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Nursing Interventions in Preventing Vasovagal Reactions in Blood Donors

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Nursing Interventions in Preventing Vasovagal Reactions in
Blood Donors

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Despite advancements in modern medicine, the demand for blood products for use in e.g. surgical procedures and cancer treatments remains high. As a result, countless chronically ill and injured people are dependent on the willingness of volunteers to donate blood. Research has consistently shown that the experience of adverse blood donation events, such as vasovagal reactions (VVRs), has a negative impact on donor retention.

The purpose of this thesis was to describe what kind of nursing interventions can be implemented to reduce the risk of VVRs occurring in blood donors. The aim was to provide the Finnish Red Cross (FRC) Blood Service with information which could potentially be used to develop current work practices. The research method chosen for this thesis was that of a literature review. A search of several online databases was conducted, using pre-determined search terms and distinct inclusion and exclusion criteria. A total of seven records were selected after employing a critical appraisal tool. The data was analyzed according to the principles of inductive content analysis, resulting in three main categories; Adoption of Psychologic Approach, Emphasis on Physiologic Intervention and Update of Donor Selection Criteria.

The findings revealed that several interventions are effective in preventing VVRs in blood donors. Physiologic interventions such as Applied Muscle Tension (AMT) and pre-donation water loading, as well as psychologic approaches to reduce anxiety in blood donors, were found to be potentially beneficial. At the FRC Blood Service collection sites, nurses are responsible for most aspects of the blood donation process, including screening and deferral of potential blood donors. Because of this, nurses are in a unique position to lead the way in the prevention of VVRs, as they work closely together with donors. It was therefore deemed quite possible that the findings of this literature review could have a very tangible impact on this comparatively small niche of nursing practice.

Though fairly solid evidence exists supporting several VVR interventions, little time and effort has been dedicated thus far to explore the validity of social support, caffeine ingestion or even audio-visual distraction as potential preventive interventions against VVRs. It is therefore highly recommended that further research exploring alternative methods of VVR prevention in blood donors be carried out, in order to ensure adequate donor retention and a sufficient blood supply.

Keywords: Blood Donation, Vasovagal Reaction, Prevention

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1. Introduction

Over the past decade, the use of blood products in the Finnish health care system has seen a steady decline. This development is largely due to recent advancements in the field of surgery, in addition to a better understanding by medical professionals of the situations in which a blood transfusion is truly required (FRC Blood Service 2017a). Nonetheless, the need for donated blood remains high, as approximately 50,000 patients receive some type of blood product every year. Similarly, despite the overall need for blood products decreasing, the demand for so-called emergency blood; type O negative, is unaltered. In fact, as the life expectancy of the Finnish population continues to increase, so does the risk of developing potentially life-threatening conditions and diseases, the treatment of which may rely heavily on blood products. It is therefore evident that the health care system is very much dependent on new blood donors becoming regular and frequent donors, as this will help sustain an adequate blood supply in the future. Furthermore, since no good synthetic alternative to human blood currently exists, thousands of chronically and critically ill or injured patients are entirely dependent on the willingness of volunteers to donate blood.

The Finnish Red Cross (FRC) Blood Service is singlehandedly responsible for the collection, manufacturing and distribution of all blood products in Finland. In 2016, the Blood Service received a total of 204,503 whole blood donations from 119,705 donors. Finnish blood donors donate an average of 1.7 times per year, with the majority (55%) donating only once a year, followed by 27% of donors who donate twice annually (FRC Blood Services 2017a).

A critical aspect of blood donor retention is directly related to donor satisfaction. Most notably, the occurrence of adverse symptoms, even when mild, may predict the likelihood of blood donors returning in the foreseeable future. In particular, the experience of adverse vasovagal reactions (VVRs) in conjunction with blood donation plays a significant role in enticing donors to repeatedly donate (Wiersum-Osselton, van der Kreek, Brand, VeldHuizen, van der Bom & de Kort 2012). The more severely a blood donor subjectively perceives an adverse event, the less likely they are to donate blood again within the following year (France, France, Roussos & Ditto 2003).

Though the FRC Blood Service guidelines do describe a number of inventions designed to reduce the risk of VVRs occurring, none of them are currently implemented on a systematic basis by the nurses responsible the practical aspects of the blood donation process. Interventions are executed sporadically, perhaps due to the lack of certainty regarding their efficacy. The purpose of this thesis is therefore to describe the kinds of nursing interventions which can be implemented in order to reduce the risk of vasovagal reactions in blood donors.

2. Background

The following chapter will be providing the theoretical framework of this thesis by describing and defining key concepts.

2.1. Blood Donation

Blood donation (phlebotomy) is a voluntary procedure in which a portion of blood is drawn and processed in order to create a product for blood transfusion. There are currently two methods of blood donation available to Finnish donors; whole blood donation and platelet donation (apheresis). In Finland, as in the rest of Europe, it is prohibited by law to offer monetary compensation for blood donation (European Parliament 2003) and all donations are consequently voluntary and acts of altruism.

There are four main components of blood: red blood cells (erythrocytes), white blood cells (leukocytes), platelets (thrombocytes) and plasma. Red blood cells and plasma make up the vast majority of whole blood; 45% and 55% respectively, with white blood cells and platelets accounting only for less than 1% of the total mass (American Red Cross n.d.).

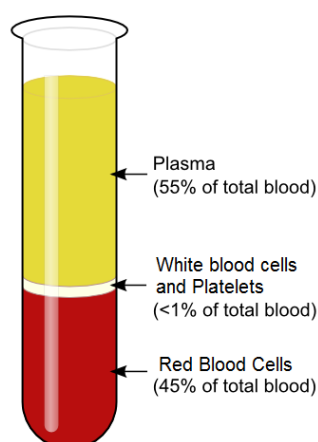


Figure 1: Blood Components (Centre for Blood Research 2015).

Whole blood donations are separated into several different blood products at a laboratory, before being transfused to patients. Three basic types of products are manufactured from whole blood donations: red blood cell units, platelet units and fresh frozen plasma units. Since plasma is relatively abundant, a certain amount of donated plasma is immediately frozen and delivered to pharmaceutical companies for further development. Medications derived from human plasma are used in the treatment of patients suffering from hemophilia (FRC Blood Service 2015a).

Red blood cell products are typically infused to patients undergoing either elective or emergency surgery, while platelets are primarily used in the treatment of cancer patients. Reconstituted whole blood units are also manufactured and are commonly used in blood replacement treatment of newborn, often premature babies. In 2016, FRC Blood Service produced 194,320 units of red blood cells and 34,850 platelet units (FRC Blood Service 2017a).

2.2. The Donation Process

The donation process begins by electronically registering the prospective blood donor, after which a standard health questionnaire is filled out by the donor. Next, a nurse conducts a thorough interview to determine donor eligibility. The interview takes place in a secluded space to ensure absolute confidentiality of the personal details revealed. Additionally, the donor's hemoglobin concentration is measured by taking a small sample from the finger tip. Hemoglobin is a protein present in red blood cells which is responsible for transporting oxygen throughout the body. In order for a person to qualify as a blood donor, the hemoglobin level must be between 125-175g/l for women and between 135-195g/l for men (FRC Blood Service 2017b).

Other basic requirements include a minimum weight of 50kg and being in possession of a Finnish identity code verified by an official government document. Additionally, all blood donors are required to have lived for at least the past three months in either Finland or another EU/EFTA country. (FRC Blood Service 2017b).

