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VACCINATION COMPETENCE

The Concept and Evaluation

by

Anne Nikula

TURUN YLIOPISTO
UNIVERSITY OF TURKU
Turku 2011

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To my Family

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VACCINATION COMPETENCE - The Concept and Evaluation

Department of Nursing Science, Faculty of Medicine, University of Turku, Finland

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ABSTRACT

The purpose of this two-phase study was to define the concept of vaccination competence and assess the vaccination competence of graduating public health nurse students (PHN students) and public health nurses (PHNs) in Finland, with the goal of promoting and maintaining vaccination competence and developing vaccination education. The first phase of the study included semi-structured interviews with vaccination professionals, graduating PHN students and clients (a total of n=40), asking them to describe vaccination competence as well as the factors strengthening and weakening it. The data were analyzed through content analysis. In the second phase of the study, structured instruments were developed, and vaccination competence of PHN students (n=129) in Finland and PHNs (n=405) was assessed using a self-assessment scale (VAS) and taking a knowledge test. PHNs were used as a reference group, enabling us to determine whether a satisfactory level of vaccination competence was achieved by the end of studies, or whether it was gained through work experience vaccinating clients. The data were collected from five polytechnic institutions and seven health centers located in various parts of the country. The data were collected using instruments developed for this study, and were analyzed statistically.

In the first phase, based on the results of the interviews, vaccination competence was defined as a large multi-faceted entity, including the concepts of competent vaccinator, competent implementation of the vaccination, and the outcome of the implementation. Semi-structured interviews revealed that factors strengthening and weakening vaccination competence were connected to the vaccinator, the client being vaccinated, the vaccination environment and vaccinator education. On the whole, factors strengthening and weakening vaccination were the opposite of each other.

In the second phase, on the self-assessment of vaccination competence, students rated themselves as significantly lower than working professionals. On the knowledge test, the percentage of correct answers was lower for students than PHNs. When all background variables were taken into account in multivariate analysis, there was no longer a significant difference between the students and PHNs on the self-assessment. However, in multivariate analysis, the PHNs still performed better than students on the knowledge test.

For this study, a satisfactory level of vaccination competence was defined as a mean of 8.0 on the self-assessment and 80% correct answers on the knowledge test. Based on these criteria, students almost reached the level of satisfactory in their overall self-assessment, and PHNs did. Both groups, however, did rank themselves as satisfactory in some sum variables. On the knowledge test the students did not achieve a level of satisfactory (80%) in their total score, though PHNs did. As before, both groups did achieve a level of satisfactory in several sum variables.

Further research and development should focus on vaccination education, the testing of vaccination competence and vaccination practices in clinical practice, as well as on developing the measurement tools.

Keywords: vaccination competence, graduating public health nurse student, public health nurse, public health nursing, vaccination, self-assessment, knowledge test

Anne Nikula

ROKOTUSOSAAMINEN - Käsite ja osaamisen arviointi

Hoitotieteen laitos, Lääketieteellinen tiedekunta, Turun yliopisto, Suomi

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TIIVISTELMÄ

Tämän kaksivaiheisen tutkimuksen tarkoituksena oli kuvata, mitä rokotusosaaminen on, ja mitkä tekijät heikentävät ja vahvistavat sitä. Tarkoituksena oli myös arvioida suomalaisten, valmistuvien terveydenhoitajaopiskelijoiden ja terveydenhoitajien rokotusosaaminen. Tavoitteena oli rokotusosaamisen ylläpitäminen ja vahvistaminen rokotusosaamisen koulutusta kehittämällä. Tutkimuksen ensimmäisessä vaiheessa rokotamisen ammattilaiset, valmistuvat terveydenhoitajaopiskelijat ja asiakkaat (yhteensä n=40) kuvasivat teemahaastatteluisia, mitä rokotusosaaminen on, ja mitkä ovat sitä vahvistavia ja heikentäviä tekijöitä. Aineisto analysoitiin sisällönanalyysillä. Toisessa vaiheessa kehitettiin kyselylomakkeet ja valmistuvien terveydenhoitajaopiskelijoiden (n=129) ja terveydenhoitajien (n=405) rokotusosaaminen arvioitiin itsearviointilla (VAS) ja tietotestillä. Terveydenhoitajat toimivat viiteryhmänä, jotta saataisiin selville, saavutetaanko hyväksytyksi määritelty rokotusosaamisen taso jo koulutuksen lopussa vai saavutetaanko se vasta rokotamalla työkokemuksen kautta. Aineistot kerättiin valtakunnallisesti viidestä ammattikorkeakoulusta ja seitsemästä terveyskeskuksesta. Aineistot analysoitiin tilastollisesti.

Tutkimuksen ensimmäisen vaiheen, eli teemahaastattelujen tulosten perusteella rokotusosaaminen muodostui laajaksi kokonaisuudeksi, joka koostui osaavasta rokotajasta, rokotamisen osaavasta toteutuksesta ja sen lopputuloksista. Rokotusosaamista vahvistavat ja heikentävät tekijät muodostuivat rokotajasta, rokotettavasta asiakkaasta, rokotusympäristöstä ja rokotajan rokotuskoulutuksesta. Vahvistavat ja heikentävät tekijät olivat pääosin toistensa vastakohtia.

Tutkimuksen toisen vaiheen, eli kyselytutkimuksen tulosten mukaan, opiskelijoiden rokotusosaamisen itsearvio oli merkitsevästi matalampi kuin terveydenhoitajien, ja tietotestissä opiskelijoiden oikeiden vastausten osuus oli pienempi kuin terveydenhoitajien. Kun monimuuttuja-analyysissä otettiin huomioon kaikki yhteiset merkitsevät taustamuuttujat, rokotusosaamisen itsearvioissa opiskelijoiden ja terveydenhoitajien välillä ei enää ollut eroa. Sen sijaan tietotestissä terveydenhoitajien tiedot pysyivät parempina myös monimuuttujamallissa.

Yhteenvetona voidaan todeta, että terveydenhoitajaopiskelijat lähes saavuttivat tässä tutkimuksessa hyväksytyksi määritellyn rokotusosaamisen tason itsearvion (keskiarvo 8.0), mutta eivät tietotestin (80%) kokonaistuloksessa. Terveydenhoitajat saavuttivat hyväksytyksi määritellyn rokotusosaamisen tason sekä itsearviossa että tietotestissä. Molemmat ryhmät saavuttivat kuitenkin hyväksyttävän rokotusosaamisen tason useissa yksittäisissä summamuuttujissa.

Kehittämisehdotuksia ja jatkotutkimuksia esitetään kohdennettavaksi rokotusosaamisen koulutukseen, osaamisen testaamiseen, rokotustoimintaan hoitotyön käytännössä ja mittarin kehittämiseen.

Avainsanat: rokotusosaaminen, valmistuva terveydenhoitajaopiskelija, terveydenhoitaja, terveydenhoitotyö, rokotaminen, itsearvio, tietotesti

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LIST OF ABBREVIATIONS

CV	Competent Vaccinator
PHN student	Public Health Nurse Student
PHN	Public Health Nurse

LIST OF ORIGINAL PUBLICATIONS

The thesis is based on the following publications which are referred to in the text by their Roman numerals from I to V:

- I. Nikula A, Hupli M, Rapola S, Leino-Kilpi H. 2009. Vaccination Competence. *Public Health Nursing* 26 (2), 173-182.
- II. Nikula A, Rapola S, Hupli M, Leino-Kilpi H. 2009. Factors Strengthening and Weakening Vaccination Competence. *International Journal of Nursing Practice* 15 (5), 444-454.
- III. Nikula A, Nohynek H, Puukka P, Leino-Kilpi H. 2011. Vaccination Competence of Graduating Public Health Nurse Students. *Nurse Education Today* 31 (4), 361-367.
- IV. Nikula A, Nohynek H, Puukka P, Leino-Kilpi H. 2011. Vaccination Competence of Public Health Nurses. *Public Health Nursing* 28 (6), 533-542.
- V. Nikula A, Puukka P, Leino-Kilpi H. 2011. Vaccination Competence of Graduating Public Health Nurse Students and Public Health Nurses. *Nurse Education Today*. In Press.

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1. INTRODUCTION

Vaccination is a global method of promoting health. Health promotion involves reducing inequities in health and helping people reach their fullest health potential (World Health Organization, WHO 1986). Health promotion can be defined as action to maintain the best possible health and quality of life of the members of the community and to encourage individuals' involvement in their personal health. Programs may include for example health education and immunization (McFerran & Martin 2008). In Finland, health promotion follows the Health 2015 public health program (Sosiaali- ja terveystieteiden ministeriö 2001) and Quality Recommendations for Health Promotion (Sosiaali- ja terveystieteiden ministeriö 2006a). Recommendations for promoting health are divided into six strategic lines, one of which is health promotion skills and competences. A key component of promoting health is prevention, which is divided into three parts: primary, secondary and tertiary prevention. Vaccination is one of the most important means of primary prevention in the world (Koskenvuo & Mattila 2003). Vaccines increase life expectancy, and in addition to preventing diseases themselves, also prevent possible consequences of communicable diseases, such as secondary infections, death, debilitation, infertility, sick leaves and days off to care for a sick child (Nohynek et al. 2005, United States Department of Health and Human Services 2011).

Vaccination is one of the most significant health care innovations globally. The first vaccination was invented in Europe by Edward Jenner in 1796, against smallpox. Smallpox is also the first disease to be eradicated worldwide through vaccination (WHO 2011). This achievement was made possible only through the concerted efforts of immunization specialists from all over the world, and indeed, such international cooperation will continue to be a crucial factor in reducing and eradicating other communicable diseases. WHO estimates that some 12 billion injections are administered worldwide each year. Immunization accounts for 5 to 10% of all injections (International Council of Nurses 2009).

Vaccination can help prevent dangerous communicable diseases, which at their worst spread into pandemics, i.e. worldwide epidemics, such as the 1918 Spanish flu pandemic, the 1968 Hong Kong pandemic, the 1957 Asian flu pandemic, the 1977 Moscow pandemic (Heikkinen 2007) and the Swine flu pandemic which in Finland began in 2009 (Terveyden ja hyvinvoinnin laitos 2010). In Finland, the last widespread epidemic was in 1984. At that time, the entire population was vaccinated against polio using the Sabin vaccine delivered in a sugar cube (Terveyden ja hyvinvoinnin laitos 2011a). Immunization programs have reduced the incidence of a large number of dangerous infectious diseases (such as polio, measles, mumps, whooping cough, and diphtheria) in both developed and developing countries. Immunization programs, however, must be continually implemented, as communicable diseases quickly flare up if vaccination coverage is reduced.

Vaccination programs and vaccination coverage vary by country and region (WHO 2006, Rapola 2007a, EUVAC 2011a). Vaccination coverage refers to how large a percentage of the population has been immunized against a given disease. The level of acceptance of vaccinations in a population affects vaccination coverage, and therefore the impact of vaccination programs (Leino 2010). In Finland, all vaccinations are voluntary (except in the Army), and on the whole Finns perceive vaccines quite positively (Nohynek et al. 2005). Vaccination coverage in Finland is generally high (WHO 2006, WHO/Unicef 2011), though there is room for improvement in some age groups and with some vaccines. Especially

influenza vaccinations are poorly received with children and risk groups (Blank et al. 2009). If health care professionals have good knowledge, skills and a positive attitude towards vaccinations, this has a significant effect on the implementation of vaccination recommendations (Rapola 2007b).

In Finland, many diseases have either disappeared completely (e.g., the MMR-diseases, measles, mumps and rubella in the 1990's) or become exceedingly rare (e.g., diphtheria and tetanus) due to effective immunization programs. In this situation, it becomes easy to question the necessity of vaccinations, and the focus shifts away from fear of the disease itself to fears about actual or posited risks (Strömberg & Leino 2005). In recent years, measles vaccination coverage has decreased markedly in areas surrounding Finland, with the result that 23 cases of measles were diagnosed in Finland as well by the end of May 2011. None of those diagnosed had been vaccinated (EUVAC 2011b, The Statistical Database of the Infectious Diseases Register 2011).

In the developed world, where effective vaccination programs have significantly reduced or even eradicated diseases, people who are critical of vaccinations or refuse vaccinations entirely have become louder, trying to get publicity for their cause. They actively participate in Internet discussion groups and in the media. For example, towards the end of the 1980s, a media debate about a possible link between the MMR-vaccine and autism lowered vaccination coverage in Great Britain and Sweden, though not in Finland (Vesikari & Kortelainen 2005). Presently, a link between the swine flu vaccination and narcolepsy is being investigated. The association has been strongly demonstrated (European Medicines Agency 2011, Terveyden ja hyvinvoinnin laitos 2011b). In Finland, 60 children and youth were diagnosed with narcolepsy in 2009-2010 (Terveyden ja hyvinvoinnin laitos 2011c, WHO/Europe 2011). In the next few years, research will show whether the media scrutiny of a link between the Pandemrix vaccine and narcolepsy in the 4-19 age group will affect the general level of vaccination coverage in the country.

Vaccinators are certified health care professionals who have received vaccination training and thus permission to administer vaccinations. In Finland, the administering of vaccinations is regulated by law (Communicable Diseases Decree 786/1986, Asetus 1107/2008). According to the regulation, vaccinations may be administered by physicians and other health care professionals with appropriate training under the supervision of a physician. In practice, most vaccinations are given by public health nurses (PHNs), who are responsible for vaccinating people of all ages. According to the law (Communicable Diseases Act 583/1986, Laki 935/2003), municipalities are responsible for arranging vaccinations for the population.

The competency-based approach to education, training and assessment has surfaced as a key policy in industrialized nations. The European-wide European Healthcare Training and Accreditation Network, EHTAN project has developed a competence matrix for nurses employed in the European Union (EU) (Cowan et al. 2005). It sets standards in education and addresses issues regarding EU-nursing qualifications and competence with the intention of facilitating nurse workforce mobility, and is in line with The Bologna Declaration (The Bologna Declaration 1999, Opetus- ja kulttuuriministeriö 2011).

With the help of the European Qualification Framework (EQF), the qualification systems in different countries can be linked to a common reference framework. The reference levels describe a learner's knowledge, skills and competence. In the Finnish National Qualifications Framework (NQF), lower and upper level polytechnic degrees are levels 6 and 7, respectively, so students graduating with these degrees have achieved these levels of

competence (ARENE 2007). When the polytechnics joined the European Credit Transfer System (ECTS) project, descriptions of public health nursing competence were also made. In these descriptions, it is said that PHNs should master the prevention of infectious diseases and implement the official immunization program. Competence areas include expertise in vaccinating different age groups and travel vaccinations (Opetusministeriö 2006, Subject Specific Competences 2006).

Previous research on the work of Finnish PHNs has been done from the point of view of developing public health nursing work and education (e.g., Simoila 1994, Koponen 1997, Tossavainen 1998, Lohiniva 1999, Naumanen-Tuomela 2001, Sormunen et al. 2001, Kyrönlahti 2005), but this earlier research has not focused on the vaccination competence of PHNs or PHN students. The general competence of graduating public health nursing students has also been studied (Mölsä 1992, Heino et al. 1995, Jaroma 2000, Räisänen 2002), though none of these studies focused on vaccination competence. This study examines PHN students and PHNs from the point of view of vaccination competence.

The aim of this study was to 1) define the concept of vaccination competence through semi-structured interviews; and 2) assess the vaccination competence of graduating Finnish public health nurse students (hereafter PHN students) and working public health nurses (hereafter PHNs). The main focus is to assess the vaccination competence of graduating PHN students, with PHNs being used as a reference group. Through the use of the reference group, we hope to show whether vaccination competence is achieved already by the end of studies, or whether it is gained through work experience. For this study, vaccination competence is defined as being composed of three areas: a competent vaccinator, competent implementation of vaccination and the outcomes of competent implementation of vaccination, as discussed in Publications I and II. Publications III, IV, and V describe the results of the self-assessment and knowledge test of PHN students and PHNs; this summary takes up in more detail the question of what constitutes a satisfactory level of vaccination competence. This summary also includes suggestions for developing vaccination education at the basic and continuing education levels, along with suggestions for improving the implementation of vaccinations in practice.

In this study, vaccination is seen as a professional activity of health care professionals. Professional activity includes a goal, an actor, activities and outcomes in a certain context. In this study, these individual actors are PHN students and PHNs, whose implementation of actions, the outcomes of actions and knowledge of vaccination have been measured in the context of public health nurse education and practice.

The progress of the study can be seen in Figure 1.

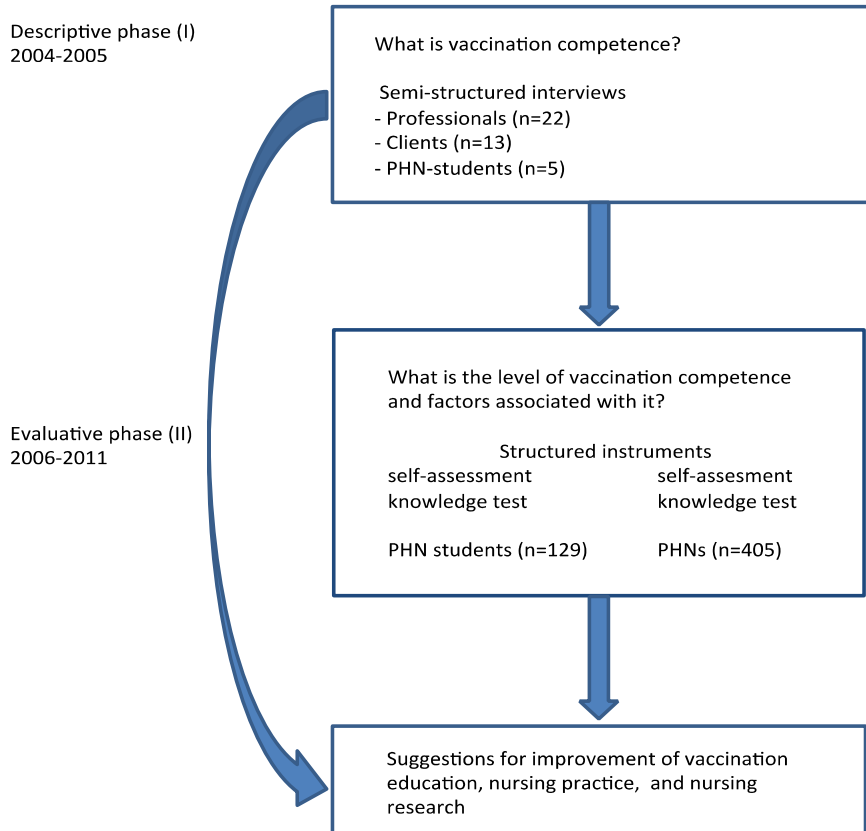


Figure 1. The progress of the study

2. LITERATURE REVIEW ON VACCINATION COMPETENCE

In this literature review, the main concepts of the study and the summary of literature review have been described. This description has been used in the development of the definition of vaccination competence.

2.1. Literature Search

The literature search was done in several steps. First, searches were completed using the PubMed, Cinahl, Medline Ovid, Medica, Science Direct and Cochrane databases for the period 1994-2004, using several keywords and their combinations: *clinical competence, professional competence, immunization, vaccination, public health nurse, student, evaluation, health promotion, primary prevention* (MeSH-terms) and the subject headings *vaccination competence, vaccinator and competence*. The inclusion criteria were: studies written in English, no more than 10 years old, abstract or human vaccinations. Exclusion criteria were: articles which did not include an abstract, those focusing on vaccination development and those not focusing on human vaccinations.

