Congruence between perceived and theoretical knowledge before and after an internet-based continuing education program about venous leg ulcer nursing care

Background Previous research has revealed nurses' knowledge gaps in venous leg ulcer (VLU) nursing care, and continuing education is needed. The closer nurses' perceived knowledge is to their evidence-based theoretical knowledge, the better possibilities they have to conduct evidence-based VLU nursing care.

Objectives: To assess the congruence between nurses' perceived and theoretical knowledge about VLU nursing care before and after an internet-based education about VLU nursing care (eVLU).

Design Quasi-experimental study with intervention and comparison groups and pre- and post-measurements.

Setting: Home health care in two Finnish municipalities.

Participants: Nurses (n=946) working in home health care were invited to participate. In the intervention group 239 nurses and 229 nurses in the comparison group met the inclusion criteria, and they were all recruited to the study.

Method: Nurses were divided into intervention and comparison groups with lottery between the municipalities. Nurses in both groups took care of patients with VLU according to their organizations' instructions. In addition to this, nurses in the intervention group received a 6-week eVLU while those in the comparison group did not. Data were collected with a questionnaire about perceived and theoretical knowledge before education, at six weeks, and at 10 weeks. The percentages of congruence were calculated at every measurement point, and the McNemar test was used to detect statistical significance of changes between measurements.

Results The increase of congruence was more often statistically significant in the intervention group than in the comparison group.

Conclusion The results support the hypothesis that the congruence between perceived and theoretical knowledge will be higher among nurses receiving eVLU. Because of the low participation and drop-outs, the results should be interpreted with caution.

Keywords internet-based education, perceived knowledge, theoretical knowledge, venous leg ulcer

INTRODUCTION

Based on previous research, nurses lack knowledge in VLU nursing care. Nurses acquire most of their knowledge from their own experience and colleagues, and decision-making in VLU nursing care is mainly driven by experiential knowledge (Haram *et al.* 2003, Gillespie *et al.* 2014, Ylönen *et al.* 2017*)*.

Background

VLU is a wound of venous origin in the ankle or the lower leg (e.g. Chronic Leg Ulcers: Current Care Guidelines 2014). The prevalence of VLUs increases as the population ages (Moffat *et al.* 2004). In the United Kingdom it has recently been shown that one-year costs for a healed VLU are £3,000 (€3,400), and for an unhealed VLU, £13,500 (€15,300). The mean of annual treatment costs is £7,600 (€8,600) per VLU. (Guest *et al.* 2017.)

According to evidence-based guidelines the most important goal of VLU nursing care is to control long-term edema, and compression treatment must be carried out appropriately to achieve this (e.g. Chronic Leg Ulcers: Current Care Guidelines 2014). Problems put forward by patients with VLU are related to pain, moving, social life, odour, difficulties in bathing and washing, and slippage of dressings (Maddox 2012, Young *et al.* 2017).

Most patients with a VLU live in their own homes (Probst *et al.* 2014). Home health care refers to a wide range of health care services that are provided to individuals in their homes for any illness or injury, and it is arranged variably across Europe. In Finland home health care is arranged based on the same legislation in all municipalities (Health Care Act 2010). The goal of home health care in all European countries is to support people living in their own homes (The Ageing Report 2017, Kiersey *et al.* 2017.)

During the last few years, several studies have focused on nurses' continuing education (CE) (e.g. Beitz & van Rijswijk, 2012, Baxter *et al.* 2013, Lahti *et al.* 2014, Esche *et al.* 2015). Studies of CE specifically in VLU nursing care seem to be lacking even though a need for them has been identified.

In knowledge measurement, objective measurement is recommended whenever possible (Spurlock & Wonder 2015), as it has been argued that people have only moderate understanding of their abilities (Zell & Krizan 2014). Therefore, measuring only self-assessed perceived knowledge may not accurately reflect a person's actual knowledge level (Kruger & Dunning 1999).

Congruence between nurses' perceived and actual knowledge has been examined in some studies; in perioperative skin preparation (Markström & Bjersa 2015), diabetes care (Drass *et al.* 1989, El-Deirawi & Zuirakait 2001, Chan & Zang 2007, Yacoub *et al.* 2014, Alotaibi *et al.* 2017), patients' rights (Iltanen *et al.* 2012), and artificial nutrition (Gamberi *et al.* 2017).

In the study by Iltanen *et al.* (2012), there was no correlation between perceived and theoretical knowledge, while Drass *et al.* (1989) found a moderate low negative correlation between nurses' perceived and theoretical knowledge of diabetes. In studies by El-Deirawi *et al.* (2001), Chan & Zang (2007), Yacoub *et al.* (2014) and Alotaibi *et al.* (2017) a positive correlation between nurses' perceived and actual knowledge was found. However, in studies by Alotaibi *et al.* (2017) and Gamberi *et al.* (2017) it was found that subjects overestimated their knowledge. Studies examining congruence between nurses' perceived and theoretical knowledge before and after CE intervention are lacking.