Once a person has been deemed eligible to donate blood, he/she is directed to lie down on a donation bed in a separate area. The nurse prepares the blood collection bags, places a tourniquet on the donor's upper arm and palpates for a suitable vein. The donor is given a roll of gauze and asked to regularly squeeze the roll throughout the blood donation. This action will aid the blood flow and reduce the duration of the procedure.

Next, the skin is meticulously disinfected, after which the nurse performs the venipuncture, inserting a large gauge needle. During whole blood donation, approximately 490ml of blood is collected. In addition to the primary collection bag which contains 460ml when full, a smaller bag containing roughly 30ml is also filled. Blood samples are then taken from the smaller bag and tested for HIV, Hepatitis A and B, Syphilis and Parvovirus at the central Blood Service laboratory prior to the blood products being processed (FRC Blood Service 2015b).

The blood collection bag typically takes between five to ten minutes to fill up, at which point the nurse ends the active donation by sealing the bags and removing the needle from the donor's arm. A roll of gauze is applied firmly to the venipuncture site and the general after-care instructions are relayed by the nurse. These include keeping the bandage on for at least four hours in order to reduce the risk of bruising, drinking plenty of fluids on the donation day, as well as avoiding any strenuous physical activities. The donor is also instructed to stay reclining on the donation bed for an additional few minutes before proceeding to the cafeteria area for something to eat and drink (FRC Blood Service 2017c).

Although donating nearly half a liter of blood may seem like a lot, this amount of blood loss only accounts for approximately 10% of the total blood volume of healthy adults and is generally well tolerated (FRC Blood Service 2015c). The World Health Organization recommends that the amount of blood collected during donation does not exceed 13% of the total blood volume, meaning a donor should weigh at least 50kg in order to donate 450ml (WHO 2012).

The fluid balance is usually restored within 24 hours and a majority of donors will not notice any significant changes in physical well-being after donating blood. The minimum interval for whole blood donation is 61 days for men and 91 days for women. This difference is due to the fact that women generally require a longer period of restitution after donating blood in order to fully recover.

Hemoglobin concentration decreases by 10g/l on average after blood donation (FRC Blood Service 2015c) and the body compensates by releasing iron from its stores. Women have smaller iron stores than men and these are nearly entirely depleted when donating blood, resulting in women's hemoglobin levels rising at a slower rate than men's (NHS Blood And Transplant n.d.). An iron supplement is provided by FRC Blood Service in conjunction with whole blood donation to regular male donors and all female donors of fertile age.

In Finland, a person may donate blood for the first time between the ages of 18-59. Generally speaking, women are more active blood donors than men, with young women between the ages of 19 and 28 taking the lead (FRC Blood Service 2017a). This may at least be partially explained by the fact that people who work in the field of health care; which tends to be somewhat female dominated, typically are more aware of the need for blood products, and therefore donate blood more frequently. The distribution of blood donors' age and gender are detailed in Figure 2.

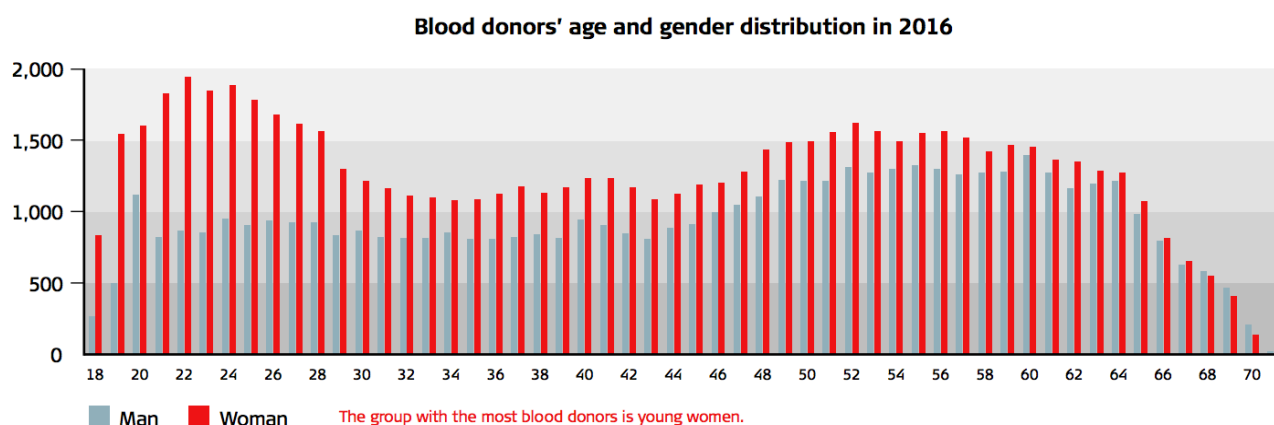


Figure 2: Blood donor's age and distribution in 2016 (FRC Blood Service 2017a).

2.3. Vasovagal Reaction

The term was first coined by British cardiologist Thomas Lewis (1932) and refers to a process involving both the blood vessels and the heart. As the name suggests, a vasovagal reaction is

associated with the vagus nerves, a set of cranial nerves originating in the brainstem, the function of which is to transmit impulses from the brain to the heart and smooth muscles (Shier, Butler & Lewis 2005, 234-235).

The vagus nerves are a part of the autonomic nervous system (ANS), which functions entirely independently and cannot be consciously manipulated. The primary role of the ANS is to control and regulate essential, physiologic functions such as heart rate, blood pressure and breathing rate. The autonomic nervous system is divided into two sections; the sympathetic and the parasympathetic sections. The sympathetic section can be activated by the experience of emotional stress, in reaction to which the evolutionarily critical fight-or-flight response is activated. Meanwhile, the parasympathetic part of the ANS is responsible for mediating the responses of the sympathetic section, and does so by decreasing heart and breathing rates. (Shier et al. 2005, 237-238).

Despite the exact pathophysiology of vasovagal reactions (VVRs) in association with blood donation being unknown (Bédard, Marchand, Kus & D'Antono 2010), it can be generally defined as an involuntary systemic reaction which is caused by an irritation or overstimulation of the vagus nerve. If the sympathetic nervous system is activated during donation of blood, it causes an increase in blood pressure. So-called baroreceptors in the aortic arch of the heart subsequently respond by activating the parasympathetic section of the ANS, which in turn lowers the heart rate (bradycardia) and causes the smooth muscles of blood vessels to relax (vasodilation), ultimately resulting in lowered blood pressure. (Bédard et al 2010). Both physiologic and psychologic stimulations, such as fear, anxiety and the amount of blood loss relative to total blood volume, are considered important factors in the occurrence of VVRs during blood donation (Working Group on Donor Vigilance of the International Society of Blood Transfusion Working Party on Haemovigilance in collaboration with The International Haemovigilance Network The AABB Donor Haemovigilance Working Group 2014).

A vasovagal reaction is caused by momentary oxygen deprivation of the brain and is manifested as symptoms ranging from the relatively mild lightheadedness, general weakness, excessive sweating and slight nausea, to the considerably more severe symptoms of transient loss of consciousness (syncope) and even convulsions. (Meade, France & Peterson 1995; Crocco & D'Elia 2007). An essential observation when dealing with VVRs, is that the term vasovagal reaction is often used interchangeably with the term syncope in literature. Indeed, the minor symptoms preceding syncope (pre-syncope symptoms) may be described as a mild vasovagal reaction, whereas full loss of consciousness is often defined as a severe VVR (Crocco & D'Elia 2007).

The Finnish Red Cross Blood Services utilizes the Standard for Surveillance of Complications Related to Blood Donation when classifying adverse blood donor reaction. According to this classification protocol, vasovagal reactions are divided into two sub-groups; reactions involving LOC (loss of consciousness) and reactions without LOC. VVRs with LOC may be further divided into those lasting less than 60 seconds and those lasting for more than a minute. The cases in which syncope occurs can be additionally categorized according to whether fainting was followed by injury or not, as well as whether LOC occurred on the blood collection site or elsewhere. (The AABB Donor Haemovigilance Working Group 2014).