Because these initial searches yielded very few results, the search was expanded to the period of 1990-2004 using, in addition to the previous search words, different keywords related to vaccination, focusing on knowledge, skills and attitudes, different specialties of public health nursing care, other terms connected to vaccinations, vaccination programs, as well as MeSH for individual vaccines. In addition, searches were also done manually using bibliographies of existing articles, university academic theses, and paper versions of nursing and medical journals.

The literature search turned out to be complex and challenging, as many different search words and combinations were used, given that so few hits were generated with the initial search terms. Several searches were done of the electronic databases between the years 2004-2011, covering articles published from 1990 to 2011.

Based on these searches, it was found that relatively little work has been done on vaccination competence, though a great deal of research has been done in other areas connected to immunization. Most of this research has been done in the USA, New Zealand, the United Kingdom and Canada, and been mainly published in international medical journals. Some work can also be found in nursing journals, though in Finnish nursing publications only one study was identified (Uuttu & Routasalo 1995).

The following sections describe earlier studies on competent vaccinator, competent implementation of a vaccination and the outcomes of competent implementation of vaccination, with the main results summarized at the end.

2.2. Vaccination competence, the main concept of the study

In this study, vaccination competence refers to a large entity composed of three areas: a competent vaccinator, competent implementation of the vaccination, and outcomes of the vaccination.

2.2.1. Competent Vaccinator

In different parts of the world, health care professionals with many different kinds of professional and degree status function as vaccinators. The references used in this review contain 45 different names for people who give vaccinations. These can be divided into the general categories “nurse,” “physician” and “other health care professional” and are introduced in Table 1.

Table 1. Professional qualifications of people administering vaccinations based on the literature review.

Vaccinator (N=45)	Degree or professional designation
nurse n=23	public health nurse, nurse, community nurse, pediatric nurse, generalist nurse, generalist community nurse, nurse RCHN= Registered Child Health Nurse, family practice nurse, practice nurse, school nurse, district nurse, health visitor, community PHN, community midwife, psychiatric nurse, enrolled nurse, registered nurse, community health nurse, auxiliary nurse, hospital-based pediatric nurse, professional nurse, nurses' assistant, midwife
physician n=11	doctor, family physician, registered general practitioner, general practice registrar (GPR), physician, pediatrician, pediatric resident, family practice physician, practitioner, clinician, obstetrician
other health care professional n=11	health care worker (HCW), health worker (HW), health care professional (HCP), health promoter, professional, vaccinator, provider, immunizer, pharmacist, primary health care worker

In Finland, vaccinations are only given by certified public health professionals, such as physicians, PHNs, midwives and nurses (Hulkko & Tikkanen 2005). Vaccinations are primarily given by PHNs, especially PHNs working in child health clinics, and vaccinating is a major part of their work. A PHN is defined as a specialist in nursing care, the promotion of health, health care and public health, who works with different age groups and communities to promote health. PHNs vaccinate people of all ages in different kinds of care environments, mainly in public health centers: maternity clinics, child health clinics, school health services, outpatient clinics, occupational health care and home nursing. In addition, PHNs give vaccinations in private and third sector work places, university vaccination research projects, in hospitals and in conjunction with international activities all over the globe. PHNs also administer vaccinations at private health care clinics (Suomen Terveystieteiden tutkimuskeskus 2011). A PHN's duties might vary from one sector to several sectors in different public health centers in different parts of Finland. This might mean, for example, that a single PHN might administer vaccinations to clients from five different sectors (e.g., maternity clinics, child health clinics, school health services, outpatient clinics, home nursing), whereas another PHN might only vaccinate clients in a single sector, e.g. a child health clinic. In other words, some vaccinate clients of all ages, whereas others only small children.

In Finland, vaccination has been organized in slightly different ways in different workplaces. For example, nurses and midwives working at municipal health care centers in the city of Helsinki are required to answer oral questions confirming their theoretical knowledge of vaccination, and if necessary, are required to get further training and a special, written

certificate to administer vaccinations. This requirement does not affect PHNs, as they are authorized to give vaccinations based on their PHN degrees. In order to get this certificate, a vaccinator (nurses and midwives) must have received both theoretical instruction and then demonstrated the practical skills of administering vaccinations. The vaccination certificate is valid for five years. Certificates are issued by the head physician or by a physician appointed by the head physician. Vaccination competence is assessed regularly, through vaccination demonstrations and in conjunction with workplace employee development discussions (Sosiaali- ja terveystieteiden ministeriö 2006b, Helsingin terveystieteiden keskus 2007).

In Finland, the law concerning health care (Terveystieteidenhuoltolaki 1326/2010, Asetus 338/2011) focuses on the promotion and maintenance of public health and the prevention of disease. Vaccinating as a method of health promotion has been documented in several national guidelines concerning health promotion of people of different ages (Stakes 2002, Sosiaali- ja terveystieteiden ministeriö 2004a, 2004b, 2006c, 2009, Leino et al. 2007). Vaccination prevents the spread of infectious diseases and is thus part of the special competence of health care professionals. The health care Act decrees that municipalities are responsible for the implementation of vaccination programs (Communicable Diseases Act 1986/583). According to the law (Asetus 1107/2008), a vaccinator must be a physician or other health care professional who is allowed to vaccinate under a physician's supervision. In practice, this means certified health care professionals who have received professional training in administering vaccinations.

Previous research has demonstrated that improvements are needed in both basic and continuing education of vaccinators, as gaps in their knowledge and skills have been identified. For example, studies have shown knowledge of contraindications poor or variable (Siegel & Schubert 1996, England et al. 1997, Hsu et al. 1997, Harr et al. 2001, Harris et al. 2001, Cohen et al. 2003, Leask et al. 2004, Petoussis-Harris et al. 2004, Wallis et al. 2004, De la Hoz et al. 2005, Petoussis-Harris et al. 2005). There have also been gaps in knowledge about vaccination recommendations (Harr et al. 2001, Cohen et al. 2003, Heurter et al. 2003, Leask et al. 2004), individual vaccines (Bruce et al. 2001, Petrovic et al. 2001, Martinello et al. 2003, Dabas et al. 2005) and vaccination adverse events (Macdonald et al. 2004). Vaccinators have not always been able to answer questions asked by the parents of children about vaccinations (Heurter et al. 2003, Smailbegovic et al. 2003) or assuage parents' fears (Petoussis-Harris et al. 2004), which have affected parents' decisions to have their children vaccinated. Vaccinators have not known how to search for the latest scientific research, nor have they had time to do so during their normal workday (Hilton et al. 2009). Little nursing research on vaccinations has been published or is not available (Heurter et al. 2003). Some vaccinators do not use or do not know how to use available resources for finding scientific information, such as the Vaccinator's Handbook, Green Book (Petrovic et al. 2001).

Research has also focused on clients. Clients respect the opinions of vaccination professionals, trust their competence and are willing to accept their vaccination recommendations. Many studies have been done on clients' attitudes towards having themselves or their children vaccinated (Uuttu & Routasalo 1995, Impicciatore et al. 2000, Greene 2002, Ritvo et al. 2003, Keane et al. 2005, Lee et al. 2005, Yarwood et al. 2005, Benin et al. 2006, Casiday et al. 2006, Dempsey et al. 2006, Constantine & Jerman 2007, Evans et al. 2007, Lenselink et al. 2008, Austvoll-Dahlgren & Helseth 2010, Luthy et al. 2010), along with their outright or partial refusal to have themselves or their children vaccinated (Lunts & Cowper 2002, Alfredsson et al. 2004, Lansley 2004, Meyer & Reiter

2004, Offit & Jew 2003, Salmon et al. 2004, Crockett & Keystone 2005, Cullen 2005, Gullion et al. 2008).

2.2.2. Competent implementation of vaccination

In this study, vaccination means the act of giving a vaccination to a vaccinee, either orally or by injection. Vaccination is the action by which the active substance is introduced into the vaccinee's body. Vaccines are designed to stimulate the body to create immunity against a specific infectious agent. This kind of protection is called active immunity. Immunity through vaccination can be achieved without having to experience the dangers of the disease itself. Diseases can be caused by different bacteria, viruses and toxins (Kuronen & Ölander 2005, Nohynek 2005).

Vaccinations can be administered in different ways: injection, oral solutions or capsules, nasal sprays, or bandaids. In the future, different kinds of aerosols will likely replace injectable vaccines. In Finland, vaccinations are injected either under the skin (s.c.) or into the muscle (i.m.). Calmette-vaccines and Mantoux tests (Tuberculin Sensitivity Tests) are injected into the skin (i.d) (Hulkko et al. 2005). Some vaccines are delivered orally (p.o.), such as rotavirus vaccines given to children (against diarrheal infections) and cholera vaccines (given to people travelling to cholera areas) (Nohynek 2009).

The practical implementation of vaccinations has been studied from a number of perspectives. For example, technical implementation has been studied, i.e., whether the injection is done in a technically correct way into the correct site on the body (Daly et al. 1992, Chiodini 2000, Zukerman 2000, Chiodini 2001, Leask et al. 2004). Ways of reducing the pain caused by injections (Chung et al. 2002, Taddio et al. 2009) as well as ways of reducing or eliminating a patient's fear of needles (Gaskell et al. 2005) have also been studied. The vaccination of small children is said to demand special skills (Daly et al. 1992, Mahony et al. 1999, Farrant 2003, Plumridge et al. 2009). Studies have also shown that some vaccinators have not had any, or only very little, practical training in administering vaccinations during their studies (giving injections, correct technique) (e.g., Chiodini 2001, Leask et al. 2004, Vorsters et al. 2010).

Research has also been done on the risk of anaphylactic reactions in children and youth. Researchers emphasize the importance of vaccinators' recognizing the signs of anaphylactic reactions, and being able to treat and report them, despite the fact that they are so rare (Bohlke et al. 2003, Brotherton et al. 2008). According to experts (Terveyden ja hyvinvoinnin laitos 2009), anaphylactic reactions are reported in fewer than one/one million vaccinations. Record-keeping is an important part of the immunization process, and its importance should be stressed (Zahner 1999, Asetus 421/2004, Rapola 2006).

2.2.3. The outcomes of Competent implementation of vaccination

The outcomes of vaccination can be short or long term. The most significant outcome, of course, is immunity against a specific disease. For some vaccinations, protection is lifelong. Good vaccination coverage translates into widespread protection in the population. Several factors affect vaccination coverage: a national free-of-charge vaccination program, vaccinators' knowledge and attitudes, as well as the attitudes of clients towards vaccination.

Some studies have focused on vaccinators' attitudes towards vaccination. Both a vaccinator's and employer's good knowledge and positive attitudes towards vaccination affect the

vaccinator's own vaccination protection, which in turn positively affects client and patient protection (Brotherton et al. 2003, Canning ym. 2005, Lee et al. 2005, McEven & Farren 2005, O'Reilly ym. 2005, Willis & Wortley 2007, Abramson & Levi 2008, Van den Dool et al. 2008, Zhang et al. 2010).

A vaccinator's knowledge and ability to encourage clients has a large effect on whether clients have themselves or their children vaccinated. These vaccinator activity systems have a significant effect on vaccination coverage (Sharkness et al. 1998, Swennen et al. 2001, McIntyre & Leask 2003, Macdonald et al. 2004, Kimmel & Wolfe 2005, Petousis-Harris et al. 2005, Szucs & Muller 2005, Schmitt et al. 2007, Uskun et al. 2008, Hammer et al. 2010, Vorsters et al. 2010).

2.3. Summary of the literature review

The concept of vaccination competence is defined for the first time in this study. Based on a review of literature and interviewees, vaccination competence is defined as a large entity which can be divided into three areas: a competent vaccinator, competent implementation of the vaccination, and competent outcome of the vaccination. In this study, vaccination competence is seen as part of the work activity of a professionally trained health care professional (in Finland, primarily PHNs).

The literature review revealed that little research has been conducted on vaccination competence either internationally or in Finland. Given the paucity of research, information was sought in other research connected to vaccination. On the whole, previous research has focused on vaccinators' knowledge of a specific area (e.g. contraindications, vaccination recommendations, individual vaccinations), the attitudes of vaccinators and clients towards vaccination, gaps in vaccinator education and vaccination coverage. To date there have only been some studies (e.g. Harr et al. 2001, Pelly et al. 2010, Vorsters et al. 2010) focusing on students, so further studies in this area would be important.

Literature has also focused on vaccinator knowledge, attitudes, interaction with clients, ability to encourage clients to be vaccinated and provide proper instructions to clients, correct injection techniques, and the significance of vaccination recommendations. And indeed, all of these should be seen as key factors in furthering the health of clients and achieving high vaccination coverage.

3. VACCINATION EDUCATION IN BASIC PROFESSIONAL AND CONTINUING HEALTH CARE EDUCATION

Education plays a central role in the development, maintenance, and strengthening of vaccination competence. Vaccination education is included in the education of many different groups of health care professionals in different countries (cf. Table 1). There is a large variation in the amount, contents and methods of education vary a great deal between and within different professional groups, and also within groups. Very little research is available on vaccination training methods, contents and amounts.

This chapter will first describe vaccination education in basic health care education, including a discussion of vaccination teaching methods, and then discuss continuing education for health care professionals.

3.1. Vaccination education in basic health care education

The medical curricula of most western European countries include little or no vaccination education (Schmitt et al. 2007). It has been observed, for example, that undergraduate courses rarely include much training about immunization in the UK (Health Protection Agency 2005a). Likewise in Canada, there were large differences in the amount of vaccination education offered in nursing, medical and pharmacy schools, with the largest variation (1-52 hours) being in nursing education. In addition, 58% of students reported feeling that they had not received adequate training regarding immunization (Pelly et al. 2010).

Nurses, midwives and physicians in different parts of Europe (in Belgium, Bulgaria, Italy, Romania, Slovenia, Spain, Sweden) participating in the study of Vorsters et al. (2009) did not have "stand-alone" courses in vaccination, but rather vaccination education was integrated into the curriculum in one or several different study units, e.g. the care of children. These curricula include many differently-named units where vaccination education was included; a total of 58 different courses mentioned covering aspects of vaccination. Some students and curriculum managers also mentioned that vaccination is only included in optional courses or only addressed during traineeship (Vorsters et al. 2009).

In Finland, vaccination education is given in polytechnics and universities. Physicians receive vaccination education at university. In polytechnics, vaccination education is included in the nursing programs. The basic education for PHNs consists of 240 credits (4 years) in a degree program of public health nursing. During this period, students are trained in the vaccination of clients of all ages. In clinical practice, different PHNs have completed slightly different degrees, as the requirements have changed over the years due to various education reforms. Today, studies are divided into basic and professional studies, skills training, written projects and elective studies. The present curriculum is based on directives issued by the European Parliament and the European Commission. Practical skills are an important part of a PHN's professional skills. Nursing students must complete 75 credits of practical skills training, and PHNs at least 25 credits more (Asetus 352/2003, Asetus 497/2004, Opetusministeriö 2006, Polytechnics Act 351/2003). When the working-life-oriented thesis (15 credits) is included, practical skills training adds up to 100 credits. As part of their supervised studies, PHN students practice administering vaccinations to people of different age groups.

PHN curricula usually include vaccination theory and preclinical teaching at school, independent study, as well as supervised training in vaccinating people of different ages in different care environments. Vaccination education is mainly integrated into health promotion studies. Many health care polytechnic programs include vaccination education, but there is large variation in content and arrangements of curricula in Finland. The situation is similar in Canada, where the curricula of undergraduate training programs of nurses, physicians and pharmacists can vary (Pelly et al. 2010). Finnish polytechnic institutions are able to design their curricula independently, as long as they fulfill the requirements listed in the legislation (Asetus 352/2003, Polytechnics Act 351/2003).

It is difficult to calculate the number of credits given to vaccination education, as it varies from a few hours to about one credit (1 credit=27 hours) in the curricula of the polytechnic institutions participating in this study. Some polytechnics offer optional courses on vaccination in order to help students strengthen their vaccination competence. PHN students practice administering vaccinations during their practical training under the direction of a personal supervisor (a PHN), who ensures that they develop their knowledge and competence. The goal is that students can practice on clients of all ages. In the evaluation of clinical practice, a competent-based criteria are in use, but they are not tailored for vaccination competence (ARENE 2007).

In Finnish polytechnics, public health nursing education, vaccination education is spread over several different years of the curricula, usually from the first to the last years. Vaccination education does not appear as an individual unit in the curriculum, though it is mentioned in the course aims of various units. The same phenomenon has been reported elsewhere in Europe, e.g. in Belgium, Bulgaria, France, Germany, Italy, Romania, Slovenia, Spain, Sweden and United Kingdom (Schmitt et al. 2007, Health Protection Agency 2005b, Vorsters et al. 2010).

Literature indicates that teaching methods have an effect on vaccination learning. Methods emphasizing communication training, i.e., how to communicate with clients, are important (Vorsters et al. 2010). Interactive teaching and peer assessment are needed (Lewendon et al. 2001). In addition, intensive workshops and testing have been shown to be effective. For example, Uskun et al. (2008) studied the effectiveness of an intervention to increase the knowledge of primary healthcare workers about vaccination coverage. It was also found that vaccination training increased the knowledge of primary health care workers significantly compared with their pre-workshop levels (Uskun et al. 2008).

Different teaching methods have been experimented with in vaccination education. For example, in the USA, Innovative Learning Activity methods were used in various off-campus sites of vaccine administration, to promote critical thinking, caring and clinical competence. This nontraditional clinical experience has provided an invaluable learning opportunity for the students and has significantly contributed to the primary health needs of the community (Schutt & Parker 2006). Teaching methods also varied by region. For example, online learning was seen as an effective means to undertake immunization education particularly for PHNs in rural Australia (Smith & Heartfield 2008). No Finnish research articles on vaccination teaching methods were found.

Often nurses working in primary health care have been trained on adults, but have received minimal training in how to administer needle procedures to children. Most courses on immunization focus on biological issues instead of fear of needles, and thus it would be important to produce a video in order to share the knowledge and expertise of vaccinators

(Gaskell et al. 2005). Practical training should be organized during basic education, especially the vaccination of children (Harris et al. 2001, Leask et al. 2004, de la Hoz et al. 2005). Vaccinators should also know how to discuss vaccinations, especially with the parents of young children (Heurter et al. 2003, Petoussis-Harris et al. 2005) but also with their colleagues (Macdonald et al. 2004). For this reason, education on interacting with clients and problem-solving should also be developed.

3.2. Vaccination education in continuing education for health care professionals

According to the literature, more regular on-going immunization education is required (Mahony et al. 1999, Mawn & Pakkala 2000, Chiodini 2001, Petoussis-Harris et al. 2004, Petoussis-Harris et al. 2005, Smith & Heartfield, 2008, Uskun et al. 2008). Further education should offer the contents that vaccinators are shown to need (Bruce et al. 2001). Previous research has shown that vaccinators have gaps in their knowledge about contraindications (De la Hoz et al. 2005), and individual vaccinations, such as tetanus (Dabas et al. 2005), influenza (Martinello et al. 2003) and MMR (measle, mumps, rubeola) (Pertovic et al. 2001). General training is also needed on vaccines and their appropriate administration as well as on the importance of these principles (England et al. 1997, Swennen et al. 2001, Schmitt et al. 2007). Nurses need to be reinforced in the basics of practice over time (Daly et al. 1992). Many vaccinators require further training on how to use existing resources, such as vaccinator handbooks, e.g. the Green Book (Petrovic et al. 2001).