The aim of this study was to assess the congruence between nurses' perceived and theoretical knowledge before and after an internet-based CE program about venous leg ulcer nursing care (eVLU). The percentages of those who perceived knowing and who knew are presented in the results. In this study, perceived knowledge was defined as nurses' subjective evaluation of their knowledge.

Theoretical knowledge is nurses' actual knowledge about VLU nursing care, measured with a knowledge-test. The closer nurses' perceived knowledge is to their evidence-based theoretical knowledge, the better possibilities they have to conduct evidence-based VLU nursing care.

METHODS

Design

Quasi-experimental study design with intervention and comparison groups and pre- and post-measurements (Shadish *et al.* 2002) was used. The research question was: What is the congruence between perceived and theoretical knowledge? The study hypothesis was: The congruence between perceived and theoretical knowledge will be higher among the nurses receiving the education program than among those not receiving it. The TREND Statement Checklist (Des Jarlais *et al.* 2004) was used in reporting the results.

Participants and setting

This study took place in home healthcare in two large Finnish municipalities in autumn 2014. All nurses (n= 946) were invited to participate with e-mail. To be eligible to participate in the study, nurses had to have either a permanent employment relationship or at least 3 months temporary post in home care, and they were required to be taking care of patients with chronic leg ulcers. Lottery between the municipalities was used to decide intervention and comparison groups. Eligible nurses in the first municipality comprised the intervention group and eligible nurses in the second municipality served as a comparison group.

Sample size was calculated with power analysis (for F-test ANOVA, effect size 0.20, $p = 0.05$, power 0.80) using statistical package G*POWER version 3.17 (Faul *et al.* 2007). Based on power analysis, 100 nurses were needed in both groups.

Study flow

There were 480 possibly eligible nurses in the intervention group and 466 in the comparison group. Of these, 239 nurses in the intervention group and 229 nurses in the comparison group met the inclusion criteria, and they were all recruited to the study.

Only 97 (40.6%) of the nurses in the designated intervention group and 62 (27.1%) in the comparison group participated in the baseline measurement (M0). During the whole study, 47 participants in the intervention group and 22 participants in the comparison group dropped out. This left 50 (20.9%) participants in the intervention group and 40 (17.5%) participants in the comparison group for the second follow-up measurement (M2). The reasons for dropping out were not requested. (Figure 1)

Study intervention

The intervention was the implementation of eVLU which was based on evidence-based guidelines about VLU nursing care available on the Internet. Researcher was responsible in delivering the eVLU. The structure and contents of eVLU were based on previous literature review about nurses' knowledge gaps about VLU nursing care. (XXX). The knowledge gaps were identified in VLU etiology and pathophysiology, healing process, assessment, topical care and compression treatment. The evidence-based internet material used in eVLU was evaluated by experts (tissue viability nurse and physician) in VLU nursing care (XXX). The detailed development of eVLU has been reported elsewhere (XXX). Briefly, it consisted of a lecture and discussion about using eVLU, and a 6-week period (from September to October 2014) of distance learning for home healthcare teams of 8-12 nurses. The lecture to guide nurses in the use of eVLU was delivered by the researcher at the beginning of the study. Distance learning was accomplished with weekly modules in University Moodle, a virtual web-based learning platform (Moodle™ 2014). Nurses received access credentials to Moodle, and the log files were reviewed weekly by the researcher. Learning was based on a home healthcare patient case

description, and nurses answered weekly questions based on the case description. eVLU contained all the necessary material to answer the questions.

Data collection

Information about the study was sent by e-mail to all Registered Nurses (RNs) working in home health care in both municipalities. Nursing managers were asked to enable RNs' and Licensed Practical Nurses' (LPNs) participation during working hours. The data was collected by the researcher or research assistant.

Data on the nurses' socio-demographics were collected at baseline measurement (M0). Data about outcome variables (perceived and theoretical knowledge) were collected at three measurement points: baseline (M0) data were collected before eVLU, first follow-up data (M1) right after eVLU, and second follow-up data (M2) one month after the eVLU had been completed. Data collection was carried out with paper and pencil.

Outcome data were collected with a structured instrument based on previous instruments developed by Graham *et al.* (2001), which have been modified and used also by VanHecke *et al*. (2009). In this study, the instrument was called PKAK (Perceived Knowledge, Attitudes, Knowledge). In the PKAK instrument perceived and theoretical knowledge is divided in six subscales; Pathophysiology and etiology, Assessment, Healing, Infection, Topical care and Compression (XXX).