It is important to note that FRC Blood Service considers any and all adverse donor reactions which necessitate consultation and/or treatment by a physician to be severe reactions, regardless of whether loss of consciousness has taken place or whether there was an injury following syncope. The Blood Service reasons that if a donor feels the need for additional treatment; beyond the immediate care provided by the on site nursing staff, then the adverse event has clearly affected the donor to an exceptional degree.

Over the course of a six-year period, from 2010-2016, Finnish donors experienced a total 28.718 adverse reactions in conjunction with blood donation. Of those, a total of 17.809 were classified as vasovagal reactions of varying severity, amounting to an incidence rate of 1,2% of all blood donors having some type of generalized, systemic reaction either during or following donation. The most commonly occurring VVR symptom was nausea, accounting for nearly 90% of all vasovagal reactions, followed by syncope without associated convulsions. The vast majority of VVRs occurred while the donor was still at the blood donation site, though a small amount, 117 in total, happened at a later point, are were therefore classified as delayed reactions. Out of all adverse events involving a vasovagal reaction, 142 donors required further medical treatment. Table 1 offers an overview of incidence rates and types of VVRs during the years 2010-2016. (FRC Blood Service Internal Statistics).

Vasovagal Reactions 2010-2016	
Nausea	15.981
Syncope	1.420
Convulsions	133
VVR (medical treatment required)	120
Delayed Syncope	83
Syncope w. Injury	38
Delayed VVR (medical treatment required)	22
Delayed Syncope w. Injury	12
In Total	17.809

Table 1: Vasovagal Reactions 2010-2016 (FRC Blood Service Internal Statistics).

Although basic venipuncture is one of the most common causes of VVRs (Engel & Romano 1947), adverse blood donation events involving vasovagal reactions are comparatively rare. The vast majority of VVRs are mild, although syncope with and without convulsions do occur in a number of blood donors each year. While most adverse events take place either during blood donation or immediately afterwards, a vasovagal reaction may manifest itself only after the donor has left the donation site. These delayed VVRs are inherently more problematic, particularly if accompanied by syncope, as the risk for fall injuries is significantly increased.

The primary risk factors for developing a vasovagal reaction during or after blood donation are commonly accepted to be; the female sex, an estimated blood volume (EBV) of less than 3500ml and young age (Rios, Fang, Tu, Wright, Spencer, Hillyer, Hillyer, Eder & Benjamin 2010). Additionally, extensive research has conclusively established that first time blood donors are at a vastly increased risk of experiencing VVRs compared to regular donors. (Agnihotri, Marwaha & Sharma 2012; Gillet, Rapaille, Benoît, Ceinos, Bertrand, Bouyalsky, Govaerts & Lambermont 2015; Philip, Sakar & Jain 2014).

The Blood Donation Reactions Inventory (BDRI) was initially developed in 1995 by a team of reputable researchers in the field of blood donation associated vasovagal reactions (Meade, France & Peterson 1995). The BDRI is a tool for blood donors to self-report adverse physiologic donation reactions and consists of 11 items, including dizziness, weakness, visual disturbance and nausea. The responder rates the subjective severity of adverse symptoms on a 5 point Likert scale with 0 representing “not at all” and 5 “to an extreme degree”. (Meade et al. 1995). Recently, an abbreviated 4-item version of the BDRI was proven equally effective in assessing vasovagal donor reactions (France, Ditto, France & Himawan 2008) and both versions are currently actively used in research.

2.4. Nursing Intervention

The concept of nursing intervention is central to modern nursing theory and practice. According to Berman, Snyder, Kozier & Erb (2008, 223) a nursing intervention may be defined simply as any and all actions carried out by a nurse on behalf of a client. Berman and colleagues further posit that there are three overall categories of nursing intervention. Firstly, nursing intervention can be independent in nature and based on the professional expertise of the nurse. Independent nursing intervention is commonly a result of clinical nursing diagnoses and may include guidance and education of clients, next of kin or communities, as well as physical care of a client. Secondly, nurses often perform interventions in response to a medical diagnosis. These are prescribed or guided by a physician and can include e.g. administration of medication and intravenous solutions, in addition to diagnostic testing. Such actions are often referred to as dependent interventions. Thirdly, so-called collaborative interventions are activities which are planned and implemented in coordination with other health care professionals, for instance with physiotherapists or social workers. Nursing interventions may be either direct or indirect in nature. (Berman et al. 2008, 223).

During the initial phase of patient care, the nurse completes a nursing care plan. This process consists of defining priorities, determining objectives and the best possible results, as well as planning which nursing interventions to perform. The selected interventions are then carried out during the implementation phase of the nursing care plan.

There are several types of nursing interventions, which are chosen based on the unique issue the client is facing. Observational interventions refer to assessments made by the nurse in order to determine the efficacy of a chosen treatment or to screen for potentially developing complications. Preventive interventions are preemptive actions needed to minimize the risk factors of the individual client. Treatment interventions usually include providing physical care to a client but may also be expressed through client guidance. Finally, interventions to promote health; an essential role of a nurse, describe actions meant to support general client well-being and health (Berman et al. 2008, 224).

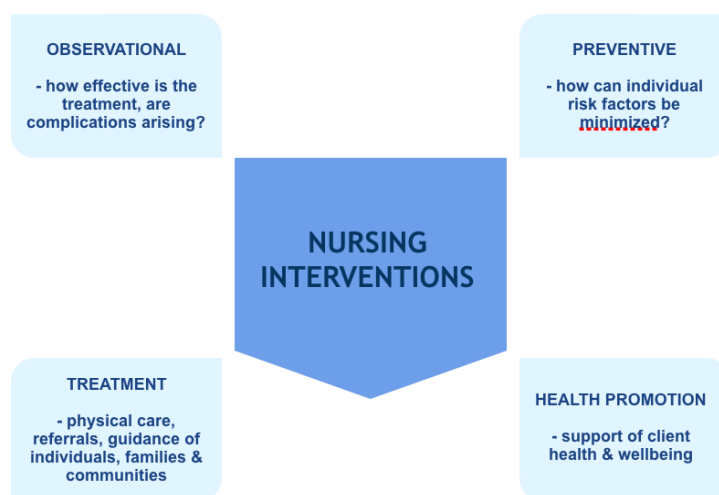


Figure 3: Types of Nursing Interventions (Berman et al. 2008, 223).

At FRC Blood Service, the entire blood donation process is overseen and carried out by registered nurses who have undergone a rigorous training process as prescribed by internal Blood Service protocols. Nurses are responsible for most aspects of blood collection, including the screening and deferral of blood donors based on pre-determined criteria, as well as the practicalities associated with phlebotomy. Likewise, when donors experience adverse events resulting from blood donation, such as vasovagal reactions, the nurses at Blood Service provide first aid treatment and assess the donor's need for further medical assistance.

3. Purpose Statement and Research Question

The purpose of this thesis is to describe what kind of nursing interventions can be implemented to reduce the risk of VVRs occurring in blood donors. The aim is to provide FRC Blood Service with information which can potentially be used to develop current work practices.

Thus, the research question is; what kind of nursing interventions can be implemented in order to prevent vasovagal reactions in blood donors?

The research question was initially identified during conversations with the supervisor of the FRC Blood Service Sanomatalo collection site, when it was suggested that a further investigation into the prevention of vasovagal reactions was warranted. The scope of the research question was later modified to reflect implications for current nursing practice, while simultaneously attempting to assure that the question would elicit an appropriate amount on data.