In order to provide effective immunization services, primary healthcare workers should have up-to-date information about immunization. Previous research has shown, for example, that general practitioners (GPs) had not received any immunization training since graduation (Uskun et al. 2008). Typically, some physicians had had only one lecture or tutorial during their training in Australia (Leask et al. 2004) and some vaccinators had never received any specific training in this area in United Kingdom (Chiodini 2001). Health care professionals (HCPs) should receive more support for their own education on vaccinology, have rapid access to up-to-date information on vaccines, and have easy access to consultation with experts regarding vaccination-related problems. HCPs' level of information on vaccination issues was not always optimum (Schmitt et al. 2007).

Some vaccinators do not want further training, even if they have not had any immunization education. As Macdonald et al. (2004) found, professional confidence in discussing vaccines must be based upon knowledge, but some health visitors and practice nurses stated that they had received no formal education about immunizations. Unsurprisingly therefore, 78% (N=160) of all nurses expressed a desire for further education (Macdonald et al. 2004). Some vaccinators felt that they knew a great deal about vaccination, although results showed gaps in their knowledge (Petoussis-Harris et al. 2005) or respondents reported no education about immunization during the training (Lee et al. 2005).

As is the case with basic studies, there seem not to be standardized vaccination training programs at the postgraduate level. For example, according to the Health Protection Agency (2005b) provision of postgraduate immunization courses for health care workers in the UK varies from locality to locality. However, in the UK an advisor group hosted by the Health Protection Agency (2005a, 2005b) produced National Minimum Standards for Immunization Training to offer consistency in the training provided across the country and to aid those areas where training is not yet established. In addition, an EU project, Vaccine Safety,

Attitudes, Training and Communication (VACSATC), developed, implemented and evaluated a prototype of an accurate pre-service immunization curriculum during a summer school on vaccinology at Antwerp University, Belgium. The participants were doctors, nurses and midwives (Vorsters et al. 2010).

Continuing education in the field of vaccination varies. In Finland, PHNs may voluntarily seek continuing education, for example, based on needs and interests raised in appraisal discussions. PHNs have the right and the responsibility to attend such training in order to maintain and develop their professional skills (Act on Health Care Professionals 559/1994, Occupational Health Care Act 1383/2001). Municipalities are required to organize continuing education (Terveydenhuoltolaki 1326/2010), though usually the worker decides on the topic of the education, and further education may contain other topics besides vaccination. PHNs participate in further education modules of varying length organized by various groups (e.g., National Institute for Health and Welfare, units of continuing education in universities and polytechnics and vaccination manufacturers).

The division of labor and job descriptions of health care personnel in Finland has recently been updated, and a limited authority to prescribe prescription medicines is part of this reform. This limited prescribing authority mainly affects new prescriptions and extending prescription refills. In terms of vaccinations, it means that nurses can prescribe vaccinations against influenza, hepatitis and chicken pox, but not to children under 12. This authority can be granted to PHNs who are also certified nurses, and is granted by The National Supervisory Authority for Welfare and Health, Professional Practice Rights, and requires passing special education. According to Council of State regulations, this special education consists of 45 credits of professional specialization training. In order to be accepted into the training program, an applicant must be employed in a public health center, and be employed by a municipality or district (Asetus 1088/2010, Asetus 1089/2010, Laki 433/2010).

3.3. Summary of vaccination education

Vaccination education is included both in basic professional and continuing health care education. There is, however, large variation and there are no systematic guidelines for vaccination education. In basic professional education, vaccination education can be included into curricula throughout the whole education. Students are expected to possess satisfactory theoretical and practical knowledge and skills of vaccination (i.e. the ability to vaccinate clients of all ages) before they graduate and move on the working world. In continuing education, health care professionals can select the topic of vaccination mainly based on their own interests. The exception, however, is with the implementation of new vaccines, as education is required before administering them for the first time.

4. PURPOSE OF THE STUDY AND RESEARCH QUESTIONS

The purpose of this study was twofold: firstly, to create a definition of vaccination competence, and to identify factors strengthening and weakening it; and secondly, to assess the level of vaccination competence of graduating PHN students and PHNs. Thirdly, in this summary I was also interested in what would be the satisfactory and optimal levels of vaccination competence. The levels were defined and this definition was used for PHN students and PHNs. PHNs were used as a reference group. Graduating students were compared with working PHNs in order to determine whether the students had achieved a satisfactory level of vaccination competence by the end of their studies, or whether such a level would be only be achieved through work experience vaccinating clients. In addition, I was also interested in whether either group would achieve a satisfactory (VAS, mean 8.0, knowledge test 80%) or optimal level (VAS, mean 10.0, knowledge test 100%) of competence, and how large the differences might be between the two groups.

The goal was to develop and maintain a satisfactory level of vaccination competence among health care professionals, and to make suggestions for developing basic and continuing education as well as for practical work. It is hoped that these results will ultimately promote national health through ensuring that competent vaccinators will be available to administer a functioning vaccination program with wide coverage.

See Figure 1 for a graphic depiction of the progress of the study (Page 13).

Research Questions:

Phase I (descriptive phase). The aim was to define what vaccination competence is, and identify the factors strengthening and weakening it.

1. What is vaccination competence? (Paper I)
 - 1.1. What are the qualities of a competent vaccinator?
 - 1.2. What is competent implementation of the vaccination procedure?
 - 1.3. What are the outcomes of a competent vaccination implementation?
2. What factors strengthen and weaken vaccination competence? (Paper II)

Phase II (evaluative phase). The aim was to evaluate the level of vaccination competence of PHN students and PHNs and identify the factors related to this competence.

3. What is the level of vaccination competence of PHN students and PHNs?
(Papers III, IV)
4. What factors are associated with the vaccination competence of PHN students and PHNs? (Papers III, IV)
5. Are there differences in the vaccination competence of PHN students and PHNs?
(Paper V)

5. MATERIALS AND METHODS

This chapter describes the study samples, data gathering and ethical questions for the two phases of the study (Phase I and II).

5.1. Sample

Phase I

In the descriptive phase, a multidimensional definition of vaccination competence was created through interview study (Papers I, II). There were 40 participants in these interviews, including vaccination professionals (n=22), graduating PHN students (n=5) and clients who had received vaccinations themselves or were the parents of children receiving vaccinations (n=13). The interviewees were selected by using the following inclusion criteria:

- 1) professionals (PHNs, physicians, public health nursing teachers) - working with vaccinations ≥ 2 years;
- 2) students - graduation within 6 months;
- 3) clients - vaccinated within 6 months (adults and one adolescent) or experiences of having their children vaccinated during their first and second year at a child health clinic or at school (parents of young and school-aged children).

For a more detailed description of the participants, see Paper II, Table 1.

Phase II

In the evaluative phase the sample consisted of graduating PHNs and working PHNs. Information about their vaccination competence was gathered through a questionnaire. Students were chosen through a purposive sample consisting of all the students graduating in 2008 (n=143) from five polytechnics (7 units) selected from different regions of Finland. Of these students, 129 returned the questionnaire (90%), see Table 2. (For a more detailed description of the participants, see Paper III, Table 1).

For the working PHNs, the sample included all the PHNs (n=484) who were working in seven different health centers or occupational health centers in different parts of Finland. Of these, 405 participants returned the questionnaire (84%) (refer to Table 2). The study sample was selected to include PHNs from all geographical regions, including the northern, southern, eastern and western parts of Finland. The largest health center in each area was chosen for the study. Due to its large size, from the largest health center a random sample of 20% was drawn, though from the other centers all subjects were included. (For a more detailed description of the participants, see Paper IV, Table 1).

Table 2. The samples (n), target population (N) and response rates (%) of participating polytechnic PHN students and health center PHNs, along with the population size being served.

PHN Students Polytechnics (Poly)			PHNs Health Centers (HC)			Location in Finland	Target Population
Poly	n / N	Response rate %	HC	n / N	Response rate %		
1	19 / 20	95	1	48 / 48	100	North	57,000
2	18 / 18	100	2	51 / 63	81	East	57,600
3	18 / 26	69	3 4	45 / 51 52 / 59	88 88	East	27,500 46,600
4	38 / 41	93	5	103 / 135 ¹	76	South	560,000
5	36 / 38	95	6 7	37 / 43 69 / 85	86 81	West	36,700 76,200
Total	129 / 143	90	Total	405 / 484	84		861,600

¹N=135 is a 20% random sample of all N=637 PHNs in this HC

5.2. Data collection

Three sets of data were collected in this study: one set of interview data (Phase I) and two sets of questionnaire data (Phase II).

Phase I

In phase I, information about vaccination competence (and factors strengthening and weakening it) was gathered using semi-structured interviews (Papers I and II). The interviews were conducted during the period 8.12.2004-3.6.2005. Most of the interviews were conducted as focus groups (Krueger 1994, Côté-Arsenault & Morrison-Beedy 1999, Krueger & Casey 2000), though due to scheduling conflicts, some of the interviews were conducted in pairs or as individual interviews. The interview topics were vaccination competence and factors seen as strengthening or weakening it (Appendix 1). Before beginning the actual interviews, pilot interviews were conducted, which were taped. These pilot interviews showed that the interview topics worked, the technical apparatus for recording the interviews was functional, and the time allotted was sufficient (Miles & Huberman 2001).

One researcher conducted all the interviews, and they were all recorded. Interviews with students and teachers were done at polytechnics. PHNs and physicians were interviewed at their workplaces. The parents of small children and adult clients at outpatient clinics were interviewed in the examining room at the clinic, and home nursing clients were interviewed in their homes. The parents of school-aged children were at their own request interviewed in their homes.

Phase II

In phase II, two sets of data were collected (Papers III, IV, V). Data about the vaccination competence of graduating PHN students and PHNs were collected using structured instruments (Appendices 2 and 3, Appendix Table 1) developed for this study. These

instruments were developed based on the literature review and results of the interview study in phase I. These instruments were piloted with graduating students (n=12) in December 2007 and with PHNs (n=14) administering vaccinations in different sectors in January 2008. Based on these pilot studies, adjustments were made to the instruments, mainly small technical changes. The instruments consisted of three parts: 1) background variables (PHN students 17 items, PHNs 16 items); 2) the self-assessment VAS statements (Visual Analogue Scale, 0-10 cm), in which participants assessed their qualities as vaccinators (8 items), their implementation of vaccination (30 items) and the outcome of their vaccination implementation (4 items); and 3) a knowledge test consisting of 58 variables (correct 1 / wrong 0) measuring the respondents' vaccination knowledge (For a detail description of the content of knowledge test, see Appendix Table 1). These measures are also presented as figures in Paper III.

Data from graduating PHNs (n=129) were gathered from five different polytechnics in different parts of Finland (Table 2) in the spring of 2008 (18.3-28.5.2008). The researcher collected most of the data. In two of the polytechnics, contact teachers working in close cooperation with the main researcher (who received detailed written instructions, along with telephone and email consultations) collected the data.

Data from working PHNs were gathered in the fall of 2008 (12.8.-28.11.08) from all of the PHNs (n=405), working in seven different health centers, whose work included administering vaccinations, and whose native language was Finnish (Table 2). These PHNs were mainly working in maternity and child health clinics, school and student health care, outpatient clinics, occupational health services, and home nursing. The researcher collected most of the data. In one health centre the data were collected by a contact person and in two, some of the data were collected by a contact person. The researcher individually trained all of the contact persons.

5.3. Data analysis

Phase I

In phase I of the study, the researcher who conducted the interviews also transcribed them, resulting in a data set of 612 pages. The researcher coded the transcriptions so that it was easier to return to the original data. The transcribed texts were checked several times against the tapes, which also helped the researcher develop a comprehensive picture of the data (Polit & Beck 2008). The researcher also listened to the recordings whilst reading the transcripts in order to get a firm sense of the data.

The data were analyzed using content analysis inductively, so that the main topics emerging in the data were divided into categories and sub-categories under the main headings (Miles & Huberman 2001). The unit of analysis was a statement, which could be composed of a word, sentence, or part of a sentence (Berg 2004, Burns & Grove 2009). A few of the interviewed informants (three PHNs and one nursing teacher) read the transcriptions and provided feedback on the creation of these categories. A more detailed descriptions of the ways the data were analyzed, abstracted and categorized can be found in Papers I and II.

Phase II

In phase II, the questionnaires were given ID numbers based on the polytechnic and health center. After that, the respondents' marks on the VAS-scale (self-assessment of vaccination

competence) in each item were measured using a transparent ruler, and the values recorded in the margin. A total of 22,428 marks were measured. The values recorded in the margins were entered into a data matrix on the computer.

Thus far, no consensus has been established on how exactly to define a satisfactory level of vaccination competence, either in the research literature or other relevant texts. One of the goals of this study, therefore, was to establish such levels, and see how they worked in the assessment of PHN students and PHNs. For this study, an average of 8.0 (optimal 10.0) was tentatively considered a satisfactory level of vaccination competence on the self-assessment, with a corresponding figure of 80% (optimal 100%) of correct answers on the knowledge test. This is in keeping with numerical assessment in the Finnish comprehensive school system, which uses a 10-point scale, where 8 is considered "good" (Perusopetuksen oppilaan arviointi 2011). Grading scales at polytechnic institutions are mandated by statute (Polytechnics Act 351/2003). Finnish polytechnics use a grading scale of 0-5, where 4 (very good) is comparable to an 8 in the comprehensive school scale. Similarly, in Australia nurses must achieve a grade of 80% to satisfactorily pass the Immunization certification course (Government of Western Australia 2009). By comparison, in a 2-day immunization induction program (initial basic training course) organized in Essex in the United Kingdom, immunizers must achieve a score of 70% (21/30) on a knowledge assessment MCQ consisting of 30 questions in order to pass (Essex Health Protection Unit 2011).

In addition, verbal assessment can be used in competence evaluation. For example, Benner (1984) has developed a verbal scale to measure nursing competence. Benner's competence framework includes 5 levels of competence from novice to expert nurse with substantial experience. Meretoja's (2003) Nurse Competence Scale similarly distinguishes the level of competence on a continuum from novice to expert. Other types of verbal assessment are also available. In the United Kingdom, for example, the Health Protection Agency (2005a, 2005b) produced National Minimum Standards for Immunization Training in 2005. Immunization training should take place at the local level and be led by local trainers. Suggested minimum clinical competencies are assessed during at least two practice sessions, which are recorded with the date. An Immunization Competency Assessment tool used by all staff involved in delivering immunizations includes the categorizations "need to improve" and "meets or exceeds" expectations (Health Protection Agency 2010). An "immunization competencies leveling tool" developed in Canada (Immunization Competencies for Health Professionals) includes the following levels: aware, knowledgeable, proficient (Public Health Agency of Canada centre for Immunization and Respiratory Infectious Diseases 2008).

The data of the evaluative phase were analyzed using SAS for Windows 9.1 software. Sum variables were formed of the self-assessment variables, calculating means for the self-assessment and its three sections. Sum variables for different areas of the knowledge test were formed by calculating the number of correct answers and dividing it by the number of corresponding questions. Multiplying this mean by 100 equalled the percentage of correct answers. This enabled comparison of different knowledge areas of the test since they included an unequal number of questions (Papers III, IV, V).

Cronbach's alpha coefficient was used to evaluate the consistency of the sum scores (Papers III, IV). Explorative factor analysis was used to evaluate the construct validity of the instrument (Appendix Table 2). Principal component factoring with a varying number of factors was used as well as both varimax and promax rotation methods. Factor loadings 0.30 or above were considered relevant for interpretation of the factors.

Due to non-normal distributions of the sum scores, nonparametric statistical methods were used, when available (Papers III, IV, V). The sum scores of the subscales of the VAS self-assessments were compared using the Wilcoxon Signed Rank test. The Bonferroni method (Hsu 1996) was used to maintain the overall significance level of the pair-wise comparisons. The different areas of the knowledge test were compared using a similar method (Papers III, IV).

Spearman Rank Order correlations were used to study the associations between the sum scores of the self-assessment and knowledge test. The distributions of the sum scores between the categories of the background variables were compared using the Wilcoxon Rank Sum test (Papers III, IV). In papers III and IV, multivariate analyses were done to identify the independent determinants of the two total sum scores. All univariately significant background variables were first included in the multivariate linear model and were then removed one by one until all determinants in the model were statistically significant.

In paper V, the distributions of the background variables between the respondent groups (students and PHNs) were compared using a chi square test. The results of self-assessments and the knowledge test between students and PHNs were compared using the Wilcoxon Rank Sum test. In paper V, to determine which background variables were associated with the results of self-assessment of competence and the knowledge test, and whether there was a difference between students and PHNs after adjustment by other variables, a multivariate linear model was constructed separately for the total results of the self-assessment and for the result of the whole knowledge test. All background variables were first entered into the model and non-significant variables were then removed one by one until every independent variable in the model was significant. The respondent group variable (student, PHN) was kept in the model even if it was not significant. If there were more than two categories in the background variable, pair-wise comparisons between the categories were made using Tukey's HSD test (Hsu 1996). Results with $p < 0.05$ were considered statistically significant (Burns & Grove 2009).

5.4. Ethical considerations

During all phases of the study, research ethical principles were followed (Graneheim & Lundman 2004, Etene 2009, World Medical Association, WMA 2011). The study was done in two phases. **In Phase I**, research permits to interview PHN students and teachers were obtained from the three different polytechnic rectors or directors. Research permission to interview PHNs, doctors and clients was also obtained from the head of one health center. In terms of recruiting clients, the head nurse asked PHNs to ask clients about their willingness to participate in the study and to make their contact information available to the researcher. The researcher then personally contacted those who were willing to participate and arranged to conduct the interviews. All of the interviewees were sent a cover letter (targeting 7 different groups, see Appendix 4), and they gave both written and oral consent to be interviewed, to tape record the interviews, and to have the results reported.

In Phase II research permits to administer questionnaires to PHN students were obtained from the five different polytechnic principals or directors. Two of the schools have units in two different cities, so for these two, separate permits were sought to collect data in the different units. There were thus seven physical locations in seven different cities in different parts of Finland (Table 2). In order to protect the anonymity of the participating schools, references to them or their curricula have not been included in the list of references. Research

permits for PHNs were obtained from all of the participating health centers, according to their standard procedures. Although seven health centers participated in the studies, permits were obtained for a total of ten, as in three of the health centers, separate permits were obtained for the occupational health sections.

For both PHN students and PHNs, answering the questionnaires was voluntary. The voluntary nature of the study was mentioned in the cover letter (Appendix 5), and was reiterated orally before the participants filled out the questionnaires. The cover letter described the research, the confidentiality of the data, the anonymity of the subjects, and provided the contact information of the main researcher and her supervisor in case the subjects wished to contact them later for any reason. Answering the questionnaire itself thus represents the subject's agreeing to participate in the study. The subjects (PHN students and PHNs) returned the questionnaires and it was not possible for the researcher to identify the respondents. During the larger data collecting sessions, the questionnaires were returned in a cardboard box reserved for the participants. The anonymity of subjects was guaranteed during all phases of the study (Burns & Grove 2009, Etene 2009).

In both phases, the subjects were told that participation was voluntary and that they had the right to withdraw from the study at any point (Burns & Grove 2009, Etene 2009). The interview tapes, paper questionnaires, statistical results and other data are kept in a locked cabinet. The data will be destroyed when they have been fully analyzed (Personal Data Act 523/1999) and the research project is finished. Confidentiality is connected to what the researcher promises the subject about how the data will be analyzed, used, and dealt with at the conclusion of the study. Of primary importance in research on human subjects is for the researcher to respect the subject's humanity and his/her right to self-determination (Pelkonen & Louhiala 2002).

