this period of time, a large scale education programme on VBSC practices was launched in county A, which may have influenced the results in this thesis by improving adherence among participants working in county A. Moreover, students performing their clinical placements in county A, who may have been positively influenced by staff working at settings in county A.

Using the group dynamics in focus groups to generate deeper and richer data is beneficial compared to the data obtained from individual interviews, if aiming at clarifying experiences and perceptions in common, and related to a specific topic (Rabiee, 2004). It is reasonable to assume nursing students in the final semester are suitable to reflect on nursing students’ VBSC practice guideline adherence during training.

**Questionnaires**

Questionnaires were used for data collection in study I-III. As demonstrated in the review by Adams, Soumerai, Lomas, and Ross-Degnan (1999), there is always a risk for exceeded self-reported adherence rates compared to the
objective rates, resulting in elicit self-presentation tendencies such as high levels of adherence (i.e. the tendency to present oneself in a positive light).

The term validity refers to how well an instrument measures what it intends to measure (Polit & Beck, 2004). The instruments used in this thesis showed acceptable validity as follow:

The VSBQ, showing acceptable validity (Bölenius et al., 2012; Wallin, 2008), and reliability (Bölenius et al., 2012) was used to assess the dependent variables. In study I and II, an early version of the questionnaire was used, hence before it was tested for validity and reliability, which may have influenced the results. Independent variables were assessed using background variables (I, II, III), as well as scales and single items (III). The psychometric analyses of the Capability beliefs regarding EBP scale support a one-dimension scale and show promising properties of concurrent validity (Wallin et al., 2012). The measure of students’ extent of Research use has demonstrated evidence for content validity (Estabrooks, 1999), as well as supporting validity evidence for single-item measures (Squires et al., 2011). Regarding the Capability beliefs regarding academic ability scale, information on validity and reliability is not available. However, it has been used in the LANE study (Rudman et al., 2010), consist of items adapted from Bandura’s self-efficacy scales (Bandura, 2006), and is similarly constructed as the previously described Capability beliefs regarding EBP scale. Finally, the Social climate section from the General Nordic Questionnaire for Psychological and Social Factors at Work (QPSNordic) which has demonstrated sufficient construct validity as well as criterion validity (Dallner, 2000).

Focus group interviews

In study IV, focus group interviews were used for data collection to explore experiences and perceptions in a nursing student group. A focus group should consist of homogeneous participants who have in common something central to the issue to be discussed, and it should provide the participants with the freedom to express thoughts, feelings and behaviours candidly (Morrison & Peoples, 1999). One risk with focus group interviews is that some participants may dominate the discussion, which might bias the findings. The assistant moderator’s role was therefore to ensure that all participants had the opportunity to talk, and that the subject had been fully covered (cf Morgan & Krueger, 1998). There were no differences in data obtained from the smaller
groups compared to the larger. Hence, also small groups gave rich interviews. Smaller groups also provide a beneficial intimate interaction (cf Toner, 2009). To ensure trustworthiness of interpretations within qualitative content analysis, arguments for the most probable interpretations should be presented. In this regard, findings should be presented in a way that allows the reader to look for alternative interpretations (Graneheim & Lundman, 2004). The concept of trustworthiness also includes the question of transferability, which refers to ‘the extent to which the findings can be transferred to other settings or groups’ (Polit & Beck, 2004, s.734). With the ambition to facilitate transferability, a description of the context, selection and characteristics of participants, data collection and process of analysis was presented in this thesis. KN's personal history might have influenced the interpretation process (cf Graneheim & Lundman, 2004).

Although KN did not encounter any of the students in educational contexts during the study period, the mere fact that KN has a teacher position at the department may have influenced the studies (II, III, IV).

**Conclusions**

Guideline adherence within healthcare is crucial in achieving and maintaining patient safety. The findings in this thesis indicate that both students and healthcare staff were subjected to professional socialisation processes in clinical contexts. Earlier findings demonstrating suboptimal adherence to VBSC guidelines among healthcare staff were confirmed in the results, together with the new findings of decreasing adherence among nursing students as well. Hence, guideline adherence in general needs to be improved. In this thesis, individual factors among nursing students were found to be associated with guideline adherence, e.g. capability beliefs about EPB and capability beliefs about academic ability. In this regard, nursing educators need to target these factors by providing students with tools and strengthening their capability beliefs to be able to stand up for, and defend patient safety issues and the use of CPGs. However, education representatives do not have sufficient impact on clinical practice and social environment, and therefore the responsibility of enhancing patient safety through the use of CPG and safety cultures formally lies with the healthcare organisations. Still, with the mission to bridge the theory-practice gap, the CCARE model of clinical supervision might be useful, since it focuses on the individuals both within the culture of academe and the clinical setting and facilitates collaboration between the two groups of stakeholders.

The power of habit is known to be strong. For example, hand hygiene routines have been suggested to be learnt behaviour (Larson, Early, Cloonan, Sugrue,
& Parides, 2000; Whitby, McLaws, & Ross, 2006), which implies that it is carried out without much thoughts about the procedure. With respect for all the studies performed in this area for decades, and still are, together with the fact that the issue of hand hygiene guidelines has been around for almost two centuries, it is reasonable to assume that habits are very difficult to change. From the behavioural point of view, VBSC procedures too may become, at least in part, an unconscious behaviour once they are implemented into everyday life at the clinical setting. Therefore, the habitual part of VBSC practice needs to be further targeted.
Postface

When I entered the world of education, I became aware of my shortcomings regarding VBSC practices. I did not intentionally put patients at risk by deviating from guidelines, and I am also convinced that no other healthcare staff do either. It is probably a case of performing routines without actually considering them very often, you just do them the way you always have, or the way your peers do – it becomes a habit.

Being part of the research world, has meant a tremendous amount to me, and as I have made this journey my views on many things have changed. I am grateful for having had the opportunity, and am looking forward to continuing my journey.
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