4. Research Method

4.1. Literature Review

The research method chosen for this thesis is that of a literature review, as this format strives to collect and summarize all available information on a given topic. When done correctly, literature reviews provide a nuanced and extensive overview and are instrumental in forming the foundation for evidence based practice (EBP) in health care (Dearholt & Dang 2012, 17). This is of paramount importance, since referring to only a few isolated studies may prevent the health care practitioner from seeing the full picture and thus make poorly-informed or biased decisions (Aveyard 2010, 7-9). For this reason, the literature review methodology was selected specifically in order to assimilate relevant data which could potentially be used to justify a future pilot study at FRC Blood Service.

The literature review process began by identifying the research question. Great care was taken to ensure that the question was clearly and concisely formulated, since a vague question would likely have led to an unfocused review and not provided the desired answers. Similarly, the research question was stated in as eloquent a manner as possible, so that the emphasis of the review would be evident and leave little room for wrongful interpretation (Aveyard 2010, 24).

During the next phase of the literature review process, a comprehensive strategy for searching literature was developed. The various databases likely to yield the best and most relevant results were identified and an exhaustive search was carried out. Finally, a thorough analysis of the collected data was performed and the results were synthesized and presented.

4.2. Inclusion and Exclusion Criteria

Due to the vast availability of information, it was critical to define the essential parameters for data retrieval, prior to conducting the actual literature search. This was achieved by determining the inclusion and exclusion criteria (Aveyard 2010, 71).

For this literature review, the data inclusion criteria were as follows; English language sources with full text available. This parameter was set in order to ensure that all information was fully comprehensible and to avoid misconceptions due to language barriers. In an attempt to limit the volume of data, as well as to ensure that all information was recent, the search was

further limited to evidence published from 2005 and onwards. Additionally, only online sources were considered for inclusion, as it was deemed impractical to pursue data not readily available in a digital format. Finally, only primary sources were included in this literature review. The rationale for this decision was attempting to avoid second-hand information, which may be inherently less reliable due to the potential for misquotation and bias.

4.3. Data Retrieval

The data searches were completed during late October 2017 using online databases accessible to students of Laurea University of Applied Sciences. The decision of which databases to include in the data retrieval was based on suggestions made in literature (Aveyard 2010, 75; Dearholt & Dang 2012, 74-76), as well as the descriptions of the various databases.

The first database searched was Laurea's own search portal, Finna. This portal references a vast number of electronically available books, digital publications such as professional journals, in addition to other databases. The literature search was conducted by combining the previously determined search terms "blood donation", "vasovagal reaction", "vasovagal symptom", "prevention" and "intervention" in various ways. For the final Laurea Finna search, the word stems "blood don" and "prevent" were followed by the standard truncation symbol * (asterix), in order to elicit a larger number of hits by allowing for numerous conjugations of the same words to be included in the search results. All searches were focused by applying the Boolean operator AND, thus attempting to avoid inappropriate and unrelated results.

The next database searched was the Cumulative Index to Nursing and Allied Health Literature (CINAHL), which contains full text sources from more than 600 different health care focussed journals, primarily within the field of nursing. The initial CINAHL database search yielded only very limited amount of results, most of which were duplicates of articles already found via the Finna searches. Similarly, the search of the SAGE publications database; a resource with more than 600 academic journals spanning several professional fields, yielded comparatively few results, none of which made it through the initial selection phase. Due to poor initial search results from both the CINAHL and SAGE databases, in addition to yielding nearly exclusively duplicate sources, the decision was made to not expand the search criteria of these databases.

The primary literature search produced a total of 476 records. During the first selection phase, all titles and abstracts were meticulously screened in order to determine each record's relevance in relation to the research question. Only records which appeared to directly address the research question were considered for deeper analysis. Any results in the format of comments to other records, newspaper articles and conference proceeding documents were automatically excluded, as these were deemed empirically unsound. Additionally, records which appeared to be relevant but ultimately proved unaccessible were also excluded. The number of records selected after the first screening was 27. This amount was then further reduced by excluding all duplicates of which there were 16, resulting in a total

of 11 records included in the second screening phase. The details of the literature process are listed in Table 2.

Database & search date	Search Terms	Exclusion criteria	Results	1st screening	2nd screening
Laurea Finna 22.10.2017	Blood Donation AND Vasovagal Reaction AND Prevention	English language, full text available, publication 2005-2017	64	6	3
Laurea Finna 22.10.2017	Blood donation AND vasovagal symptoms AND intervention	English language, full text available, publication 2005-2017	75	6	3
Laurea Finna 22.10.2017	Blood don* AND vasovagal AND prevent*	English language, full text available, publication 2005-2017	321	14	1
SAGE Journals 22.10.2017	Blood Donation AND Vasovagal Reaction AND Prevention	English language, full text available, publication 2005-2017	13	0	0
CINAHL (via EBSCO host) 22.10.2017	Blood don* AND vasovagal AND prevent*	English language, full text available, publication 2005-2017	3	1	0
In Total:			476	27	7

Table 2: Overview of Literature Search.

4.4. Appraisal of Evidence

When compiling a literature review, the importance of carefully considering the type of evidence included in the report cannot be overemphasized. This process is commonly referred to as evidence appraisal and it is the critical feature by which a good quality literature review is distinguished from a less reliable narrative review (Aveyard 2010, 16-19). The inclusion of poor quality evidence should therefore be avoided, as it will inevitably have a major negative impact of the overall reliability of the literature review.

To ensure that only suitable evidence was included in this review, a critical appraisal tool was employed in order to assess the various records produced by the literature search. Though

methods for evaluating evidence are abundant, the decision was made to utilize the Johns Hopkins Research Evidence Appraisal Tool (REAT), which is a practical tool for evaluating research evidence (Dearholt & Dang 2012, 119). The rationale for selecting this particular tool, as supposed to other alternatives, was the fact that it has been developed by an exceedingly reputable source. More to the point, the REAT was designed specifically to support evidence based practice in the field of nursing, thus making it appropriate for this review.

The Johns Hopkins Research Evidence Appraisal tool is divided into two schemes; one assessing the strength of research evidence and one appraising the quality. The strength is expressed on a scale ranging from level I-III, indicating the strongest evidence, to level V representing the weakest. Levels IV and V represent evidence obtained from non-systematic literature reviews, from committees or national authorities, and/or may be based merely on the experience of recognized experts of a field. For the purpose of this thesis, evidence rated as level IV and V was not considered of sufficiently high quality and were therefore excluded during both the first and the second screening phase.

Level	Type of Evidence
I	Evidence obtained from an experimental study, randomized controlled trial (RCT), or systematic reviews of RCTs, with or without meta-analysis
II	Evidence obtained from a quasi-experimental study or systematic review of a combination of RCTs and quasi-experimental studies, or quasi-experimental studies only, with or without meta-analysis
III	Evidence obtained from quantitative non-experimental study; systematic review of a combination of RCTs, quasi-experimental, and non-experimental studies, or non-experimental studies only with or without meta-analysis; or qualitative study or systematic review or qualitative studies, with or without a meta-synthesis

Table 3: Strength of Research Evidence Rating Scheme (Dearholt & Dang 2012, 108).

The quality of research evidence is similarly graded using a scale ranging from A (high quality), through B (good quality) to C (low quality). Only evidence appraised as being of good and high quality was included in this literature review, any evidence of low quality or containing major flaws was immediately discarded.