In both phases, the data were analyzed confidentially, and were not released to an outside party. Data were handled so that the identities or opinions of individual subjects could not be identified in any written report.

6. RESULTS

The results of this study are reported according to the research questions: the first phase of the study a definition of vaccination competence was made and factors strengthening and weakening it were described (Papers I, II). The second phase evaluates the vaccination competence of PHN students and PHNs, and explores factors associated with vaccination competence; also some comparisons between the two groups were made (Papers III, IV, V).

6.1. Definition of, and factors strengthening and weakening, vaccination competence

The definition of vaccination competence is based on semi-structured interviews with professionals, students and clients (Paper I). Vaccination competence is composed of three areas: a competent vaccinator, competent implementation of the vaccination and the outcomes of competent implementation of vaccination (Table 3). More specific descriptions of these three areas can be found in Paper I.

Table 3. Areas of vaccination competence.

Competent vaccinator	Competent Implementation of Vaccination Procedure	Outcomes of a Competent Vaccination Implementation
<ul style="list-style-type: none"> • Vaccinator with distinctive personal qualities • Vaccinator with desirable attributes required in vaccinator-client encounter • Authorized, completed health care degree • Committed to vaccinating • Aiming at having an influence on the social level 	<ul style="list-style-type: none"> • Vaccinator's preparations • Preparing a client • Actions during vaccination • Actions after vaccination 	<ul style="list-style-type: none"> • Immediate outcomes • Long-term outcomes

A competent vaccinator (CV) possesses the distinctive personal qualities desirable in the vaccinator-client encounter. CVs are health care professionals holding a degree in health care who are authorized to vaccinate. Furthermore, a CV is a specialist dedicated to vaccinating, who considers vaccinating as a mission. That is, for CVs, vaccinating is more than merely administering injections, but is connected to having a positive social impact as well.

Competent implementation of the vaccination procedure consists of the CV's actions before, during and after the vaccination. Before the client arrives, the CV carefully prepares for the procedure, including creating a pleasant atmosphere. An important part of competent implementation is preparing the client before the vaccination. During the vaccination, the CV needs to create a safe environment, and be able to give the injection with proper technique. In addition, during any problem situations (e.g. a frightened or resisting child), a CV must be able to quickly and creatively come up with professional solutions. After the vaccination, competent implementation includes follow-up of the client's well-being, guidance, and discussion of possible adverse events and their treatment.

The outcomes of competent implementation were divided into immediate and long term. Immediate outcomes include the client having a good emotional experience and the vaccinator's feeling of success, including successful technical results. Long-term outcomes include the continuity of client contact, clients' positive attitude and feedback (e.g., about adverse events) as well as vaccinators evidence-based practice based on epidemiologic research.

Data about factors strengthening and weakening vaccination competence were gathered by interviewing vaccination professionals, students, and clients (Paper II). Factors strengthening and weakening vaccination competence were divided into four categories, connected to the vaccinator him- or herself, the client, the vaccination environment, and vaccinator immunization education. For the most part, the opposites of the factors strengthening vaccination competence were seen as weakening it (Table 4).

Vaccination competence is high when a vaccinator is able to have successful client encounters, consisting of sufficient working knowledge, good skills, a positive attitude as well as willingness to develop as a vaccinator. Factors connected to clients include a positive attitude towards vaccination, careful preparation of the vaccination situation in advance, and the vaccinator's "helpful" behavior during the vaccination. Factors connected to the vaccination environment include the physical, social, and cultural work environment. In terms of vaccination education, important components were adequate basic and continuing education, suitable teaching methods as well as practical training.

Table 4. Factors strengthening and weakening vaccination competence.

Strengthening factors related to	Weakening factors related to
Vaccinator professional conduct <ul style="list-style-type: none"> • Successful client encounters • Good knowledge and skills • Positive attitude towards vaccinations • Willingness to develop as a vaccinator 	Vaccinator professional conduct <ul style="list-style-type: none"> • Vaccinators' routine-like manners • Limited knowledge, poor skills, negative attitude towards vaccination • Fear of injecting clients • Personal reasons, worries, hecticness, stress • Unwillingness to develop as a vaccinator
Client conduct <ul style="list-style-type: none"> • Positive attitude towards vaccinations • Careful preparation beforehand • Client's action assistance in implementation of vaccination 	Client conduct <ul style="list-style-type: none"> • Negative attitude towards vaccinations • Lack of information • Fear of injections • Communication problems, resistance, client's physical restrictions, parent failing to hold the child firmly during vaccination
Vaccination environment <ul style="list-style-type: none"> • Suitable physical environment • Suitable social environment • Suitable cultural working environment 	Vaccination environment <ul style="list-style-type: none"> • Substandard physical environment • Substandard social environment • Substandard cultural environment in the work community
Vaccinator education <ul style="list-style-type: none"> • Adequate education • Suitable teaching methods • Practicing the administration of vaccines during education 	Vaccinator education <ul style="list-style-type: none"> • Inadequate and unsuitable education • Lack of clinical practice placements for PHN students • Inadequate continuing education

6.2. The vaccination competence of graduating public health nurse students and public health nurses and factors associated with vaccination competence

Vaccination competence was measured with a self-assessment and a knowledge test, and analyzed using statistical methods (Papers III, IV, V). In the following, the self-assessment and knowledge test results for each group will be discussed separately, and then the results compared between the two groups. Students were compared to PHNs who were already working as vaccinators. Through the use of the reference group, it could be determined whether the vaccination competence of graduating public health nurses was already satisfactory, or whether it only improved via work experience vaccinating clients. Another

goal was to check whether either of the groups achieved a satisfactory or an optimal level of vaccination competence and whether there were significant differences between the groups.

Results on the self-assessment and knowledge test of PHN students

The self-assessment of PHN students had a mean of 7.9 (SD 0.8). The PHN students scored highest on the outcomes of vaccination (mean 8.8, SD 0.94), second highest on the implementation of vaccinations (mean 8.1, SD 0.86) and weakest on vaccinator personal qualities (mean 6.6, SD 0.91). The implementation of vaccination was itself divided into three parts: preparing for the vaccination, the actual giving of the vaccination, and actions taken after the vaccination was given. Of these, the students assessed themselves to be most competent after the vaccination, second most competent before the vaccination, and least competent during the vaccination.

In multivariate analysis (Appendix Table 3), results on the students' self-assessment of vaccination competence (total score) were connected to the amount of preclinical teaching and motivation (Table 5).

Table 5. The Independent Determinants of Vaccination Competence of Public Health Nurse Students (n=129) in the Self-Assessment, VAS (Total Score).

Preclinical teaching (those with a larger amount of teaching assessed their competence to be better, p=0.020)
Motivation (very motivated students assessed their competence to be better, p<.0001)
Multivariate linear model. Model p<.0001. Model 100 x R ² =27.5%

On the knowledge test, the overall percentage of correct answers for the graduating PHN students was 76%. They were best on vaccination recommendations (90%) and general contraindications (89%). The percentage of correct answers on anaphylactic reactions was 83%, on antiseptic practice 78% and recommended injections sites 77%. The weakest results were observed on the names of vaccinations (56%). In multivariate analyses (Appendix Table 4), results on the knowledge test were connected to the student's age, the amount of preclinical teaching as well as experience vaccinating clients of different ages during the training period (Table 6).

Table 6. The Independent Determinants of Vaccination Competence of Public Health Nurse Students (n=129) in the Knowledge Test (Total Score).

Age (the under 24-year-olds had the lowest scores, p=0.006)
Preclinical teaching (those with a higher amount of teaching had the lowest score, p=0.012)
Practice of vaccinating clients of different ages (those with much or a great deal of practice had a higher score than those with less practice, p=0.006)
Multivariate linear model. Model p<.0001. Model 100 x R ² =20.0%

A limited association was found between the students' self-assessment and the knowledge test. There was a non-significant correlation ($r=0.03$) between the total score variables. Only two significant correlations were found, thus indicating that a low or high self-assessment was not connected to the result of the knowledge test (Appendix Table 5).

Results on the self-assessment and knowledge test of PHNs

The self-assessment of PHNs had a mean of 8.3 (SD 0.80). They assessed themselves to be most competent on the outcomes of vaccination (mean 9.1, SD 0.76) and weakest on vaccinator personal qualities (mean 6.8, SD 0.93). As before, the implementation of vaccination (mean 8.6, SD 0.90) was divided into three areas: preparing for the vaccination, implementation of the vaccination procedure itself, and actions afterwards. Of these, PHNs rated themselves to be most competent on preparing for vaccinations, second best on actions after vaccinations and weakest on actions during the vaccination itself. In multivariate analysis, the self-assessment score was connected to age, length of working experience, frequency of giving vaccinations, working in a school or occupation health care setting, as well as motivation for further education (Table 7).

Table 7. The Independent Determinants of Vaccination Competence of Public Health Nurses (n=405) in the Self-Assessment, VAS (Total Score).

Age (older nurses assessed their competence to be better, $p=0.013$)
Length of work experience in health care (n=333¹) (those who had been working for a longer time assessed their competence to be better, $p=0.036$)
Frequency of vaccination (those who vaccinate more frequently assessed their competence to be better, $p=0.0006$)
Working in school health care (those who were working in school settings assessed their competence to be better, $p<0.0001$)
Working in occupational health care (those who were working in occupational health centers assessed their competence to be worse, $p<0.0001$)
Motivation to participate in vaccination education (those who were highly motivated for education assessed their competence to be better, $p=0.0092$)
Multivariate linear model. Model $p<0.0001$. Model $100 \times R^2=37.7\%$

¹ Due to missing values in the length of work experience in health care n is less than the total sample size.

On the knowledge test, the overall percentage of correct answers for the PHNs was 83%. They were well aware of vaccination recommendations (93%), general contraindications

(88%) and recommended injection sites (83%), but there were gaps in their knowledge of handling anaphylactic reactions (79%), vaccination names (78%) and aseptic practices (77%). In multivariate analysis, their results on the knowledge test were connected to whether they had taken the Finnish high school matriculation examination, frequency of giving vaccinations, working in school health care, outpatient clinics, and home nursing, as well as their desire to learn more about the vaccination of travellers (Table 8).

Table 8. The Independent Determinants of Vaccination Competence of Public Health Nurses (n=403) in the Knowledge Test (Total Score).

Matriculation examination (those with matriculation examination had higher scores, p=0.013)
Frequency of vaccination (those who vaccinate more frequently had higher scores, p=0.0004)
Working in school health care (those who were working in school settings had higher scores, p=0.002)
Working in an outpatient clinic (those who were working in outpatient clinics had higher scores, p=0.027)
Working in occupational health care (those who were working in occupational health centers had lower scores, p=0.0083)
Working in home nursing (those who were working in home nursing had lower scores, p<.0001)
Wish for further training in traveller vaccinations (those wishing for training had higher scores, p=0.044)
Multivariate linear model. Model p<.0001. Model 100 x R ² =22.5%

Many significant associations were found between the PHNs' self-assessment and the knowledge test. There was a significant correlation ($r=0.27$) between the total score variables. The self-assessment of competence after vaccination did not correlate with any part of the knowledge test. In the knowledge test, managing an anaphylactic reaction did not correlate with any part of the self-assessment. Despite some non-significant correlations, the self-assessments and knowledge levels of PHNs seemed to be in line. High self-assessments were mostly connected to good levels of knowledge in the knowledge test.

Comparison of the vaccination competence of PHN students and PHNs and the factors associated with vaccination competence

On the self-assessment, graduating PHN students considered their competence to be significantly weaker than PHNs (mean 7.9/students vs. 8.3/PHNs, p<0.0001). Students judged themselves to be weaker in all areas included on the VAS. Both students and PHNs assessed themselves highest in the outcomes of vaccination (mean 8.8/students vs. 9.1/PHNs) and weakest on vaccinator qualities (mean 6.6/students vs. 6.8 PHNs), with the figures for implementation being in the middle (mean 8.1/students vs. 8.6/PHNs) (Figure 2).

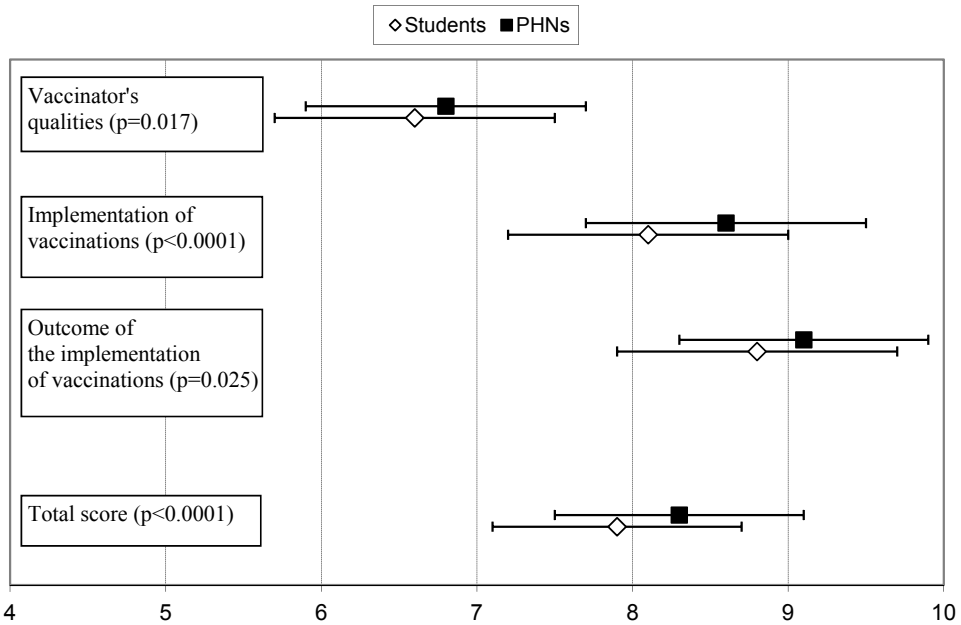


Figure 2. The level of self-assessment (mean±SD) of vaccination competence areas and total score of PHN students and PHNs (significance of the difference between the groups).

Furthermore, it was determined whether difference in the total score between PHN students and PHNs on the self-assessment still existed when the background variables were taken into consideration. The total self-assessment score in both groups was associated with the age of the respondent, whether the respondent had searched for further information on vaccination in National Institute for Health and Welfare publications, their desire for additional theoretical knowledge of vaccination and their motivation for further vaccination training. After adjustment by these determinants, there was no longer a significant difference between students and PHNs ($p=0.81$) (Table 9).

Table 9. Comparison of PHN Students (n=129) and Public Health Nurses (n=398) in multivariate analysis of Vaccination Competence in the Self-Assessment, VAS (Total Score).

PHN students vs. PHNs (after adjustment by the other determinants no difference was found, p=0.81)
THE INDEPENDENT DETERMINANTS IN THE MODEL
Age (older respondents assessed their competence to be better, p<.0001)
Searching for information concerning vaccinating from the print version of the NIHW manual (those who searched for information assessed their competence to be better, p=0.0010)
Searching information concerning vaccinating from the electronic version of the NIHW manual (those who searched for information assessed their competence to be better, p=0.0005)
Wanting more theoretical knowledge about vaccination (those wanting education assessed their competence to be better, p=0.010)
Motivation to participate in vaccination education (those who were highly motivated for education assessed their competence to be better, p<.0001)
Multivariate linear model. Model p<.0001. Model 100 x R ² =25.8%

There were significant differences in the knowledge test results between PHN students and PHNs (total score, PHN students mean 76%, PHNs 83%, p<0.0001). PHNs had better knowledge of vaccination recommendations than students. For both students and public health nurses, this area was the one they knew the best. PHNs also had better knowledge than students of recommended injection sites and the names of vaccinations. Students were better informed on how to handle anaphylactic reactions than PHNs, while knowledge about general contraindications and aseptic practices were at the same level (Figure 3).

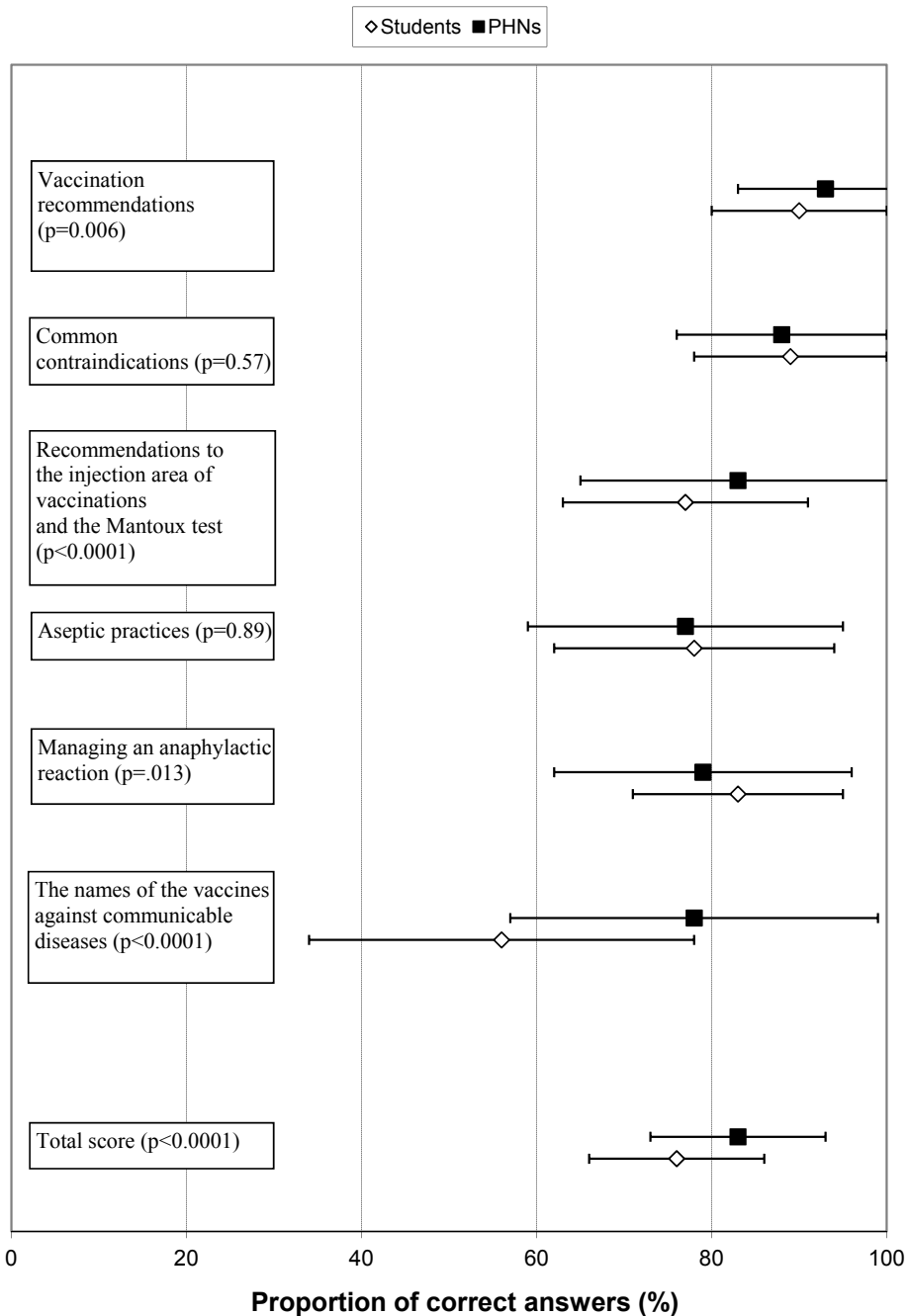


Figure 3. The level (mean±SD) of the vaccination competence in the knowledge test areas and total score of PHN students and PHNs (significance of the difference between the groups).