The original instruments were translated and then back-translated from English (Graham *et al.* 2001) and Flemish (VanHecke *et al.* 2009) into Finnish (Sousa & Rojjanasrirat 2010). The PKAK instrument was further refined based on literature review, deductive reasoning, and expert panels (XXX). Permission to use and revise the original instruments was obtained from the authors, who also approved the final version of the PKAK -instrument.

Perceived knowledge was measured with a five-point Likert scale: 1 = totally disagree, 2 = somewhat disagree, 3 = neither disagree nor agree, 4 = somewhat agree, 5 = totally agree. Higher scores denoted higher perceived knowledge level. Theoretical knowledge had three alternatives: 1 = wrong, 2 = right and 3 = do not know. Correct answers yielded 1 point and wrong and do not know answers 0 points. Higher scores denoted higher theoretical knowledge level.

Data analysis

For the analysis, the results for perceived knowledge were combined into two groups; answers 4 and 5 = perceived knowing and answers 1, 2 and 3 = did not perceive knowing. The results of theoretical knowledge were correspondingly combined into two groups: answer 2 = knew the right answer, answer 1 and 3 = did not know the right answer. The percentages of those who perceived knowing and knew are presented in the results.

The Number Cruncher Statistical System (NCSS) 10 (2015) was used in data analyses and percentages were used to summarize the data. Because of the low number of participants, percentages of congruence are reported according to the total number of participants at each measurement point. McNemar test was used to measure p-values of change of congruence between different measurement points in both groups, and reported p-values refer to the same participants in sequential measurements. A p-value of < 0.05 was considered statistically significant.

Ethical considerations

Ethical approval was obtained from the University Ethics Committee in February 2014. Permission for the study was obtained from chief administrators in participating municipalities (23 April 2014 and 13 June 2014). Permission to use material on the Internet for eVLU was obtained from the institutions responsible for their publishing. Participation in the study was voluntary. Individual participant data

was kept separate from the study data and identified with a unique participant number. It is not possible to recognize individual participants and municipalities in the study reports.

RESULTS

Nurses in the comparison group were older (p=0.009) and they had longer working experience in home healthcare (p= 0.011), and they also had longer experience in VLU nursing care (p= 0.095) than nurses in the intervention group. (Table 1)

There were some differences in the congruence at baseline measurement between the groups in all subscales. The congruence increased in both groups during the study, but the increase was statistically significant in more items in the intervention group than in the comparison group. The percentages of congruence were between 4.9% and 74.2% at baseline, 4.8% and 94.3% at the first follow-up (M1) and between 4.0% and 94.0% at the second follow-up (M2). (Tables 2, 3 and 4)

In subscale pathophysiology and etiology the congruence increased during the study in both groups. The increase was statistically significant in the intervention group in three items between baseline (M0) and the first follow-up (M1) and in five items between baseline (M0) and the second follow-up (M2). In the comparison group, the increase of congruence was statistically significant in one item between baseline (M0) and the second follow-up (M2). (Table 2)

In the subscale patient assessment the congruence increased during the study in both groups. The increase was statistically significant in two items in the intervention group between baseline (M0) and the first follow-up (M1) and in the same two items between baseline (M0) and the second follow-up (M2). In the comparison group, there was a statistically significant increase of congruence in one item between baseline (M0) and the second follow-up (M2). (Table 3)

In the subscale healing the congruence increased during the study in most items in both groups. In the intervention group, the increase was statistically significant in one item between baseline (M0) and the first follow-up (M1) and in the same item between baseline (M0) and the second follow-up (M2). In the comparison group, the increase was statistically significant in one item between baseline and the first follow-up (M1) and in two items between baseline (M0) and the second follow-up (M2). (Table 3)

In the subscale infection the congruence increased during the study in both groups in most items. The increase was statistically significant in one item in the intervention group between baseline (M0) and the first follow-up (M1) and in the same item between baseline (M0) and the second follow-up (M2). In the comparison group, the increase was not significant in any of the items between any of the measurement-points. (Table 3)

In the subscale topical care the congruence increased during the study in both groups. In the intervention group the increase of congruence was statistically significant in one item between baseline (M0) and the first follow-up (M1) and in two items between baseline (M0) and the second follow-up (M2). In the comparison group, the increase of congruence was statistically significant in one item between baseline (M0) and the second follow-up (M2). (Table 4)

In the subscale compression the congruence increased during the study in both groups. The increase was statistically significant in seven items in the intervention group in seven items between baseline (M0) and the first follow-up (M1) and in three items between baseline (M0) and the second follow-up (M2). In the comparison group, the increase of congruence was statistically significant in one item between baseline (M0) and the first follow-up (M1) and in two items between baseline (M0) and the second follow-up (M2). (Table 4)

DISCUSSION

The hypothesis for this study was that the congruence between perceived and theoretical knowledge would be higher among nurses receiving eVLU than those not receiving it. The closer nurses' perceived knowledge is to their theoretical knowledge, the better possibilities they have to conduct evidence-based VLU nursing care. In general, the congruence increased during the study in both groups, but the increase was more often statistically significant in the intervention group than in the comparison group.