Grade	Research Evidence
A (high)	Consistent, generalizable results; sufficient sample size for study design; adequate control; definitive conclusions; consistent recommendations based on comprehensive literature review that includes thorough reference to scientific evidence
B (good)	Reasonably consistent results; sufficient sample size for the study design; some control; fairly definitive conclusions; reasonably consistent recommendations based on fairly comprehensive literature review that includes some reference to scientific evidence
C (low/ major flaw)	Little evidence with inconsistent results; insufficient sample size for the study design; conclusions cannot be drawn

Table 4: Quality Rating Scheme for Research Evidence (Dearholt & Dang 2012, 108).

Of the 11 articles included in the second screening phase, four records were discarded due to being of too poor quality to justify including in this literature review. The excluded records were comprised of two non-systematic literature reviews (B & C grade), one quasi-experimental study with major flaws (C grade) and one non-experimental (descriptive/prevalence) study of poor quality (C grade). A total of seven records were determined to be of sufficiently high quality to be included in the data synthesis; four randomized controlled trials (RCTs), two quasi-experimental studies and one systematic review. The strength and quality assessment of the included records is available in full in Appendix 1 and the PRISMA flow chart in Figure 4 demonstrates the record selection and screening processes.

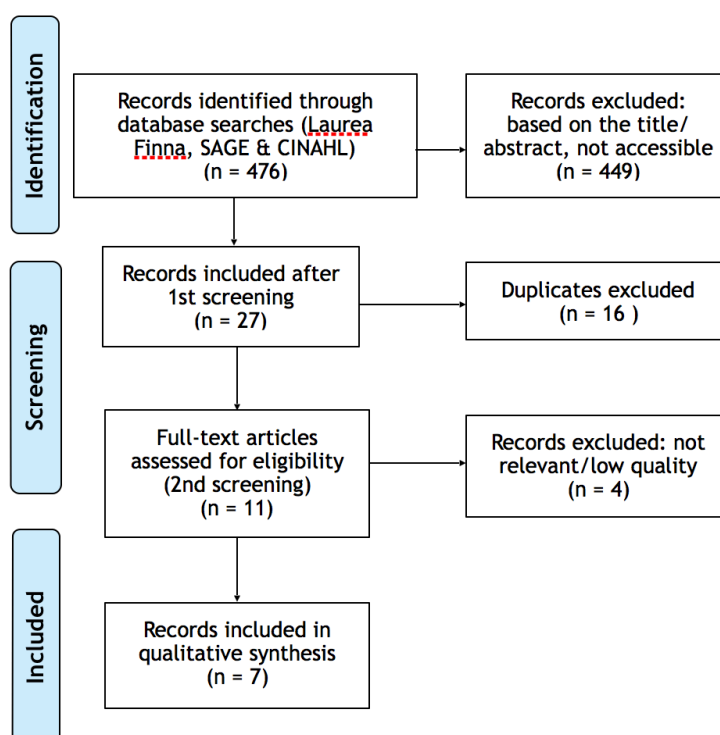


Figure 4: PRISMA flow chart of record selection and screening processes (Moher, Liberati, Tetzlaff, Altman & The PRISMA Group 2009).

4.5. Data extraction

Though it is generally recommended that data extraction be conducted by at least two separate individuals in an effort to avoid the introduction of bias into a study (Higgins & Green 2011), this was deemed to be outside the scope of options for this literature review.

Rather, having determined which records to include in the data analysis, the seven articles selected during the second screening phase were carefully scrutinized. A basic form was used to visually represent and keep track of the individual pieces of evidence in order to minimize the risk of valuable data being inadvertently excluded from the analysis. The purpose and main findings of the individual articles were documented using the data extraction form, as

were the aforementioned strength and quality assessment (Aveyard 2010, 120-121). The full details contained by the extraction form are available in Appendix 1.

4.6. Data Analysis

Subsequent to the data extraction, the data was summerized and then analyzed using the so-called simplified approach, as suggested by Aveyard (2010, 128-134). The rationale for choosing this particular method was informed by the fact that it allows for evidence obtained from a multitude of differently designed research studies to be incorporated into a singular, qualitative analysis.

Using this method of inductive content analysis, the articles were first meticulously examined in order to identify all the data relevant to the research question of this literature review, so as to minimize the risk of inadvertently omitting crucial data. Each piece of raw data was then coded by assigning it a uniquely formulated sentence. Next, all data was grouped together into sub-categories according to similarity, resulting in seven sub-categories. These were then assigned a preliminary title based on contents. Finally, three main categories were induced from the seven separate sub-categories and given a formal title, thus completing the process of moving from specific data to generalized theory. The data analysis process is described in Figure 5.

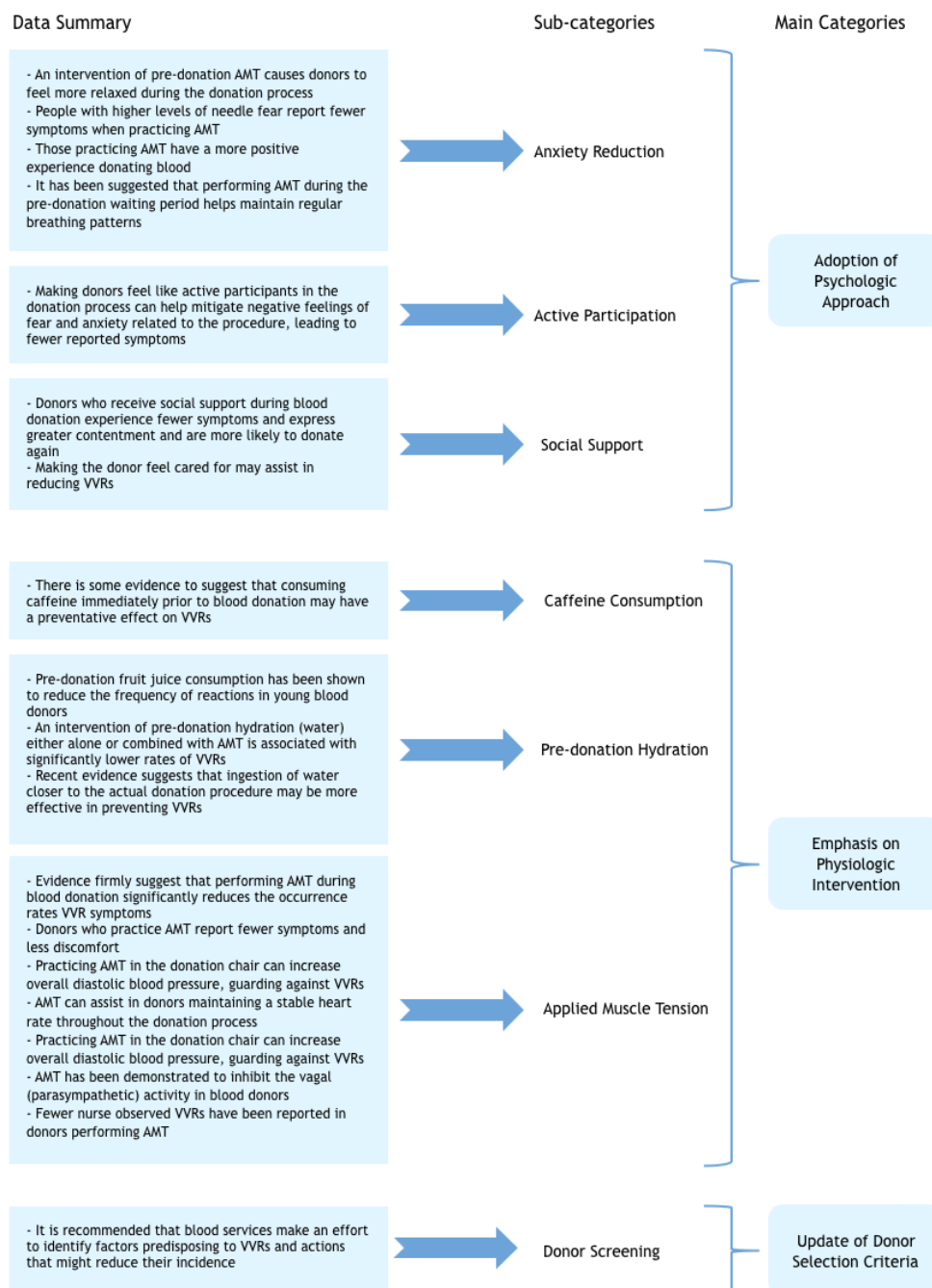


Figure 5: Content analysis process.