Finally, it was determined whether the difference in the total score between the groups on the knowledge test still existed when background variables were taken into consideration. The results on the knowledge test (total score) were significantly correlated with having taken the Finnish high school matriculation examination, searching for information in NIHW publications as well as the desire and motivation for further education. After adjustment by the other determinants, there was still a significant difference between students and PHNs, in that the PHNs performed better on the knowledge test ($p < 0.0001$) (Table 10).

Table 10. Comparison of PHN Students (n=129) and Public Health Nurses (n=403) in multivariate analysis of Vaccination Competence in the Knowledge Test (Total Score).

PHN students vs. PHNs (after adjustment by the other determinants, PHNs had higher scores, $p < 0.0001$)
THE INDEPENDENT DETERMINANTS IN THE MODEL
Matriculation examination (those who had taken the matriculation examination had higher scores, $p = 0.0041$)
Searching for information concerning vaccinating from the electronic version of the NIHW's manual (those who had searched for information had higher scores, $p < 0.0001$)
Wanting more education about vaccinating travellers (those wanting education had higher scores, $p = 0.0002$)
Wanting more education about "other things" (those wanting education had higher scores, $p = 0.015$)
Motivation to participate in vaccination education (those who were fairly motivated for education had the lowest score, $p = 0.043$)
Multivariate linear model. Model $p < 0.0001$. Model $100 \times R^2 = 14.3\%$

7. DISCUSSION

In this discussion, first the results of the different phases will be discussed, comparing them with earlier studies. Secondly, the study's trustworthiness, reliability and validity will be evaluated. Finally, suggestions for nursing education, practice and research will be offered.

The purpose of this two-phase study was first to define the concept of vaccination competence and then assess the level of vaccination competence of graduating public health nurse students and public health nurses. In Phase I, a definition of vaccination competence was created, initially through a literature review, and then through interviews with professionals, students and clients. Phase II measured the vaccination competence of PHN students and PHNs and the factors related to these levels. This research is in the area of health promotion. Globally, vaccination is one of the most important methods of promoting health, and this study provides knowledge to improve health promotion in Finland as well, a country where vaccination coverage is generally quite high.

7.1. Discussion of the results

Definition of, and factors strengthening and weakening, vaccination competence

Based on the results of interviews with vaccination professionals, students and clients, one can say that vaccination competence is a large entity. It is not a single procedure, giving an injection, but requires a wide range of skills and knowledge before, during and after the vaccination. Vaccination competence consists of three areas: a competent vaccinator, competent implementation of the vaccination, and the outcomes of competent implementation of a vaccination. This definition can be considered appropriate for this study; it was used in developing the measures and was applied to both groups.

In the definition of the concept of vaccination competence, however, the three parts have different scope. Competent implementation of the vaccination is the widest, and it was necessary to further divide it into three parts, in order to both describe and measure it. By contrast, competent outcomes of the vaccination were defined more narrowly. This concept still requires a more detailed description and connection between the parts. Particularly, the inclusion of the environment and its meaning would be important to consider, as participants raised it as a factor which strengthens or weakens competence. In addition, the concept could be expanded to include factors connected to vaccination safety (e.g. adverse events and the ways vaccinations are handled).

Based on these results, key characteristics of a competent vaccinator include personal qualities needed in client contact situations (such as being calm, friendly, and respectful), and an interest in improving the vaccination situation in society. Naturally, competent vaccinators should possess the necessary authorization to vaccinate (cf. Communicable Disease Decree 1986).

Competent implementation of vaccination consists of three phases, the competent vaccinator's actions before, during and after the vaccination. The subjects highlighted the importance of getting the client's consent to be vaccinated, the importance of keeping clients well-informed about all procedures and advising them about vaccination-related issues.

Having good record-keeping procedures was also highlighted. These results are in line with earlier studies (Zahner 1999, Asetus 421/2004, Rapola 2006.) In terms of preparing for vaccinations, the interesting result was that clients did not mention being asked to give their consent to take the vaccination, while for the professionals this was a key component of vaccination competence. National instructions (e.g. Nohynek et al. 2005, Essex 2011) also emphasize the importance of getting the client's consent to be vaccinated. Furthermore, creating of a safe environment and mastery of different injection techniques were emphasized (cf. Chiodini 2000, Chung et al. 2002). Vaccinating children was seen as a special competence, corresponding with earlier studies (e.g. Daly et al. 1992, Leask et al. 2004).

After the vaccination, the vaccinator monitors the client's well-being, discusses how to manage possible adverse events, as well as records the vaccinations given (e.g. Nohynek et al. 2005), which demonstrates control over the entire vaccination process. When describing the outcomes of vaccinations, the results emphasized having a positive emotional experience, satisfaction, continuity in the care relationship, preserving a client's positive attitudes towards vaccinations, the immunity gained through vaccination, and vaccination coverage.

Factors strengthening and weakening vaccination competence can be divided into four factors. Three of these are connected to the basic care situation: the vaccinator, client, and environment. In this study, the vaccination environment was seen broadly, not just as a physical and social space, but also as a cultural work environment. A fourth factor influencing vaccination competence was vaccination education, and indeed education and personal qualities were found to be the two factors most commonly mentioned to influence vaccination competence. In this study, the factors strengthening and weakening vaccination competence were elicited, analyzed and reported separately, though in fact they tend to be opposites of each other and in the future could be considered as opposite ends of a single spectrum. Future research could test this.

Factors strengthening vaccination competence for individual vaccinators include good interpersonal skills, client-centered practices, empathy, good knowledge and skills, a positive attitude towards vaccinations and the desire to develop as a vaccinator. In addition to the opposites of these, factors considered to weaken vaccination competence included the vaccinator's fear of giving injections, stress and other concerns. Of course, these positive individual factors could be required of all PHNs, not just those who give vaccinations.

Strengthening factors connected to clients include having a positive attitude towards vaccinations and preparing themselves (or their children) for the process. The preparation of young children was seen as especially important, along with holding them firmly and safely during the injection (assisted by clear directions from the vaccinator). Client factors weakening vaccination competence include a fear of and resistance to getting an injection. Future research might focus on the family's point of view as a factor strengthening vaccination competence.

Strengthening factors for clients and vaccinators include a pleasant environment, good equipment, the proper temperature, privacy and continuous care relationships. Vaccinators also benefit from open discussion at the workplace about vaccination issues. Environmental factors seen as weakening vaccination competence included stress, hurry, employee turnover, and lack of resources for education.

Education supports vaccination competence when it includes enough theoretical and practical training, uses the most effective teaching methods, and is readily available both as basic and

further training. Repeated practice is especially important for students who fear giving injections, as they can strengthen their skills in giving painless injections (cf. Chung et al. 2002) and injecting children.

The level of vaccination competence and factors associated with vaccination competence

This study analyzed levels of vaccination competence and associated factors using a self-assessment and knowledge test. By combining these two, a more comprehensive view of competence was generated. The next sections will discuss the results of these two tests.

Self-assessment

In this study, a satisfactory level on the VAS self-assessment was considered to be an average of 8.0 (optimal mean 10.0) on the different measures. The optimal result can be considered an ideal to which one aspires. On the self-assessment, the average for students was 7.9, while for PHNs it was 8.3, so students rated themselves significantly lower than professionals. In their total scores, students did not rate themselves as reaching a level of satisfactory, but they did reach above 8.0 on two subscales, competent implementation of vaccinations and outcomes of the competent implementation of vaccination. On the third subscale, vaccinator qualities, the average remained under the level of satisfactory. Although the students assessed themselves as having less than a satisfactory level of competence, this result is not cause for concern, as their self-assessment will likely increase with additional work experience vaccinating clients. In addition, it is worth noting that their average score (mean 7.9) is very close to the satisfactory level. In the self-assessment, PHNs rated themselves above 8.0 in both their total score as well as in two subscales (competent implementation of vaccinations and outcomes of the competent implementation of vaccinations); only vaccinator qualities remained under the level of satisfactory.

Neither group (students and PHNs) ranked themselves as reaching the optimal level, i.e. a score of 10, in either their total score or in any of the subscales. However, PHNs were relatively close and overall the scores demonstrate that both PHN students and PHNs consider themselves to be fairly competent.

Both students and PHNs rated themselves highest on the outcomes of vaccination and weakest on vaccinator qualities. Students who had had the opportunity to administer a lot of vaccinations during their training assessed their vaccinator competence as satisfactory. In other words, the opportunity to administer many vaccinations increased the students' awareness of their own competence and therefore raised their scores on the self-assessment. The fact that both groups assessed their vaccinator qualities as weak can perhaps be partially explained by the content of the instrument. For example, the items including writing articles and contacting decision makers (See items numbers 23 and 24, Appendix 3) perhaps do not adequately reflect the reality of the work of Finnish PHNs. In this sense, the content validity of the instrument still needs improvement.

Students who had had a great deal of preclinical teaching and who were highly-motivated for vaccinator education assessed themselves more highly than the others. It seems, therefore, that plenty of practice administering vaccinations during preclinical teaching strengthens student awareness of their own competence, which translates into a higher score on the self-assessment. Of the PHNs, those who were older, had worked for a longer time in the health care sector, who vaccinated frequently, who worked in school health care and who were motivated to attend further training in vaccination education, assessed themselves more

highly. PHNs working in occupational health care assessed their skills more lower than those working in other sectors, or perhaps they administer vaccinations less frequently than PHNs working in other sectors.

According to results of multivariate analysis, when all background factors were taken into account, there was no longer a significant difference in the self-assessment between the two groups. Thus, it can be expected that after going to work, getting more experience vaccinating clients and with increased age, the PHN students will rate themselves higher and reach the same level as the PHNs of this study. Nevertheless, vaccination education at the basic level should include adequate amounts of preclinical teaching, where students can practice giving injections in class, as well as practical work with clients during their training.

Knowledge test

In this study, a satisfactory result on the knowledge test was considered to be 80% (optimal 100%) of the correct answers. The average total scores for students and PHNs were 76% and 83%, respectively. Students achieved a level of satisfactory in vaccination recommendations, contraindications, and managing an anaphylactic reaction, but not in their total scores, recommended injections sites, aseptic practices or vaccination names (or whether there was a vaccination against a given disease or not). In addition to their total scores, PHNs exceeded the 80% level in their knowledge of vaccination recommendations, contraindications and recommended injection sites, but fell short in managing an anaphylactic reaction, aseptic practices and vaccination names.

The largest difference between groups on the knowledge test was names of vaccinations (and whether a vaccination existed for a given disease or not). This difference was significant (students 56% vs. PHNs 78%, $p < 0.0001$). The smallest differences were in contraindications and aseptic practices. Both students and PHNs knew vaccination recommendations and contraindications the best. By contrast, American nurse students were similarly most knowledgeable about vaccination recommendations, but had weaker knowledge of contraindications (Harr et al. 2001). Many studies have also shown that vaccinators had poor or variable knowledge of contraindications (Siegel & Schubert 1996, England et al. 1997, Hsu et al. 1997, Harr et al. 2001, Harris et al. 2001, Cohen et al. 2003, Leask et al. 2004, Petoussis-Harris et al. 2004, Wallis et al. 2004, de la Hoz et al. 2005, Petoussis-Harris et al. 2005). In addition, a Canadian study demonstrated that nurse students had significantly lower knowledge scores than medical and pharmacist students in immunization knowledge (Pelly et al. 2010).

Public health nursing students were weakest on names of vaccinations (or whether there was a vaccination against a specific disease or not). The weak performance of students is most likely due to the fact that they have had relatively little practical experience administering vaccinations; the students who had had the most practical experience of administering vaccinations also knew the names of vaccinations the best. The weak result of students can also be explained by the fact that during the studies, the names of vaccinations might not have been studied, nor the diseases for which vaccinations already exist. PHNs, too, have room for improvement in their knowledge of vaccination names. This result may be partially explained by the fact that the knowledge test asked questions about vaccinations for people of different ages, and it might be that those working with children, for example, don't know vaccinations for adults, and vice versa.

In knowledge of handling anaphylactic reactions, the students had a better result than the PHNs (83% vs. 79%). It might be that the students had recently been tested in this area before graduation. The older students had the best knowledge. On one hand, this might be because older students understand the seriousness of anaphylactic reactions and, on the other hand, they may have had to deal with this situation either in their own work in health care or in their families. In their daily work, few PHNs have to deal with an anaphylactic reaction, since they are so rare, fewer than one/one million vaccinations (Terveyden ja hyvinvoinnin laitos 2009). Despite their rarity, research has stressed the importance of being able to identify, treat and report such reactions (Bohlke et al. 2003, Brotherton et al. 2008). It is important to remember, however, that this study was not able to observe the real activity of PHNs in vaccination practice.

In terms of aseptic practices, neither group reached the required level for satisfactory (80%), as students had 77% and PHNs 78%. There is thus room for improvement in both groups. Similar results have been obtained regarding nurses' aseptic practices in hospitals in Finland and the USA, where only one-third of the participants were aware of proper hand hygiene recommendations (Kennedy et al. 2004, von Schantz 2005). By contrast, research on Finnish hospital health care workers showed that they had good or excellent knowledge of hand hygiene recommendations (Routamaa & Hupli 2007). Respondents were asked about disinfecting their hands both before and after injections, as according to current regulations should be done in all contacts with clients (e.g. Syrjälä et al. 2005). The participants were also asked about disinfecting the injection site before the injection. The weak result may stem from the fact that although currently it is believed that there is no benefit to disinfecting the injection site, many continue to disinfect it, thus following old disinfection practices.

The results of the students on the knowledge test were connected with the amount of preclinical training and the number of different-aged clients vaccinated during the training periods. Those who were older and who had vaccinated a lot of differently-aged persons during their training had better results on the knowledge test. In multivariate analysis, the amount of preclinical teaching in vaccination was negatively correlated with the results in knowledge test: those having less teaching earned better results than those with much teaching. This might be explained by the fact that these participants had thus had more theoretical training, which allowed them to better absorb vaccination knowledge. This finding in no way implies that preclinical teaching should be cut, as it is indeed a crucial part of public health nursing education. Only there can students safely practice injection techniques before vaccinating real clients in authentic vaccination situations.

Of the PHNs, those working in occupational health and home nursing had the weakest results. This might be due to the fact that the instrument contained many statements about the vaccinations of children and youth, which PHNs who primarily work with adults might not run across in their daily work (e.g. vaccinations against children's diseases and where in the body these injections are given to children). It might also be that fewer vaccinations are given in occupation and home nursing than in the other sectors. This area would require further research.

Of the PHNs, those working in child health clinics were more like to give vaccinations daily than those working in other sectors. According to univariate analysis, the results were better than those of PHNs who did not work in child health clinic. Multivariate analysis did not, however, provide new information on this. When interpreting these results, it is important to remember that many PHNs work in several sectors, e.g. PHN working in child health clinic might also work in a school health care and outpatient clinic.

This study also reveals that those respondents who sought further information in National Institute for Health and Welfare (NIHW) publications assessed themselves more highly and did better on the knowledge test. Good vaccinators thus sought further information in the print and electronic publications of the NIHW. The opposite result was obtained in a UK study, which found that vaccinators were either not aware that national research materials were available (e.g. the Green Book), or did not know how to use them (Petrovic et al. 2001).

In multivariate analysis, when all significant background variables were taken into account, there was still a significant difference between students and PHNs, with PHNs being better. Work experience vaccinating clients appears to increase knowledge, as age itself does not explain the difference. It is possible that this study did not collect the background factors which would explain this difference, so in the future it would be important to test the influence of different background factors.

Self-assessment is subjective. Many tend to rate their own abilities either too low or too high. It is therefore important that alongside self-assessment, there are also more objective measures, such as a knowledge test. By using both types of measures, we can form a more comprehensive view of vaccination competence.

In this study, satisfactory vaccination competence was considered to be 80% correct answers on the knowledge test, both as a total score and for each section. In the future, we might ask whether this level should be raised, for example to 90% or even 100%. Furthermore, we also need to consider the balance between different sub-sections. For example, is section X more important than section Y and how should this be taken into account in the evaluation of competence or teaching of students. In this study, they were taken as equally important.

7.2. Trustworthiness, validity and reliability of the study

In this section, the trustworthiness, validity and reliability of the two phases will be examined separately, first the interview (Papers I, II) and then the questionnaire phase (Papers II, IV, V).

Trustworthiness of the interview study

In Phase I the data were collected by semi-structured interviews. The trustworthiness of the study was assessed by estimating its credibility, dependability, confirmability and transferability (Lincoln & Guba 1985, Catanzaro 1988, Miles & Huberman 2001, Polit & Beck 2008, Burns & Grove 2009).

Credibility deals with the focus of the research and refers to confidence in how well the results are in line with the participants' ideas about the information being gathered, the truth of the data and their interpretations (Miles & Huberman 2001, Polit & Beck 2008). The selection of participants also has an effect on credibility (Graneheim & Lundman 2004). In this study, participants were selected on the basis of how well they fulfilled the selection criteria, which essentially meant that they had expert knowledge and experience of vaccination. Participants were selected who wanted to participate in the study and who had the ability to express themselves sufficiently well (Morse 1991). Participants were informed well ahead of time of the interview's topics. In order to draw the widest and most reliable picture, the topic was explored from several angles (Mackenzie 1994): those of PHN professionals (e.g. teachers of vaccination, vaccination professionals from different sectors, PHNs involved in administering vaccinations, and physicians), PHN students, and clients of

different ages (Paper II, Table 2). Interviews were conducted with a large number (n=40) of people from the different groups, in order to obtain as much information as possible about the subject. The topics were piloted and determined to work well.

The researcher both conducted and transcribed the interviews, which increases reliability. Efforts were made to gather data in group interviews, though due to scheduling issues, doctors and clients were interviewed individually. In addition, all of the interviews were taped, which meant that authentic comments could be transcribed. During the taping, the researcher took only very few notes, so as not to disturb the participants (Burns & Grove 2009). The researcher considered the results of the previous interviews before going on to the next one. The researcher's confident way of handling the tape recorder also helped to gain the trust of the interviewees (May 1991).

Participants were assured of the study's confidentiality, that they would be treated anonymously, and that participation was voluntary. Topics were discussed freely until no new aspects emerged and data saturation was reached. The interaction between the researcher and the interviewees was informal and based on trust. The researcher kept a research diary (describing her experiences and considering her choices), wrote down her thoughts and observations immediately after the interviews, and made use of these notes during the reporting phase. All phases of the research were written down in detail.

Dependability means that the results can be confirmed with other research; the study can be repeated using the same protocol, across researchers and methods (Lincoln & Guba 1985, Miles & Huberman 2001). Dependability of qualitative data refers to the stability of data over time and over conditions (Polit & Beck 2008). The researcher should describe the basis and process of drawing the conclusions, for giving the other researchers opportunity to follow the decisions made (Miles & Huberman 2001, Yardley 2000). The transcriptions of the data were coded using different colors. The key point in each statement was identified, and simplified into a suitable "meaning unit." During this phase, the risk of incorrectly interpreting the data is large, so special care was taken. Content analysis requires the researcher to be creative (Morse 1991, Graneheim & Lundman 2004). In content analysis, problems can be caused by the subjectivity of the analyst (Catanzaro 1988, Burns & Grove 2009), so it essential to include several researchers in the process of coding. In this study, efforts to improve trustworthiness included the main researcher discussing aspects of the analysis with other researchers in an effort to reach consensus, especially in problem situations. In addition, the researcher discussed some of the results with some of the interviewees. In describing the data, the researcher often returned to the raw data, the original statement, in order to check the analysis.

In reporting the results, dependability was further enhanced by including many original quotations. In addition, examples have been provided of the abstraction process (Paper I, Table 1 and Paper II, Table 3) to allow others to evaluate the formulation of the main categories (Cavanaugh 1997).

Confirmability refers to the objectivity or neutrality of the data (Polit & Beck 2009). The researcher's own hypotheses or previous experiences can influence the research process, so in this study all efforts were made to ensure that the researcher's own opinions and experiences had no influence on either the analysis or results (Mays & Pope 2000). In addition, all the different phases of the analysis process have been documented and reported (Polit & Beck 2008). In order to ensure confirmability, the researcher coded the data several times at regular intervals.

Transferability refers to the extent to which the findings from the data can be transferred to other settings or groups and is thus similar to the concept of generalizability (Lincoln & Guba 1985, Miles & Huberman 2001). The interpretation of the results is the researcher's personal opinion, so the interpretation is neither repeatable nor transferable to other contexts (Denzin 2000). The researcher has tried to carefully describe the participants and research environment, so readers can judge for themselves potential transferability (Lincoln & Guba 1985, Miles & Huberman 2001). In this study, the interviewees were exceptionally highly-motivated and excited about discussing their own views on vaccination competence, and their own experiences with vaccination. It's likely that their views and experiences are typical of other recent public health nursing graduates and working PHNs who were not included in this research population.

Validity and Reliability of the Survey

In this section, the reliability of both the PHN student and PHN surveys is discussed together, since they were conducted in the same way using the same instruments: self-assessment and knowledge test.

In Phase II the data were collected by structured instruments. Validity can be considered in terms of both internal and external validity. Internal validity refers to the degree to which an instrument measures what it is supposed to measure. Three types of internal validity are often reported: content validity, construct validity and criterion validity (Miles & Huberman 2001, Polit & Beck 2008, Burns & Grove 2009). Content, construct and criterion validity will be examined in the next sections.

Internal validity

Content validity is the most important type of validity, and is used to evaluate the operationalization of the concept (Polit & Beck 2008). It reflects the extent to which the instrument and its items include all the major elements relevant to the construct being measured (Burns & Grove 2009). The instruments were developed for this study and were being used here for the first time. The items were based on the literature review, previous research and interviews conducted in Phase I, plus the researchers' own practical experience. The instruments were piloted with both PHN students and PHNs.

The instruments could be criticized for not being entirely comprehensive. For example, the instrument could have included statements about the adverse events of vaccinations, as well as the storage and disposal of vaccines. On the other hand, the instrument may have included statements which are less relevant in practical daily work of PHNs, such as writing articles for journals or being in contact with decision-makers.

Construct validity determines whether the instrument actually measures the theoretical construct it is intended to measure (Burns & Grove 2009). It is the most difficult and complex type of validity. The more abstract the concept, the more difficult it is to achieve construct validity (Polit & Beck 2008). The structure of the self-assessment was checked through explorative factor analysis (Appendix Table 2) (Burns & Grove 2009). In factor analysis the original theoretical structure can be explored by analyzing how the data aligns with the hypothesized factors (Nummenmaa et al. 1997). If in the factor analysis the items of a sum variable have high loadings on the same factor, this can be seen as supporting the structure of the instrument.

The results of the factor analysis provide good support for the Vaccinator Qualities sum variable in the PHN data; only two items had high loadings on other factors. These items considered writing for journals and other publications and contacting decision-makers. In the PHN student data, the factor analysis was not as supportive although most items of this sum variable had high loadings on the same factor. Factor analysis gave good support for the Competence in preparing for vaccination sum variable in the PHN data. In the PHN student data, the results were more complex and this sum variable was not supported by the analysis.

Competence during vaccination was, in the factor analysis, the most problematic. In the PHN data, the items were located on four different factors, and no clear structure could be determined. In the student data, the situation was similar. However, the vast majority of the items of this sum variable had a loading of 0.30 or more on one factor, which at least in part supports the fact that they are measuring the same thing. This section of sum variables included different vaccination techniques and vaccination of different-aged groups. It might be that PHN students felt in command of all the things they had just learned, whereas those who had already been working for a longer time felt as though they had specialized in a specific sub-category of vaccination (e.g. occupational or home nursing), and did not feel that they possessed general competence in the ways the instrument described such competence. In the PHN data, competence after vaccination was the sum variable most strongly supported by the factor analysis. Only the section "monitoring the client's well-being" seemed to be located in another factor. In the student data, this result was a little less clear. Both data sets supported the outcome of the implementation of vaccination factor.

In general, the sum variables of the self-assessment were supported rather well by the factor analysis, although there were a few problem areas. It was easier to see a clear structure in the PHN data, but student results were similar, though not perhaps as clear. After factor analyses the items which did not load on their original theoretical factors were evaluated. However, to maintain the content validity of the instrument all items were kept in their original sum variables.

The construct validity of the instruments was also assessed by checking the correlation between the self-assessment and the knowledge test (Appendix Table 5). For the PHNs, the self-assessment correlated quite strongly with the result on the knowledge test, i.e. a good self-assessment was connected to a good result on the knowledge test. In addition, the totals on the sub-categories of the self-assessment were positively correlated with the total score on the knowledge test, as well as on many of the sub-scores. These correlations also support the instrument's construct validity. In the student data, there was not a significant correlation between the total score variables on the self-assessment and knowledge test. Only two significant positive correlations were found: vaccinator qualities correlated with knowing vaccination names and preparing for a vaccination correlated with knowledge of vaccination recommendations. For the students, however, almost all results were not correlated. It seems thus that students are not able to assess their vaccination competence realistically, or in other words, their self-assessments were not in line with their results on the knowledge test. In this sense, the data did not support construct validity (Appendix Table 5).

Criterion validity means that the results obtained by the instrument used can be proportioned to and reflect against the result obtained by another instrument measuring the same research topic (Nummenmaa et al. 1997). In this case, however, a useful existing instrument was not reported.

External validity

External validity refers to representative sample sizes and the generalizability of the results (Burns & Grove 2009). In order to get reliable results, this study included a representative sample from both groups: 143 graduating nursing students and 484 PHNs. In 2006, a total of 672 PHN graduated, so the number of participants was approximately 20% of this amount. The number of PHNs included corresponds to approximately 3% of those working in health centers (Terveydenhuollon oikeusturvakeskus 2007a, 2007b). The response rate for students was 90% (n=129) and for PHNs 84% (n=405), so response rates were good. Non-participation was random and small. There was no attrition during the permission-seeking stages, as research permission was granted by all the units contacted. In one school and one health center where the principal researcher did not herself gather data, attrition was higher than in other locations, so the researcher's direct contact with respondents reduced attrition. Validity could have been improved by using mathematical means to calculate sample sizes (Polit & Beck 2008). Power analysis was not performed to determine adequate sample sizes (Burns & Grove 2009), because these instruments were being used for the first time and efforts were made to make the sample sizes as large as possible.

The timing of the study may influence its external validity (Burns & Grove 2009). The data were gathered in 2008, student data in March-May and PHN data in August-November. Students responded during one of their lessons, and the PHNs during working hours, which no doubt had a positive effect on participation rates. Finland's vaccination program has changed to some extent since then, so students and nurses have likely received vaccination training since the data were collected, so these data are specific to the time of data collection.

Reliability

Reliability is defined as the extent to which random error is minimized, and the study can be said to provide reliable results. Random errors are associated with 1) the researcher; 2) the respondents; 3) circumstances and 4) the quality of the instrument. Random error can be caused, for example, by the unwillingness of respondents to participate, fatigue, disturbances taking place during the testing situation, or uncertainties connected to the instrument, i.e. if the statements do not apply to the respondent, e.g. statements about adult vaccinations for a respondent who only vaccinates children (Nunnally & Bernstein 1994, Polit & Beck 2008, Burns & Grove 2009).

Efforts were made to motivate participants through the use of a cover letter and oral information provided prior to the testing situation. Another effort to increase the reliability of data collection was giving the directions in the same way to all participants (Burns & Grove 2009). The response rate was high, and in general, the forms were filled out carefully. The respondents also gave positive oral feedback on the importance of the study, showing that they were motivated to participate. In addition, the large numbers of participants also ensures reliability, as with a larger group it is easier to demonstrate similarities and differences (Burns & Grove 2009). Efforts were also made to keep the research environment as peaceful and similar as possible. For the most part, data were collected from students in a supervised classroom as part of a class session, and from PHNs in conference rooms or auditoria during working hours.

The instrument's reliability was tested by using Cronbach's alpha coefficient (Appendix Table 6, Appendix Table 7), which provides information about the instrument's consistency. The higher the reliability coefficient, the more consistent the instrument is (Polit & Beck

2008). In new instruments, an alpha score of 0.60 is considered to be acceptable. For already tested, existing instruments, a score of at least 0.70 is required (Burns & Grove 2009). According to Nunnally & Bernstein (1994), a score of 0.60 is acceptable in survey studies. According to these results, especially the knowledge test portion of the instrument needs to be developed.

For the PHN students, the alphas of the self-assessment scale (VAS) proved acceptable in all sum scores (Appendix Table 6). The values ranged between 0.61 and 0.86, the sum being 0.90. As for the knowledge test, the value for the whole test proved good (0.78), although considerable variation was found. The values attained ranged between 0 and 0.82. The only accepted alpha (0.82) was in the sum score of the names of vaccines. In all others, the alpha was lower than 0.70, most values falling below 0.30 (Appendix Table 7). For the PHNs, the alphas of the self-assessment scale (VAS) proved acceptable in all sum scores except preparing for vaccinating (0.57) and competence after vaccination (0.55). The values ranged between 0.55 and 0.86, the sum being 0.89 (Appendix Table 6). In the knowledge test the values ranged between 0.18 and 0.87, the sum being 0.80 indicating high internal consistency. The only accepted alpha (0.87) was in the sum score of the names of vaccines. In all others, the alpha was lower than 0.60, with most falling below 0.48 (Appendix Table 7).

The data were analysed item-by-item and reported as sum scores. In an effort to avoid false interpretations, other researchers were asked to evaluate the items. The items on the instrument were based on the results of the interview study, previous research, and the practical experience of the researchers. Efforts were made to ensure that the physical properties of the questionnaire—such as the use of clear language, logical construction, and plenty of white space to make reading easier—helped to increase the motivation of respondents and decrease the possibility of errors. The instrument did not contain negative statements or questions which might make answering more difficult (Burns & Grove 2009).

Measuring the lines on the VAS-scale might lead to errors, so special care was taken when measuring these lines. In order to further ensure reliability, 20% of the lines were re-checked; in other words, another researcher re-measured every fifth answer on the response sheets. Almost all of the measurements were identical.

7.3. Suggestions for vaccination education and nursing practice

The topic of vaccination competence is topical for many reasons. In recent years, vaccination has been under discussion in the media, in part because of the swine flu epidemic and a link between the swine flu vaccination and narcolepsy. In these discussions, the role of vaccination has also been of concern, mainly because it has been seen as a global method of promoting health (WHO 1986). This study provides new knowledge on the concept of vaccination competence, the factors strengthening and weakening such competence, and information about the vaccination competence of graduating public health nursing students and working PHNs. The results can be used to improve of competence and suggestions can be made about the concept itself and about the evaluation of vaccination competence and vaccination education both in basic professional and continuing health care education. In the following section, a summary of these suggestions will be presented.

Concept of vaccination competence

Based on these results, vaccination competence (in Finnish: *Rokotusosaaminen*) is a multidimensional concept consisting of a competent vaccinator, competent implementation of the vaccination, and competent outcomes of the vaccination. Vaccination competence can be strengthened by factors related to the vaccinators themselves, vaccination clients, the vaccination environment, and vaccination education. Factors weakening vaccination competence are mostly opposite to the strengthening ones.

This study has given information mainly about the vaccinator, implementation of vaccination and its outcomes. In the future, there is still a need to further clarify the concept. Particularly, it would be important to focus on the vaccination environment and clients.

Level of vaccination competence

Based on these results, this study produced new knowledge about the level of vaccination competence of PHN students and PHNs. Mainly the level was satisfactory (as defined in this study), but also some weaker areas were identifiable. PHN students seem to be very close to achieving the level of satisfactory as defined for this study on the self-assessment but are less close on the knowledge test. PHNs achieved, and even exceeded, the satisfactory level. Both groups, however, achieved a level of satisfactory on several sum variables. This means, that already at the end of basic professional education, PHN students come very close to achieving a satisfactory level of vaccination competence and will continue to improve their competence by practical work.

In vaccination knowledge, some gaps both in the group of PHN students and PHNs were seen. Students achieved a satisfactory level in vaccination recommendations, contraindications and managing anaphylactic reactions. Gaps, however, were identified in their knowledge of aseptic practices, recommended injection sites and vaccination names (as well as whether there were vaccinations against specific diseases or not). PHNs achieved a satisfactory level in vaccination recommendations, contraindications and recommended injection sites; the gaps were seen in aseptic practices, managing anaphylactic reactions and vaccination names (as well as whether there were vaccinations against specific diseases or not). These results need to be generalized with caution, because the knowledge test was used for the first time, and no connection between knowledge and activities in nursing practice was tested.

Knowledge level – both in the group of PHN students and PHNs - correlated positively with having sought information in the publications and handbooks about vaccination (the Vaccinator Handbook (Nohynek et al. 2005), and Traveler's Health Guide (Nohynek et al. 2009) were used as an example). Therefore, for improving competence, use of these sources should be made possible both in education and practice. This would also support a more general requirement for evidence-based practice.

The connection of several background factors to the level of vaccination competence was tested. In multivariate analysis, there were no significant differences between groups in the self-assessment, though differences did remain in the results of the knowledge test. This means, for example, that becoming well-versed in giving vaccinations improves knowledge, and not just increasing age. The background factors included were based on existing literature, but it is possible that some factors explaining the differences are missing. In the

future, particularly factors connected with education, environment and clients would be important to test.

Evaluation of vaccination competence is a challenging task. In this study, both self-assessment and a knowledge test were used. Both were being tested for the first time with a large data population, and it is clear that both could be further developed. For getting a more comprehensive view of vaccination competence, it would also be useful to develop clinical tests and observation instruments. Also, it might be worth developing different instruments for students and professionals, or for those vaccinating children and adults. In the interviews of this study, the idea was raised that children would only be vaccinated by PHNs practiced in vaccinating children of different ages, so more specialized instruments could be developed to aid them in their work.

Evaluation of the level of vaccination competence can also be useful for management, e.g. for recruitment and development discussions. This study gives basis to evaluative instruments, but has focused less on process of evaluation. One managerial change might be to centralize the administering of vaccinations, so only workers who are especially interested and motivated to vaccinate would administer vaccinations. On the other hand, the PHNs who participated in this study were very interested in participating in vaccination continuing education, which demonstrates that at least Finnish PHNs want to administer vaccinations and maintain their vaccination competence.

Vaccination education

This study produced knowledge about vaccination competence for both basic professional and continuing education. The content of vaccination education in the basic professional education of PHNs is defined in curricula on a rather general level. Based on the results of this study, it would be important especially to check the content in aseptic practices, injection sites and vaccination names (as well as whether there is a vaccination for a specific disease or not), as these were the areas where students demonstrated the most weaknesses. In terms of the continuing education of PHNs, aseptic practice, managing an anaphylactic reaction and vaccination names need special attention (as well as whether there is a vaccination for a specific disease or not), as these were the areas where PHNs demonstrated weaknesses.

Educational methods were not investigated in this study. Based on these results, however, some suggestions can be made. For example, it would be important to identify the possible gaps in knowledge of vaccination as early as possible during education. This would require development of new educational methods, like a "Vaccinator's License," [*Rokottajan ajokortti*] to monitor vaccination competence. Also, it seems to be important to give opportunities to practice vaccination during education with clients of different ages.

Based on this study, the connection between vaccination competence and curricula is obvious. In Finnish polytechnics, vaccination education for PHNs is mainly integrated into different courses. It would be important to analyse the vaccination content in the curricula, too. This, however, is difficult due to differences in the curricula in different polytechnics, and continuous change and development of the curricula.

7.4. Suggestions for further research

This study is one of the first in the field of vaccination competence. Thus, many suggestions for further research can be made, as follows.

- Further concept analysis and/or clarification of vaccination competence would be important in the future. In addition, an even more comprehensive view of competence could be gained by adding the observations of an outside observer to a genuine vaccination situation. These outside observers could focus on the specific practical steps (such as handling vaccinations, vaccination techniques, record-keeping), interpersonal communication (such as obtaining consent to administer the vaccination, guidance and counseling) and solving problem situations. Concept analysis might further open up dimensions of vaccination competence.
- Both instruments used to evaluate vaccination competence, the self-assessment and knowledge test, need to be developed in the future, both in terms and of their content and structure. Electronic versions of these instruments could also be developed, and these could be tested internationally as well. Future work might also focus on whether the classification of a "satisfactory" level of competence (a mean of 8.0 on the self-assessment, and 80% on the knowledge test) should be raised, and what kind of grading scales above and below these scores might be developed (if this were considered necessary).
- Educational interventions for improving vaccination competence should be tested. This study has produced descriptive data about vaccination competence. By using intervention studies, the meaning of different teaching methods and content could be analysed. In these interventions, also the role of client and families of children could be taken in account.
- Also, in terms of education, public health nursing curricula, teaching methods, and the contents of vaccination education should be investigated. In the Finnish context, as part of curricular planning, it would be important to analyze the contents of vaccination education, the depth and breadth of such education (including the number of hours devoted to the subject), as well as the teaching methods, and to determine which methods, or combinations of methods, produce the best results. Research might focus on how current vaccination education strengthens vaccination competence. In addition to PHNs, other health care professionals should also be included in future studies, because other health care professionals are increasingly administering vaccinations in Finland (e.g. nurses at private clinics).
- To date there have only been a few studies focusing on students, so further studies in this area would be especially important. In the future, it would also be important to further study the significance of clients, especially parents and families, as this study highlighted clients as a factor strengthening vaccination competence.
- In some clinical fields, PHNs vaccinate more than in others. In this study, vaccination competence was measured in this study with one instrument. In the future, there is a need to analyse the possible need to separate the evaluative instruments according to clinical fields.

In summary, many areas for future studies can be named. Vaccination is a worldwide preventive intervention, so in the future cross-cultural studies in the field will also be required.

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Huuvvari, Ylä-Nikula, November 2011

Anne Nikula

APPENDICES AND APPENDICES TABLES**Appendix 1.** Interview Topics

Vaccination competence and factors strengthening and weakening it

12.11.2004.

Opening

Discuss aims of the interview, and how it will proceed. Ensure that permission to tape record has been obtained from all participants.

Topic 1. Begin with open discussion with all participants on the topic: What is vaccination competence?

Topic 2. Competent vaccinator. What are the qualities of a competent vaccinator?