5. Findings

The data analysis was performed on seven carefully selected records which were meticulously reviewed, resulting in the discovery of three primary categories, induced from the data.

These categories indicate what kind of nursing interventions can be implemented in order to prevent vasovagal reactions in blood donors and are as follows; Adoption of Psychologic Ap-

proach, Emphasis on Physiologic Intervention and Update of Donor Selection Criteria (see Figure 6).

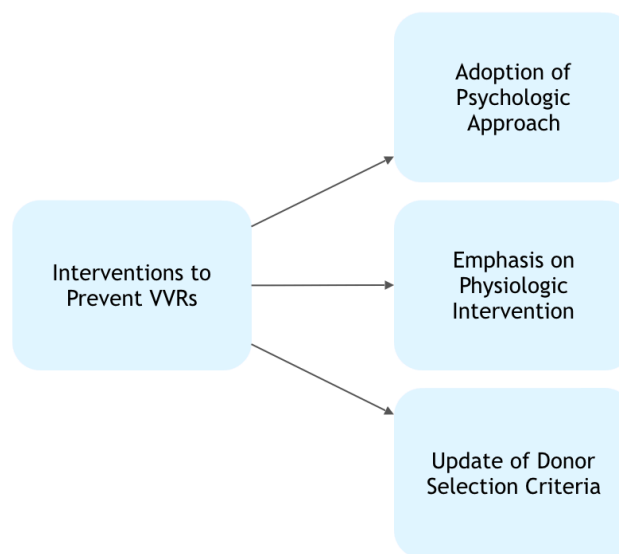


Figure 6. Findings - main categories.

5.1. Adoption of Psychologic Approach

Despite blood donation being an entirely voluntary, non-remunerated activity, it nonetheless can be an anxiety-provoking one. Although the motivation for donating blood is often founded in altruism, the process itself can be fraught with ambivalent feelings of fear, particularly among the demographic of young, first time donors (Ditto, Byrne & Holly 2009).

Since feeling anxious and fearful regarding blood donation might deter certain people from donating blood altogether, it is therefore of paramount importance that blood services adopt a psychologic approach to the blood donation process, in particular by attempting to alleviate the pre-donation anxiety of blood donors (Holly et al. 2011). Succeeding in doing so may play a significant role in reducing the incidence of vasovagal reactions in blood donors, a known obstacle to donor retention (France et al. 2003; Wiersum-Osselton et al. 2012).

During the course of the data analysis, one intervention in particular emerged as being effective in preventing vasovagal reactions in blood donors; namely that of applied muscle tension (AMT), also commonly referred to as simply applied tension. Initially devised by Öst and Sterner (1987), AMT originated as a behavioral technique designed to mitigate adverse effects resulting from blood and injury phobia. Applied muscle tension has since been adopted by numerous researchers and remains one of the most popular interventions in studies on the prevention of VVRs in blood donors.

AMT involves isometric tension of either the whole body or occasionally of the lower body only, performed in repeated, short cycles of a few seconds of continuous tension, followed by a few seconds of relaxation (Holly, Torbit & Ditto 2011). Applied muscle tension can also be performed as leg lifting exercises in which the donor briefly lifts one leg at a time above the donation chair, alternating between legs at regular intervals. As a technique, AMT has proven easy to learn, necessitating only a brief instructional video on how to accurately perform the exercise (Ditto & France 2006).

Although it was initially theorized that practicing AMT has a purely physiologic effect; specifically by raising and maintaining blood pressure (Öst & Sterner 1987), clinical studies of the technique have later suggested that the mechanism of AMT is as much psychologic. In a study of anxiety reduction among blood donors, applied muscle tension was proven effective in preventing vasovagal reactions, particularly in females with a higher pre-existing fear of needles. (Holly, Balegh & Ditto 2011). Similarly, a study by Ditto & France (2006) concluded that blood donors who practiced applied muscle tension while undergoing the blood collection process had a considerably better experience donating blood, compared to those who did not perform AMT. Additionally, there is some evidence to suggest that performing applied muscle tension prior to sitting down on the donation chair serves as a buffer for stress, by allowing for the donor to maintain a regular breathing pattern, thereby reducing anxiety (Holly, Torbit & Ditto 2011).

Another case for the adoption of a psychologic approach to blood donors and the donation process as a whole, was recently made by Vavic, Pagliariccio, Bulajic, Dinić & Marinozzi (2014). Their study found that attempting to dissipate the existing fears of blood donors by making the donor feel cared for, may create a placebo effect more effective than any physiologic intervention. More to the point, Holly, Torbit & Ditto (2011) similarly suggested that social support is an important factor in preventing vasovagal reactions among blood donors and can increase the likelihood of repeat donations.

5.2. Emphasis on Physiologic Intervention

The experience of a vasovagal reaction, regardless of it being mild or severe, has been firmly established as one of the primary deterrents to voluntary blood donation (France, Ditto, Wisel, France, Dickert, Rader, Sinclair, McGlone, Trost & Matson 2010). So far, the vast majority of clinical research into the prevention of VVRs has focused mainly on physiologic interventions, chief among them, the practice of applied muscle tension. Although there certainly appears to be a psychologic component to AMT, its merits as a physiologic method of VVR prevention cannot be denied.

A recent RCT study by Ditto et al. (2009) found that the heart rates of the participants in the group assigned to the treatment (AMT) remained stable and even slightly elevated compared to the control group which didn't practice AMT. Additionally, a modest increase in diastolic blood pressure was observed among participants in the treatment group, leading to the conclusion that performing applied muscle tension during blood donation may guard against VVRs

by increasing activity of sympathetic nervous system, while suppressing parasympathetic activity. (Ditto et al. 2009).

Several other research studies collectively support the notion that AMT is an effective physiologic measure for VVR prevention. A quasi-experimental study conducted by Ditto and France (2006) found that practicing applied muscle tension during the active donation process not only increased donor heart rate, but also significantly reduced the number of self-reported adverse symptoms, leading to an increase in overall donor satisfaction. Furthermore, a recent large scale systematic review and meta-analysis of the existing literature on VVR prevention in blood donors similarly concluded that AMT may indeed have a positive effect blood donor experience. However, the results were mostly confined to groups of female donors and therefore somewhat less conclusive than those made by other research studies (Fisher, Allen, Dorée, Naylor, Di Angelantonio & Roberts 2016).

Pre-donation hydration or water loading, that is, the consumption of water or other fluids before donation blood, was also identified as a potential intervention preventing VVRs (France, Ditto, Wissel, France, Dickert, Rader, Sinclair, McGlone, Trost & Matson 2010). Despite its efficacy being less studied; due to the tendency of research to focus on the effects of AMT, there is still some evidence supporting pre-donation hydration as a valid intervention. In a review of several RCTs, the act of drinking 500ml water before donating blood was concluded to lead to a 20% reduction in observed VVR rates. Blood donors who consumed water prior to donating blood gave considerably more positive responses when completing the Blood Donation Reactions Inventory (BDRI) post donation, compared to donors who did not drink water (Fisher et al. 2016).