Topic 3. Competent implementation of vaccination. What would competence implementation of a vaccination? What is competent implementation of a vaccination like?

Topic 4. Outcomes of competent implementation of vaccination. What would constitute competent outcomes of vaccination?

Topic 5. Strengthening vaccination competence. What factors do you see as strengthening vaccination competence?

Topic 6. Weakening vaccination competence. What factors do you see as weakening competence?

Topic 7. Assess the vaccination competence of PHNs in Finland, on a scale of 1-10.

Thanking the participants, and inquiring whether they have anything more to add.

Appendix 2. Kyseilylomake terveydenhoitajaopiskelijoille

Turun yliopisto. Hoitotieteen laitos. ”Rokotusosaaminen. Arvio valmistuvien terveydenhoitajaopiskelijoiden ja terveydenhoitajien rokotusosaamisesta”.

KYSELYLOMAKE VALMISTUVILLE TERVEYDENHOITAJAOPISKELIJOLLE

TAUSTATIEDOT

ID-koodi _____ (tutkija täyttää)

Ympyröi jokaisessa kohdassa valitsemasi vaihtoehdon numero tai kirjoita vastauksesi sille varattuun tilaan.

1 Sukupuolesi

1 nainen

2 mies

2 Ikäsi vuosina _____

3. Oletko ylioppilas?

1 kyllä

2 en

4. Onko Sinulla aikaisempi terveydenhuoltoalan tutkinto?

1 ei (Mikäli vastasit ei, niin siirry kysymykseen 7).

2 kyllä Mikä? _____ Valmistumisvuosi? _____

5. Työssäolikasi terveydenhuoltoalalla ennen terveydenhoitajakoulutuksen alkua?

_____ vuotta, jos alle vuoden, niin _____ kuukautta

6. Kuluuko työhösi terveydenhuoltoalalla ennen terveydenhoitajakoulutuksen aloittamista injektioiden (esim. lääke-, vitamiini- tai hormoni-) tai injektioina annettavien rokotusten antaminen?

1 kyllä

2 ei

7. Kuinka paljon terveydenhoitajakoulutuksen opinnoissasi on ollut rokottamisen teoriaopetusta?

5 erittäin paljon

4 melko paljon

3 melko vähän

2 erittäin vähän

1 ei lainkaan

8. Kuinka paljon terveydenhoitajakoulutuksen opinnoissasi on ollut rokottamisen laboraatio-opetusta?

5 erittäin paljon

4 melko paljon

3 melko vähän

2 erittäin vähän

1 ei lainkaan

9. Kuinka paljon terveydenhoitajakoulutuksen opinnoissasi on ollut arvioitavia kirjallisia oppimistehtäviä tai tenttejä rokottamisesta?

5 erittäin paljon

4 melko paljon

3 melko vähän

2 erittäin vähän

1 ei lainkaan

10. Kuinka paljon terveydenhoitajakoulutuksen opinnoissasi on ollut eri-ikäisten ihmisten rokottamista ohjatussa harjoittelussa käytännössä?

5 erittäin paljon

4 melko paljon

3 melko vähän

2 erittäin vähän

1 ei lainkaan

11. Onko terveydenhoitajakoulutuksen aikana ollut käytössäsi Lääkehoidon passi (tai jokin muu vastaava dokumentti), jonka avulla on seurattu rokottamisen osaamista?

- 1 kyllä
- 2 ei

12. Mistä seuraavista lähteistä olet hakenut tietoa rokottamisesta koulussa annettun opetuksen lisäksi? Ympyröi tarvittaessa useampia vaihtoehtoja.

- 1 Kansanterveyslaitoksen toimittamien käsikirjojen kirjaversioista (Rokottajan käsikirja ja Matkailijan terveysopas)
- 2 internetin verkkosivuilla olevista sähköisistä Kansanterveyslaitoksen toimittamista käsikirjoista (Rokottajan käsikirja ja Matkailijan terveysopas)
- 3 hoitotieteellisistä lehdistä, mistä? _____
- 4 hoitotyön ammattilehdistä, mistä? _____
- 5 lääketieteellisistä lehdistä, mistä? _____
- 6 kirjoista, mistä? _____
- 7 muualta, mistä? _____
- 8 en mistään

13. Mitä seuraavista olisit kaivannut lisää rokottusopetukseen terveydenhoitajakoulutuksen aikana?

- 1 teoretietoa, mistä? _____
- 2 arvioitavia oppimistehtäviä ja tenttejä
- 3 eri rokotteiden (i.d., s.c., i.m.) harjoittelua, minkä mielisä? _____
- 4 Mantoux-kokeen tekemistä ja lukemista
- 5 käytännön harjoittelea eri-ikäisten asiakkaiden rokottamisessa, minkä ikäisten? _____
- 6 muuta, mitä? _____
- 7 en mitään

14. Kuinka motivoitunut olet ollut rokottamisen oppimisesta koulutuksen aikana?

- 4 erittäin motivoitunut
- 3 melko motivoitunut
- 2 vähän motivoitunut
- 1 en lainkaan motivoitunut

15. Miten motivoitunut olet osallistumaan rokottamista koskevaan koulutukseen valmistumisesi jälkeen?

- 4 erittäin motivoitunut
- 3 melko motivoitunut
- 2 vähän motivoitunut
- 1 en lainkaan motivoitunut

16. Millaiseksi koet rokottamisen?

- 3 helpoksi
- 2 vaikeaksi
- 1 muuksi, millaiseksi? _____

17. Haluaisitko koulusta lisää rokottamisesta valmistumisesi jälkeen? Jos, niin mitä? Ympyröi tarvittaessa useampi vaihtoehto.

- 1 teoretietoa, mistä? _____
- 2 matkailijoiden rokottamisesta
- 3 maahanmuuttajien rokottamisesta
- 4 käytännön harjoittelea, mitä? _____
- 5 muuta, mitä? _____
- 6 en mitään

ROKOTTAJAN OMINAISUUDET

Pyydän Sinua arvioimaan, missä määrin seuraavat väittämät kuvaavat Sinua itsäsi rokottajana vastaamishetkellä.

Käytä arvioinnissa oikeista janaa.

0 - ei kuvaa minua lainkaan



10 - kuvaa minua erittäin hyvin

Laita pystyviiva janalle siihen kohtaan, joka mielestäsi kuvaa itseäsi.

18. Rokottajana olen varma



19. Aistin herkästi rokolettavan asiakkaan tunnelilan ja toimin sen mukaan.



20. Rokottaminen on tärkeä terveyden edistämisen menetelmä työssäni.



21. Rokotustietoni ovat ajan tasalla.



22. Rokotustaitoni ovat ajan tasalla.



23. Otan itse aktiivisesti puheeksi rokottamisen asiakkaan kanssa.



24. Kirjoitan rokottamisesta lehttiin tai muihin julkaisuihin.



25. Otan rokottusasioissa tarvittaessa yhteyttä päättäjiin.



26. Anna kokonaisarvosana itsellesi omista ”Rokottajan ominaisuuksiasi”



ROKOTTAMISEN KÄYTÄNNÖN TOTEUTUS

Pyydän Sinua arvioimaan, missä määrin seuraavat väittämät kuvaavat osaamistasi rokottamisen käytännön toteutuksessa vastaamishetkellä.

Käytä arvioinnissa ohjeista janaa.
 0 - ei kuvaa minua lainkaan 10 - kuvaa minua erittäin hyvin

Laita pystyvä janaalle siihen kohtaan, joka mielestäsi kuvaa itseäsi.

Seuraavat väittämät koskevat valmistautumistasi rokottamiseen.

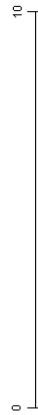
27. Varaan rokotusvälineet valmiiksi hyvissä ajoin ennen asiakkaan tapaamista.



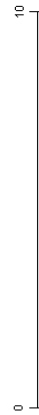
28. Varaan rokkoaineet valmiiksi hyvissä ajoin ennen asiakkaan tapaamista.



29. Tutustun uuden rokotteen tuoteselosteeseen.



30. Tarkistan asiakkaan terveyskertomuksesta aiemmin annetut rokotukset.



31. Varaan lääkkeaineet mahdollisen anafylaktisen reaktion hoitamista varten.



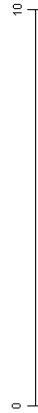
32. Tarkistan, että anafylaktisen reaktion kirjalliset hoito-ohjeet ovat näkyvillä.



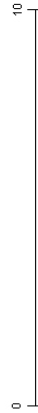
33. Kysyn asiakkaalta tai alaikäisen lapsen vanhemmalta luvan rokottamiseen.



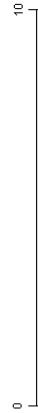
34. Arvioin asiakkaan rokotuskelpoisuuden.



35. Teen päätöksen rokotuksen antamisesta.











36. Perustelen ohjaukseni rokotettavalle (esim. vanhemmalle lapsen kiinnipitämisestä).



37. Ohjaan asiakasta konkreettisesti osallistumaan rokottamiseen (esimerkiksi, miten lihas rentoutetaan).



Seuraavat väittämät koskevat osaisiasi rokotamisen aikana.

38. Hallitsen i.d. -rokotustekniikan. 
39. Hallitsen s.c. -rokotustekniikan. 
40. Hallitsen i.m. -rokotustekniikan. 
41. Hallitsen p.o.-rokotteiden antamisen. 
42. Hallitsen Mantoux-kokeen tekemisen. 
43. Hallitsen Mantoux-kokeen lukemisen. 
44. Hallitsen imeväisikäisten (<1v) lasten rokotamisen. 
45. Hallitsen leikki-ikäisten (1-6v) lasten rokotamisen. 

46. Hallitsen kouluikäisten lasten ja nuorten (7-17v) rokotamisen. 

47. Hallitsen aikuisten rokotamisen (18-65v). 

48. Hallitsen ikäihmisten (>65v) rokotamisen. 

49. Hallitsen aseptisen työskentelyn. 

50. Hallitsen anafylaktisen reaktion hoidon. 

51. Olen taiava keksimään erilaisia selviytymiskeinoja pulmatilanteissa (jos asiakas esim. pelkää). 

ROKOTTAMISEN KÄYTÄNNÖN TOTEUTUKSEN LOPPUTULOKSET

Pyydän Sinua arvioimaan, missä määrin seuraavat väittämät kuvaavat rokottamisesi käytännön toteutuksen lopputuloksia.

Käytä arvioinnissa oheista janaa.

0 ————— 10
 0 - ei kuvaa minua lainkaan 10 - kuvaa minua erittäin hyvin

Laita pystyviiva janalle siihen kohtaan, joka mielestäsi kuvaa rokottamisesi käytännön toteutuksen lopputuloksia.

58. Asiakkaalla on positiivisia tunnekokemuksia rokottamisen jälkeen.

0 ————— 10

59. Tunnen itse onnistumisen tunnetta hyvin sujuneesta rokotamisesta.

0 ————— 10

60. Rokottaminen on onnistunut teknisesti.

0 ————— 10

61. Asiakas haluaa ottaa jatkossakin rokotuksia.

0 ————— 10

62. Anna kokonaisarvosana itsellesi omista ”Rokottamisen käytännön toteutuksen lopputuloksista”.

0 ————— 10

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Seuraavat väittämät koskevat osaramiesasi rokotamisen jälkeen.

52. Seuraan asiakkaan vointia vähintään 15 minuuttia rokotamisen jälkeen.

0 ————— 10

53. Keskustelen mahdollisista rokotuksen aiheuttamista yleisimmistä haittavaikutuksista asiakkaan tai alaikäisen lapsen vanhemman kanssa.

0 ————— 10

54. Keskustelen asiakkaan tai alaikäisen lapsen vanhemman kanssa mahdollisista seuraavaksi annettavista rokotuksista.

0 ————— 10

55. Kirjaan antamani rokotukset hoitopaikan terveyskertomusjärjestelmään.

0 ————— 10

56. Kirjaan antamani rokotukset asiakkaan rokotuskorttiin.

0 ————— 10

57. Anna kokonaisarvosana itsellesi omasta ”Rokottamisen käytännön toteutuksestasi”.

0 ————— 10

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KIITOS ARVOKKAISTA VASTAUKSISTASI JA MENESTYSTÄ TYÖSSÄSI!

Items 63-69 Vaccination Knowledge Test, See Appendix Table 1.

Appendix 3. Kyselylomake terveydenhoitajille

Turun yliopisto. Hoitotieteen laitos. ”Rokotusosaaminen. Arvio valmistuvien terveydenhoitaja-
opiskelijoiden ja terveydenhoitajien rokotusosaamisesta”. Anne Nikula.

KYSELYLOMAKE TERVEYDENHOITAJILLE

TAUSTATIEDOT

ID-koodi _____ (tutkija täyttää)

*Ympyröi jokaisessa kohdassa valitsemasi vaihtoehdon numero tai kirjoita vastauksesi sille
varattuun tilaan.*

1. Sukupuolesi

- 1 nainen
- 2 mies

2. Ikäsi vuosina _____

3. Oletko ylioppilas?

- 1 kyllä
- 2 en

4. Terveydenhoitajatutkintosi ja valmistumisvuosi?

- 1 opistoasteen tutkinto, vuonna _____
- 2 ammattikorkeakoulun tutkinto, vuonna _____

5. Onko Sinulla joku muu (yksi tai useampi) terveydenhuollolan tutkinto?

- 1 ei (Siirry kysymykseen 7).
- 2 kyllä, mikä/mikä? _____ Valmistumisvuosi _____
_____ Valmistumisvuosi _____

6. Työssäoloikasi terveydenhuoltoalalla tutkimon suorittamisen jälkeen?

- 1 terveydenhuoltoalalla yhteensä _____ vuotta _____ kuukautta, mistä ajasta
- 2 terveydenhoitajana _____ vuotta _____ kuukautta

7. Kuuluuko työhösi terveydenhuoltoalalla ennen terveydenhoitajakoulutuksen alkua injektioiden
(esimerkiksi lääke-, vitamiini- tai hormoni-injektioiden) tai injektioina annettavien rokotusten
antaminen?

- 1 kyllä
- 2 ei

8. Mikä on työpaikkasi ja kuinka usein rokotat? Ympyröi tarvittaessa useampia vaihtoehtoja.

	Rokotan päivittäin	Rokotan viikoittain	Rokotan harvemmin	En rokota ollenkaan
1 äitiysneuvola	4	3	2	1
2 lastenneuvola	4	3	2	1
3 kouluterveydenhuolto	4	3	2	1
4 opiskeluterveydenhuolto	4	3	2	1
5 avovastaanotto / avosairaanhoidon vastaanotto	4	3	2	1
6 työterveyshuolto	4	3	2	1
7 kotisairaanhoido / kotihoito	4	3	2	1
8 muu, mikä? _____	4	3	2	1

9. Millaiseksi koet rokotuttamisen?

- 3 helpoksi
- 2 vaikeaksi
- 1 muuksi, millaiseksi? _____

10. Mistä seuraavista lähteistä olet hakenut tietoa rokottamisesta? Ympyröi tarvittaessa useampia vaihtoehtoja.

- 1 Kansanterveyslaitoksen toimittamien käsikirjojen kirjaversioista (Rokottajan käsikirja ja Matkailijan terveysopas)
- 2 internetin verkkosivuilta olevista sähköisistä Kansanterveyslaitoksen toimittamista käsikirjoista (Rokottajan käsikirja ja Matkailijan terveysopas)
- 3 lääketieteellisistä lehdistä, mistä? _____
- 4 hoitotieteellisistä lehdistä, mistä? _____
- 5 hoito- ja ammattilehdistä, mistä? _____
- 6 oppikirjoista, mistä? _____
- 7 muualta, mistä? _____
- 8 en mistään

11. Ketä konsultoit rokottamisessa? Ympyröi tarvittaessa useampi vaihtoehto.

- 1 terveydenhoitajaa
- 2 lääkäreitä
- 4 Kansanterveyslaitoksen valtakunnallisen rokottuspuhelinneuvonnan terveydenhoitajaa
- 5 jotakuta muuta, ketä? _____
- 6 en kettään

12. Minkä verran olet osallistunut viimeisen vuoden aikana rokottamista koskevaan koulutukseen?

- 1 _____ työpäivää
- 2 jos vähemmän kuin yksi työpäivä, niin _____ tuntia
- 3 en lainkaan, vaikka olisin halunnut osallistua
- 4 en lainkaan, en ole halunnut
- 5 en lainkaan, koska koulutusta ei ole ollut tarjolla

13. Haluuko koulutusta lisää rokottamisesta? Jos, niin mitä? Ympyröi tarvittaessa useampi vaihtoehto.

1. Kyllä
 - 1 teoriatietoa, mistä? _____
 - 2 matkailijoiden rokottamisesta
 - 3 maahanmuuttajien rokottamisesta
 - 4 käytännön harjoittelua, mitä? _____
 - 5 muuta, mitä? _____

2. En

14. Miten motivoitunut olet osallistumaan rokottamista koskevaan koulutukseen?

- 4 erittäin motivoitunut
- 3 melko motivoitunut
- 2 vähän motivoitunut
- 1 en lainkaan motivoitunut

15. Kenen pitäisi järjestää rokottamista koskevaa koulutusta? Ympyröi tarvittaessa useampi vaihtoehto.

- 1 oman työpaikan
- 2 paikallisen ammattikorkeakoulun
- 3 Kansanterveyslaitoksen
- 4 lääketehtaiden / rokotevalmistajien
- 5 jonkin muun tahon, minkä? _____

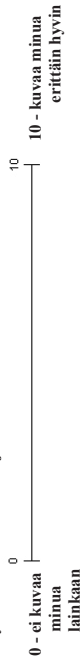
16. Jos ammatin korkeakoulussa järjestettäisiin rokottamista koskevaa koulutusta, osallistuisitko seuraavan tyyppisiin koulutuksiin? Ympyröi tarvittaessa useampi vaihtoehto.

	Osallistuisin	En osallistuisi
1 erikoistutkimisopinnot (esim. yhden lukuvuoden kesäivät, lähipetusta koululla 4 pv/kk)	1	2
2 yksittäinen opintojakso (esim. 2 kk ajan, lähipetusta koululla 1 pv/vko)	1	2
3 yksittäinen koulutuspäivä, yhden kerran vuodessa	1	2
4 yksittäinen koulutuspäivä, kaksi kertaa vuodessa	1	2
5 jokin muu, mikä ja kuinka paljon?		

ROKOTTAJAN OMINAISUUDET

Pyydän Sinua arvioimaan, missä määrin alla esitetyt väittämät kuvaavat Sinua itseäsi rokottajana.

Käytä arvioinnissa ohjeista janaa.

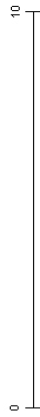


Laita pystyviiva janalle siihen kohtaan, joka mielestäsi kuvaa itseäsi.

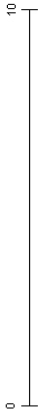
17. Rokottajana olen varma.



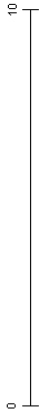
18. Aistin herkästi rokottettavan asiakkaan tunnelilan ja toimin sen mukaan.



19. Rokottaminen on tärkeä terveyden edistämisen menetelmä työssäni.



20. Rokotustietoni ovat ajan tasalla.



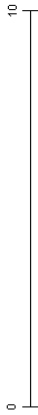
21. Rokotustaitoni ovat ajan tasalla.