When combined with AMT, water loading appears to have a significant main effect on VVR prevention, at least in female donors (France et al. 2010). At any rate, since the effect of pre-donation hydration is transient, researchers have suggested that the time of ingestion directly correlates to its efficacy as a VVR prevention method (France et al. 2010). Furthermore, Vavic et al. (2014) posit that giving blood donors something to drink pre-donation, in the case of their study, fruit juice, creates a favorable placebo effect which may prevent the onset of vasovagal reactions. Although the mechanism is slightly different, physiologic versus psychologic, the effect nonetheless remains evident.

Finally, there is some evidence to indicate that ingesting a dose of caffeine may have a mitigating effect on vasovagal reaction rates, when consumed prior to blood donation. Caffeine is thought to influence heart rate and perhaps even blood pressure, therefore making the effects similar to those observed in donors practicing AMT. Although pre-donation caffeine ingestion has not been extensively researched and is therefore not well-supported by literature, the intervention appears to at least have potential. (Fisher et al. 2016).

5.3. Update of Donor Selection Criteria

It has previously been established that first time donation status, among other factors, is a reliable indicator of the risk of vasovagal reactions in conjunction with blood donation (Agnihotri et al. 2012; Gillet et al. 2015; Philip et al. 2014).

During the data analysis, a third type of intervention with the potential to prevent VVRs emerged, albeit one substantiated by much less empirical evidence. Fisher and colleagues (2016) argue that blood services should make a greater effort to identify blood donors at risk of developing VVRs, in addition to identifying potentially effective preventive interventions. Doing so, they claim, may significantly reduce the incidence of VVR, ultimately improving blood donor health and ensuring an adequate blood supply.

6. Discussion

Although there currently being no unequivocal consensus among researchers as to which interventions are the most effective in preventing vasovagal reactions in blood donors, several measures have nonetheless been demonstrated to possess considerable potential. An emphasis on physiologic intervention, specifically by encouraging the practice of AMT in addition to fluid loading, as well as the adoption of an anxiety reducing psychologic approach to blood donation, show particular promise as preventive interventions.

On the one hand, the majority of the interventions shown to prevent VVRs in blood donors, in particular AMT and anxiety reduction efforts, appear to be effective only when applied to female donors. Meanwhile, it is important to take into consideration the fact that many studies included in this literature review relied heavily on donors self-reporting vasovagal symptoms post donation. This evaluation method is potentially problematic, since the results were based on the entirely subjective opinions of the research subjects, rather than clinical observations.

As France and colleagues rightly pointed out; the discrepancy in efficacy between the sexes may very well stem from the fact that men are more reluctant than women to report adverse symptoms following blood donation (France et al. 2010). The reason for this may be rooted in persistent cultural perceptions of masculinity, making males less likely to display vulnerability by reporting VVR symptoms. Another astute observation supporting this view was made by Holly, Balegh and Ditto (2011), who argue that men; compared with women, may be intrinsically more skeptical of interventions designed to dissolve blood donation fears and anxiety. More to the point, the apparent effect of AMT on women can perhaps be explained by their relative body size and the higher proportionate blood loss associated with donating blood.

On the other hand, though preventive VVR interventions were demonstrated to be more effective in young, female donors, it does not necessarily follow that said interventions have no

effect whatsoever in men or indeed in donors of a more advanced age. It is crucial to note that many of the research studies included in this literature review were conducted on a relatively small scale. It is therefore entirely possible that the number of participants in each study was not sufficiently large to make any decisive conclusions regarding the efficacy of the various interventions. The fact that vasovagal reactions commonly occur in less than 1,5% of all whole blood donations, makes them incredibly difficult to study. The number of participants need to be exceptionally high in order to demonstrate any significant positive impact of a given measure. Also, the focus of most of the included studies was on young donors, i.e. of an age less than 25-years, yet this does not rule out the possibility of interventions being effective with older donor demographics. What is evident, however, is that the mechanism of vasovagal reactions is not purely physiologic nor psychologic in nature, but rather contain components of each. As such, it stands to reason that interventions designed to prevent VVRs from occurring in blood donors should also be designed to address both the physiologic as well as psychologic aspects.

The issue of efficacy is perhaps of lesser importance in the context of this literature review, since the purpose was to describe the types of nursing interventions which can be implemented in order to prevent vasovagal reactions in blood donors. It can certainly be argued that even a slight indication of a preventive intervention being effective is meaningful in the context of blood donor safety and well-being. Though vasovagal reactions are somewhat rare, even a minor reduction in overall incidence rates could potentially have a major impact on donor satisfaction and ultimately on donor retention.

6.1. Implications for Nursing Practice

The amount of field specific information available to health care professionals is staggering, to say the least. Scores of new research studies and articles are published daily, making it increasingly difficult to stay up to date on recent advancements in the field. Nurses have a professional and ethical obligation to continuously educate themselves on important developments within their field (ICN 2012). However, no one can truly be expected to attain and interpret every singular piece of evidence by themselves (Aveyard 2010, 6). In fact, due to the overwhelming amount of available data, there is an increased risk of misinterpreting information, particularly if the context is not properly understood (The Cochrane Collaboration 2011).

A literature review strives to show a wider and more nuanced picture of certain phenomenon, allowing for conclusions to be made based on a body of evidence, rather than just a singular source. The access to good quality, empirically obtained evidence is crucial to contemporary nursing practice, which is increasingly informed by the principles of evidence based practice. Indeed, the notion that nurses are in a unique position to improve the quality of health care services has gained increasing recognition in recent years (Committee on the Robert Wood Johnson Foundation Initiative on the Future of Nursing, at the Institute of Medicine 2011, 24-25). Nurses possess a great potential to affect their own work environments and be at the forefront of movements bringing about positive change.

As mentioned earlier, the nurses working at Finnish Red Cross Blood Service are responsible for the entire practical process of blood donation and they work in close proximity with blood donors. Nurses interact with blood donors and make great efforts to ensure that the donation experience is pleasant and above all, safe. Whenever an unusual event occurs, for instance a vasovagal reaction, the nurses at FRC Blood Service apply their professional expertise and provide the care necessary to alleviate the discomfort of blood donors. It is therefore quite possible that the findings of this literature review could have a very tangible impact on this small niche of nursing practice.

While some of the findings of this literature review would necessitate involvement on an organizational level; for instance in case of adjustments made to current working guidelines, other interventions could be fairly easily implemented on a day-to-day basis by the nurses working at the Blood Service collection sites.

For instance, increased awareness among the nurses of the risk factors associated with VVR incidents might assist them in more precisely determining which blood donors are likely to experience a vasovagal reaction. Crucially, better knowledge of vasovagal prevention interventions might allow for the nurses to be better prepared, should an adverse event arise. Similarly, by adopting more consistent practices of encouraging donors to consume water or other fluids prior to blood donation, as well as actively teaching donors how to perform applied muscle tension, nurses at the FRC Blood Services could be instrumental in bringing down VVR incidence rates.

6.2. Limitations

There were several limitations to this literature review, the most crucial of which was perhaps the relative inexperience of the author of the review. The novice status of any researcher will almost certainly have an impact on the overall quality of the planning, as well as the execution of a study. Evidence appraisal in particular may prove difficult to the novice researcher who is lacking in expertise and knowledge of various research methodologies.