22. Olan itse aktiivisesti puheeksi rokottamisen asiakkaan kanssa



23. Kirjoitan rokottamisesta lehtiin tai muihin julkaisuihin.



24. Olan rokotusasioissa tarvittaessa yhteyttä päättäjiin.



25. Anna yleisarvosana itsellesi ”Rokottajan ominaisuuksista”.



ROKOTTAMISEN KÄYTTÄNNÖN TOTEUTUS

Pyydän Sinua arvioimaan, missä määrin alla esiteyty väittämät kuvaavat osaamistasi rokottamisen käytännön toteutuksessa.

Käytä arvioinnissa ohjeista janaa.

0 - ei kuvaa minua lainkaan
 10 - kuvaa minua erittäin hyvin

Laite pystyvävä janelle siihen kohtaan, joka mielestäsi kuvaa itseäsi.

Seuraavat väittämät koskevat valmistautumistasi rokottamiseen.

26. Varaan rokotusvälineet valmiiksi.
 0 _____ 10

27. Varaan rokkoaineet valmiiksi.
 0 _____ 10

28. Tutustun uuden rokotteen tuoteselosteeseen.
 0 _____ 10

29. Tarkistan asiakkaan terveyskertomuksesta aiemmin annetut rokotukset.
 0 _____ 10

30. Varaan lääkkeaineet mahdollisen anafylaktisen reaktion hoitamista varten.
 0 _____ 10

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31. Tarkistan, että anafylaktisen reaktion kirjalliset hoito-ohjeet ovat näkyvillä.
 0 _____ 10

32. Kysyn asiakkaalta tai alaikäisen lapsen vanhemmalta luvan rokottamiseen.
 0 _____ 10

33. Arvioin asiakkaan rokotuskelpoisuuden.
 0 _____ 10

34. Teen päätöksen rokotuksen antamisesta.
 0 _____ 10

35. Perustelen ohjaukseni rokotettavalle (esim. vanhemmalle lapsen kiinnipitämisestä).
 0 _____ 10

36. Ohjaan asiakasta konkreettisesti osallistumaan rokottamiseen (esimerkiksi, miten lihas rentoutetaan).
 0 _____ 10

Seuraavat väittämät koskevat osaamistasi rokottamisen aikana.

37. Hallitsen i.d. -rokotustekniikan.
 0 _____ 10

38. Hallitsen s.c. -rokotustekniikan.
 0 _____ 10

39. Hallitsen i.m. -rokotustekniikan.
 0 _____ 10

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50. Olen taitava keksimään erilaisia selviytymiskeinoja pulmatilanteissa (jos asiakas esim. pelkää).



Seuraavat väittämät koskevat osaamistasi rokottamisen jälkeen.

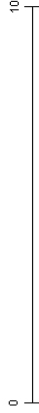
51. Seuraan asiakkaan vointia vähintään 15 minuuttia rokottamisen jälkeen.



52. Keskustelen mahdollisista rokotteiden aiheuttamista yleisimmistä haittavaikutuksista asiakkaan tai alaikäisen lapsen vanhemman kanssa.



53. Keskustelen asiakkaan tai alaikäisen lapsen vanhemman kanssa mahdollisista seuraavaksi annettavista rokotteista.



54. Kirjaan antamani rokotteet hoitopaikan terveyskertomusjärjestelmään.



55. Kirjaan antamani rokotteet asiakkaan rokotuskorttiin.



56. Anna yleisarvosana itsellesi ”Rokottamisen käytännön toteutuksia”.



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40. Hallitsen p.o.-rokotteiden antamisen.



41. Hallitsen Mantoux-kokeen tekemisen.



42. Hallitsen Mantoux-kokeen lukemisen.



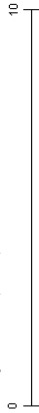
43. Hallitsen imeväisikäisten (<1v) lasten rokottamisen.



44. Hallitsen leikki-ikäisten (1-6v) lasten rokottamisen.



45. Hallitsen kouluikäisten lasten ja nuorten (7-17v) rokottamisen.



46. Hallitsen aikuisten rokottamisen (18-65v).



47. Hallitsen ikäihmisten (>65v) rokottamisen.



48. Hallitsen aseptisen työskentelyn.



49. Hallitsen anafyylaktisen reaktion hoidon.



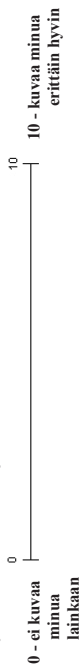
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ROKOTTAMISEN KÄYTÄNNÖN TOTEUTUKSEN LOPPUTULOKSET

Pyydän Sinua arvioimaan, missä määrin alla esitetyt väittämät kuvaavat rokottamisesi käytännön toteutuksen lopputuloksia.

Käytä arvioinnissa ohjeista janaa.



Laita pystyvä jaanle siihen kohtaan, joka mielestäsi kuvaa rokottamisesi käytännön toteutuksen lopputuloksia.

57. Asiakkaalla on positiivisia tunnekokemuksia rokotamisen jälkeen.



58. Tunnen itse onnistumisen tunnetta hyvin sujuneesta rokotamisesta.



59. Rokottaminen on onnistunut teknisesti.



60. Asiakas haluaa ottaa jatkossakin rokotuksia.



61. Anna yleisarvosana itsellesi "Rokottamisen käytännön toteutuksen lopputuloksista".



KIITOS ARVOKKAISTA VASTAUKSISTAJA MENESTYSTÄ TYÖSSÄSI!

Items 62-68, Vaccination Knowledge Test, See Appendix Table 1.

The knowledge test is not being published now, pending further development and use.

Appendix Table 1. The content of knowledge test of vaccination competence.

Content of items	Number of items
a) Vaccination recommendations	10
b) Common contraindications	12
c) Recommendations to injection area of vaccinations and the Mantoux test	6
d) Aseptic practices	5
e) Managing an anaphylactic reaction	7
f) The names of the vaccines (if one is available)	18

Alternatives: 1= correct, 2 = wrong

Appendix Table 2. Explorative factor analyses of the self-assessment measure. Principal components with varimax rotation.

	Public Health Nurses				Public Health Nurse Students			
	Factor1	Factor2	Factor3	Factor4	Factor1	Factor2	Factor3	Factor4
Vaccinator's qualities								
Confidence	0,53		0,39		0,64	0,37		
Emotional sensitivity	0,56				0,37	0,45		
Importance of health promotion	0,4					0,41		
Knowledge up-to-date	0,53		0,4		0,34			
Skills up-to-date	0,6		0,42		0,72			
I take actively vaccinating up	0,51				0,31		0,47	
I write to publications				0,23				-0,2
I contact decision-makers				0,31		0,33		
Competence in preparing for vaccination								
Equipment ready		0,54				0,52		
Vaccines ready		0,47				0,48		
Acquaint with the client information	0,36	0,57				0,44	0,45	
Previous vaccines	0,4	0,51					0,5	
Medication available		0,69					0,78	
Written instructions available		0,57					0,69	
Asking permission		0,56	0,3				0,32	
Assessing client's eligibility	0,32	0,59			0,56	0,4		
I make the decision to administer		0,27			0,41		0,3	
I justify my instructions		0,52	0,35			0,67		
I instruct in concrete terms	0,45	0,43				0,63		
Competence during vaccination								
Competent with i.d.-technique				0,8				0,61
Competent with s.c.-technique	0,32				0,48			
Competent with i.m.-technique	0,58	0,48			0,79			
Competent with p.o.-technique			0,57		0,4			0,41
Competent with administering the Mantoux-test				0,88				0,85
Competent with reading the Mantoux-test				0,81				0,82
Competent with vaccinating infants			0,9		0,55	0,44		0,3
Competent with vaccinating toddlers			0,91		0,57	0,38		0,41
Competent with school aged and young			0,75		0,72			0,34
Competent with vaccinations adults	0,44				0,77			
Competent with vaccinating the elderly			0,35		0,72			
Competent with aseptic techniques	0,62	0,36			0,4		0,53	
Managing anaphylactic reaction	0,33	0,32		0,37	0,3		0,66	
Managing problematic situations	0,54				0,43	0,3	0,32	
Competence after vaccination								
Monitoring the client		0,29						0,53
Discussing the adverse events	0,56	0,35			0,52	0,55		
Discussing the upcoming vaccinations	0,36		0,35		0,53	0,43		
Registering to the record system	0,47	0,4			0,31			-0,3
Registering on the client's card	0,51						0,3	
The outcomes of implementation of vaccination								
The client's positive state of mind	0,55				0,44	0,3		
Vaccinator's feeling of success	0,66				0,58	0,4		
Technically successful vaccination	0,75				0,59	0,56		
The client's vaccinations in future	0,58				0,61	0,36		
% of variance explained by the factor	15.8%	10.5%	9.7%	7.0%	18.1%	10.8%	8.9%	7.2%

Appendix 4. Cover letter to public health nurses participating in interview study

(There were seven versions of the cover letter, addressing different groups to be interviewed).

Hyvä Terveydenhoitaja,

Olet alustavasti puhelimitse lupautunut haastateltavaksi rokotusosaamista koskevaan tutkimukseeni. Kiitän sinua siitä.

Teen väitöskirjatutkimusta Turun yliopiston lääketieteellisessä tiedekunnassa, hoitotieteen laitoksella. Tutkimuksen aiheena on valmistuvien terveydenhoitajaopiskelijoiden ja terveydenhoitajien rokotusosaamisen tason arviointi. Tutkimuksen ensimmäisessä vaiheessa selvitetään, mitä rokotusosaaminen on. Tieto hankitaan ryhmähaastattelujen avulla rokottamisen asiantuntijoilta. Asiantuntijat tässä tutkimuksessa ovat 1) valmistumisvaiheessa olevat terveydenhoitajaopiskelijat, 2) terveydenhoitajat, jotka rokottavat, 3) rokotusaiheita opettavat opettajat terveystieteiden ammattikorkeakouluissa 4) rokottamisen parissa työskentelevät lääkärit 5) neuvola- ja kouluikäisten lasten ja nuorten vanhemmat, 6) aikuisasiakkaat terveystieteiden avovastaanotolla, ja 7) kotisairaanhoidon asiakkaat.

Kuulut ryhmään **Terveydenhoitajat**. Tutkimuksen tämä vaihe tehdään haastattelemalla terveydenhoitajia 3-6 hengen ryhmissä terveystieteiden ja kouluissa. Haastattelut on tarkoitus nauhoittaa. Haastattelijana toimii allekirjoittanut. Mukana on todennäköisesti myös toinen tutkija, joka tekee muistiinpanoja, mutta ei osallistu haastattelun kulkuun. Tässä tutkimuksessa toisena tutkijana toimii samassa opintojen vaiheessa opiskeleva opiskelutoverini xxxxxxxx (nimi poistettu). Haastatteluun varataan aikaa noin kaksi tuntia. Oheisen suostumuslomakkeen voit postittaa etukäteen oheisessa postimerkillä varustetussa kirjekuoressa tai palauttaa haastattelun yhteydessä. Haastattelutilanteessa tarjoan Sinulle kahvia tai teetä ja pientä syötävää, minkä takia pyydän ilmoittamaan myös mahdollisesta erityisruokavaliostasi.

Tutkimuksen tekemisessä noudatetaan tutkimuseettisiä periaatteita. Se tarkoittaa sitä, että haastattelut nauhoitetaan vain haastateltavien luvalla, ketään ei pystytä tunnistamaan tutkimuksesta ja haastateltavilla on lupa keskeyttää tutkimukseen osallistuminen missä vaiheessa tahansa. Tutkimuksen tekemiseen on saatu asianmukaiset luvat terveystieteiden keskukselta.

Tutkimukseni pääohjaaja Turun yliopiston hoitotieteen laitokselta on professori Helena Leino-Kilpi, p. 02 333 84 04

Huuvarissa 15 päivänä helmikuuta 2005.

Yhteistyöterveisin, Anne Nikula

Terveystieteiden tohtoriopiskelija, TtM, Th

Turun yliopisto, Lääketieteellinen tiedekunta, Hoitotieteen laitos

xxxxxxx (yhteystiedot poistettu)

Appendix 5. Cover letter to public health nursing students participating in the questionnaire study.

(There were two versions of the cover letter: 1) to graduating student nurses; and 2) to working PHNs)

Turun yliopisto

Lääketieteellinen tiedekunta

Hoitotieteen laitos

Hyvä Terveydenhoitajaopiskelija

Suuritan terveystieteiden tohtorin tutkintoa Turun yliopiston hoitotieteen laitoksella. Väitöskirjatutkimukseni tarkoitus on kahdenlainen. Ensimmäinen liittyy hoitotyön käytäntöön eli tarkoituksena on arvioida valmistuvien terveydenhoitajaopiskelijoiden ja työssä olevien terveydenhoitajien rokotusosaamista itsearvioinnin ja tietotestin avulla. Toinen tarkoitus liittyy koulutukseen, eli tarkoituksena on laatia rokotusopetuksen kehittämissuhteet terveydenhoitajaopiskelijoiden peruskoulutukseen ja terveydenhoitajien täydennyskoulutukseen.

Pyydän kohteliaimmin Sinua osallistumaan kyselytutkimukseeni, joka käsittelee *valmistuvien terveydenhoitajaopiskelijoiden ja työssä olevien terveydenhoitajien rokotusosaamisen arviota*. Osallistuminen tarkoittaa vastaamista oheiseen kyselylomakkeeseen. Tutkimukseen osallistuminen on vapaaehtoista, mutta jokaisen vastaajan osuus on erittäin tärkeä. Kysely on luottamuksellinen eikä henkilöllisyytesi tule esille missään tutkimuksen vaiheessa. Tutkimusaineistoa tullaan käyttämään ainoastaan tutkimustarkoituksiin.

Tutkimukselle on saatu tutkimuslupa ammattikorkeakoulustasi. Tutkimus toteutetaan Turun yliopiston lääketieteellisen tiedekunnan hoitotieteen laitoksella. Tutkimukseni pääohjaaja on hoitotieteen professori Helena Leino-Kilpi. Muut ohjausryhmän jäsenet ovat akatemiattutkija Hanna Nohynek Helsingin Kansanterveyslaitokselta ja hoitotieteen lehtori Maija Hupli Turun yliopiston hoitotieteen laitokselta.

Askolassa maaliskuun 25. päivänä 2008

Yhteistyöstä kiittäen,

Anne Nikula, Terveystieteiden jatko-opiskelija, TtM, Th

xxxxxxxxx (yhteystiedot poistettu)

Appendix Table 3. Multivariate analysis of student self-assessment results. The Independent Determinants of Vaccination Competence of Public Health Nurse Students (n=129) in the Self-Assessment, VAS (not published previously).

Determinant	n	Adjusted mean (SE) ¹⁾	p ²⁾
Preclinical teaching			0.020
Never (1)	23	7.39 (0.14)	
Little, somewhat (2-3)	93	7.78 (0.08)	
Much, a great deal (4-5)	13	8.03 (0.20)	
Motivation to participate in vaccination education			<0.0001
Very motivated	86	8.09 (0.09)	
Little, fairly or not motivated	43	7.38 (0.12)	

Model 100 *R-square = 27.5 %

Model p <0.0001

1) The adjusted mean is the mean value of the category adjusted by all other determinants in the model.

2) Significance of the determinant

SE: standard error of estimate

Appendix Table 4. Multivariate analysis of student knowledge test results. The Independent Determinants of Vaccination Competence of Public Health Nurse Students (n=129) in the Knowledge Test (not published previously).

Determinant	n	Adjusted mean (SE) ¹⁾	p ²⁾
Age in years			0.006
-24	77	70.7 (1.32)	
25-29	36	75.6 (1.76)	
30-	16	76.2 (2.40)	
Preclinical teaching			0.012
Never (1)	23	77.4 (1.90)	
Little, somewhat (2-3)	93	76.3 (1.21)	
Much, a great deal (4-5)	13	68.7 (2.68)	
Practice of vaccinating persons of different ages			0.0006
Never, little, somewhat (1-3)	28	70.7 (1.90)	
Much, a great deal (4-5)	101	77.6 (1.30)	

Model 100 *R-square = 20.0 %

Model p <0.0001

1) The adjusted mean is the mean value of the category adjusted by all other determinants in the model.

3) Significance of the determinant

SE: standard error of estimate

Appendix Table 5. Spearman correlations between the self-assessment VAS and the knowledge test of public health nurse students and public health nurses.

The self-assessment of vaccination competence (VAS)							
	a. Vaccinator's qualities	b. Implementation of vaccinations (b1+b2+b3)	c. The outcome of the implementation of vaccinations				
		b1. Competence in preparing for vaccinating	b2. Competence during vaccination after vaccination				
		b3. Competence after vaccination					
			Total sum score				
The knowledge test							
Public Health Nurses (n=405)							
Vaccination recommendations	0,13**	0,18***	0,04	0,21***	0,006	-0,01	0,17***
Common contraindications	0,03	0,15**	0,07	0,15**	0,08	0,08	0,14**
Recommendations to the injection area of vaccinations and the Mantoux test	0,12*	0,13**	0,11*	0,11*	0,03	0,0006	0,13**
Aseptic practices	0,15***	0,28***	0,18***	0,25***	0,06	0,14**	0,26**
Managing an anaphylactic reaction	0,03	0,004	0,06	-0,02	-0,005	-0,02	0,006
The names of the vaccines against communicable diseases (if they have)	0,19**	0,21***	0,13**	0,20***	0,08	0,01	0,22**
Total score	0,21***	0,28***	0,18**	0,26***	0,09	0,04	0,27***
Students (n=129)							
Vaccination recommendations	0,03	0,04	0,18*	-0,02	0,03	0,1	0,04
Common contraindications	-0,1	-0,12	0,03	-0,16	-0,05	-0,11	-0,13
Recommendations to the injection area of vaccinations and the Mantoux test	0,08	0,06	0,01	0,06	0,03	-0,06	0,06
Aseptic practices	0,08	0,02	0,04	-0,02	0,14	0,004	0,03
Managing an anaphylactic reaction	-0,02	-0,05	0,01	-0,1	0,09	0,05	-0,05
The names of the vaccines against communicable diseases (if they have)	0,21*	0,007	0,04	-0,09	0,15	0,17	0,06
Total score	0,16	-0,02	0,08	-0,1	0,14	0,11	0,03*

* p<0,05, ** p<0,01, *** p<0,001

Appendix Table 6. Students' (n=129) and public health nurses' (n=405) self-assessment of vaccination competence. Cronbach's alphas of the sum scores.

Sum scores	Number of items	Students α	Public health nurses α
a) Vaccinator's qualities	8	0.61	0.68
b) Implementation of vaccinations (b1+b2+b3)	30	0.86	0.86
b1) Competence in preparing for vaccinating	11	0.73	0.57
b2) Competence during vaccination	14	0.83	0.83
b3) Competence after vaccination	5	0.62	0.55
c) The outcome of the implementation of vaccinations	4	0.81	0.76
Total score	42	0.90	0.89

Appendix Table 7. Students' (n=129) and public health nurses' (n=405) knowledge of vaccination competence. Cronbach's alphas of the sum scores.

Sum scores	Number of items	Students α	Public health nurses α
a) Vaccination recommendations	10	0.15	0.43
b) Common contraindications	12	0.39	0.48
c) Recommendations to the injection area of vaccinations and the Mantoux test	6	0.05	0.46
d) Aseptic practices	5	0.25	0.18
e) Managing an anaphylactic reaction	7	-0.01	0.38
f) The names of the vaccines against communicable diseases (if they have vaccines against)	18	0.82	0.87
Total score	58	0.78	0.80