Another limitation of this study involves the types of research studies uncovered by the literature search. Though the quality and strength of evidence were generally good, it is worth mentioning that many of the studies included in the data analysis were conducted by a small group of North-American researchers. This fact may very well have led to the introduction of reporting and/or publication bias in said research studies (The Cochrane Collaboration 2011). In consequence, a conservative interpretation of the findings is advised.

Furthermore, significant limitations arose from the fact that a large number of randomized controlled trials initially deemed pertinent to the purpose of the literature review, were published in the journal *Transfusion*, which unfortunately is not accessible to students of Laurea University of Applied Sciences. It is therefore entirely plausible that important data with the potential to shed further light on the research question could have been inadvertently omitted from this review.

6.3. Trustworthiness

As mentioned previously in the section concerning inclusion and exclusion criteria, this literature review relied solely on primary sources. For the purpose of this report, secondary sources were excluded from the data analysis, in order to maintain a high level of credibility by reducing the risk for bias and misinterpretation. Though it certainly cannot be entirely ruled out that interesting opinions or observations were missed due to this exclusion, the advantages of the decision are believed to far outweigh the possible disadvantages.

A key feature of a high quality literature review is its reproducibility, which is achieved by applying and adhering to a rigorous methodology (Higgins & Green 2011). At any rate, there is no denying that this literature review fails to qualify as a systematic review, as defined by the esteemed Cochrane Collaboration (2011). However, the literature review process was conducted in an exceedingly meticulous manner, from planning to execution phase. An evidence appraisal tool developed by a highly reputable source, the Johns Hopkins Research Evidence Appraisal Tool (Dearholt & Dang 2012) was utilized in order to critically assess the data produced by the literature search. This was done in an effort to further emphasize the validity of the included evidence. The theoretical background, as well as the research methods applied in this review were described in detail, as to demonstrate the reproducibility and trustworthiness of this study.

6.4. Ethical Considerations

No principles of ethical research conduct were violated during the course of the literature review process. All statistical data obtained from FRC Blood Service and incorporated into this report was entirely devoid of personal identifiers, ensuring the anonymity of the sources of the data.

The appropriate protocol for relinquishing internal statistical data was followed as prescribed by FRC Blood Service, including the signing of a legal document to ascertain confidentiality. The data was provided on an external USB drive which was promptly destroyed after use.

Furthermore, plagiarism was avoided by ensuring that any and all original sources were appropriately cited according to the Laurea Guidelines for Referencing (King 2013) and that all conclusions and results obtained from literature were accurately and truthfully presented.

6.5. Conclusion and Recommendations

Based on the findings of this literature review, there appears to be relatively strong empirical evidence suggesting that several interventions aimed at preventing vasovagal reactions in blood donors are at least somewhat effective. Furthermore, it seems evident that by adopting an updated approach to VVR prevention, the nurses of FRC Blood Services can play a vital role in reducing the incidence of adverse reactions in Finnish blood donors, leading to a safer and more positive blood donation experience.

Thus far, the vast majority of research has focused primarily on the interventions of applied muscle tension and pre-donation hydration, and the proposed efficacy of these are well documented in literature. However, little time and effort has been dedicated to explore the validity of social support, caffeine ingestion or even audio-visual distraction as potential preventive interventions against VVRs.

It is therefore highly recommended that further research exploring alternative methods of VVR prevention in blood donors be carried out, in order to ensure adequate donor retention and a sufficient blood supply in the future.

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Appendices

Appendix 1: Data Extraction Form & Evidence Appraisal35

Appendix 1 - Data Extraction Form & Evidence Appraisal

Author(s) & Publication Year	Title	Purpose	Conclusions	Evidence Rating
Holly, C., Torbit, L. & Ditto, B. 2011	Applied Tension and Coping with Blood Donation: A Randomized Trial	To evaluate the effectiveness of applied muscle tension (AMT) in reducing vasovagal symptoms during blood donation and the mechanisms of action	AMT, both before and during blood donation, is useful in preventing vasovagal symptoms and reducing pre-donation anxiety	RCT level I, quality A
Fisher, A., Allen, D., Dorée, C., Naylor, J., Di Angelantonio, E. & Roberts, D. 2016	Interventions to Reduce Vasovagal Reactions in Blood Donors: a Systematic Review and Meta-analysis	To analyze the evidence from RCTs of interventions to reduce fainting in blood donors	Pre-donation consumption of water may decrease the rate of VVRs. The effect of pre-donation caffeine was inconclusive. There is little evidence that applied muscle tension (AMT) alone decreases the occurrence of VVRs, though evidence is stronger when AMT is combined with pre-donation hydration.	Systematic review level II, quality A
Ditto, B. & France, C. 2006	The Effects of Applied Tension on Symptoms in French-Speaking Blood Donors: A Randomized Trial	To assess the effectiveness of applied muscle tension (AMT) on VVR prevention in comparison with no treatment and placebo controls in blood donors	Some evidence supporting AMT as a preventive intervention of VVRs. The placebo was proven more effective than receiving no treatment.	Quasi-experimental study level II, quality B
Vavic, N., Pagliariccio, A., Bulajic, M., Dinić, R. & Marinozzi, M. 2014	Giving blood donors something to drink before donation can prevent fainting symptoms: is there a physiological or psychological reason?	To verify the efficacy of fruit juice administration in preventing high school first time blood donors' reactions	Giving blood donors fruit juice (or other fluid) pre-donation has a psychological (placebo) effect. No evidence to support the notion that pre-donation hydration produces a physiological effect preventing VVRs.	Quasi-experimental study level II, quality B
Holly, C., Balegh, S. & Ditto, B. 2011	Applied Tension and Blood Donation Symptoms: The Importance of Anxiety Reduction	To develop a laboratory analogue for blood donation and to examine more closely the relative roles of exercise-related cardiovascular activity versus anxiety reduction in the effects of AT on vasovagal symptoms	AMT was proven more effective in females with a higher fear of needles, than in non-fearful females and all males. The effect of AMT appears psychological in nature, as it may reduce anxiety (in females)	RCT level I, quality A

Appendix 1 - Data Extraction Form & Evidence Appraisal

<p>France, C., Ditto, B., Wissel, M., France, J., Dickert, T., Rader, A., Sinclair, K., McGlone, S., Trost, Z. & Matson, E.</p> <p>2010</p>	<p>Pre-donation Hydration and Applied Muscle Tension Combine to Reduce Presyncopal Reactions to Blood Donation</p>	<p>To evaluate the combined effect of pre-donation hydration and repeated muscle tension on the experience of presyncopal reactions to blood donation</p>	<p>The pre-donation water loading group had significantly fewer reactions than the placebo control group. The water loading and muscle exercise group had significantly fewer reactions than placebo and marginally fewer reactions than standard donation groups. All effects were observe in female donors only.</p>	<p>RCT level I, quality A</p>
<p>Ditto, B., Byrne, N. & Holly, C.</p> <p>2009</p>	<p>Physiological Correlates of Applied Tension May Contribute to Reduced Fainting During Medical Procedures</p>	<p>To examine the psychophysiological correlates of AT in a real-life medical (blood donation) setting commonly associated with fear-related vasovagal reactions. (This study is a follow up to a previously conducted RCT)</p>	<p>No reported difference in efficacy of full body AMT compared only lower body AMT. However, those practicing AMT maintained or even slightly increased their HR/ blood pressure during blood donation, compared to those who didn't perform AMT. Evidence suggests that practicing AMT may also result in increasing sympathetic activity while decreasing parasympathetic activity, thus protecting against VVRs</p>	<p>RCT level I, quality B</p>