Based on the previous studies, subjects may overestimate their capabilities and have only moderate understanding of their abilities (Lai & Teng 2011, Zell & Krizan 2014). In this study, nurses perceived knowing more than they actually knew, as congruence was not achieved even after eVLU in either of the groups. However, nurses' subjective perception of their knowledge is important and they can perceive different aspects of knowledge as important compared to the knowledge measured in the knowledge tests.

It is important to realize that humans construct their knowledge based on what they already know (Amineh & Asl 2015). It may be that if the nurses had an accurate grasp of their actual knowledge, this information could be used to estimate their educational needs in health care organizations when planning CE programs. This grasp could also be an impetus for nurses to take part in CE.

The highest congruence between perceived and theoretical knowledge in both groups and at each measurement point was seen in the assessment subscale in the items about nutrition. This is a very positive finding as nutrition has a vital role in VLU nursing care. In the compression subscale, a statistically significant increase in congruence was seen in most items in the intervention group. This is also essential as compression treatment is a cornerstone of VLU nursing care, and evidence-based

knowledge is needed to implement it correctly (e.g. Chronic Leg Ulcers: Current Care Guidelines 2014.)

The percentage of congruence between perceived and theoretical knowledge was between 9.43% and 94.3% at the first follow-up measurement (M1) and between 4.0% and 94.0% at the second follow-up measurement (M2). It seems apparent that there is a clear need to strengthen nurses' knowledge about VLU nursing care and CE is needed to constantly update nurses' knowledge.

Validity and reliability

The PKAK instrument was developed using previously used instruments and screened against evidence-based guidelines and a literature review of nurses' knowledge in VLU nursing care (XXX). Content validity of PKAK was evaluated in three expert panels. Item relevancy, clarity and difficulty were evaluated, and item content validity was satisfactory. The instrument was piloted in a population similar to the study population (XXX). Detailed information of item content validity and Cronbach's alpha coefficient results has been reported in a previous article (XXX).

The content of eVLU was constructed with evidence-based material. Instructions of how to use eVLU were delivered by the researcher and they were also available in Moodle. The content of eVLU was identical to all nurses in the intervention group. The intervention was piloted in a population similar to the study population. Nurses were informed about the purpose and aim of the study during a lecture before the study. The data were collected in the same time frame from both groups by the researcher. (XXX)

Limitations

Participant recruitment was carried out by e-mail and briefing before the study. Reminders about the study were e-mailed to managers. This approach was chosen because managers were asked to enable nurses' participation, and if, for example, work shift arrangements were needed, they were responsible for arranging them. It is possible that remainders sent also directly to the participants themselves would have increased participation.

eVLU required nurses to solve weekly questions about nursing care of a patient with VLU. This may have been one reason for low participation because based on previous research (Treweek 2015), the more the intervention requires that participants do, the more difficult it is to recruit participants and retain participation. Participant drop-out resulted in low response rates at all of the measurements. One possible reason for the low participation could have been that nurses were already confident in their knowledge of VLU nursing care, and because of this they were not interested in continuing in the study.

Because of low participation and participant drop-out the targeted sample size to obtain 80% power was not reached and the results of this study may not be generalized to the whole study population and caution is needed when interpreting the results.

It is possible that some of the nurses were more committed to VLU nursing care, and because of this, participated more actively in the study. This could influence the generalizability of the results. However, if this was the case, it can be argued that if the congruence between perceived and theoretical knowledge was low even in this group of committed nurses, it should be an even more important professional issue to be considered in practice.

It should also be remembered that other factors besides eVLU could have had an effect on congruence (Moore *et al.* 2015). For example, we could not control that nurses did not try to find additional

information. It is also possible that the content of the instrument items themselves stimulated new thinking in both groups irrespective of the eVLU. It must also be borne in mind that study participation itself usually shapes participants' behavior starting from recruitment. However, it is not easy to know definitely the mechanisms or conditions of this effect or its magnitude (McCambridge *et al.* 2014.)

CONCLUSIONS

The results of this study indicate that it may be possible to increase the congruence between perceived and theoretical knowledge of VLU nursing care with eVLU. However, the effect may be short-lived, and this calls attention to the importance of CE. With CE it is also possible to increase nurses' awareness of their knowledge, and measuring both perceived and theoretical knowledge can highlight the potential differences between the two. Measuring congruence of perceived and theoretical knowledge expands the understanding of the outcomes of CE.

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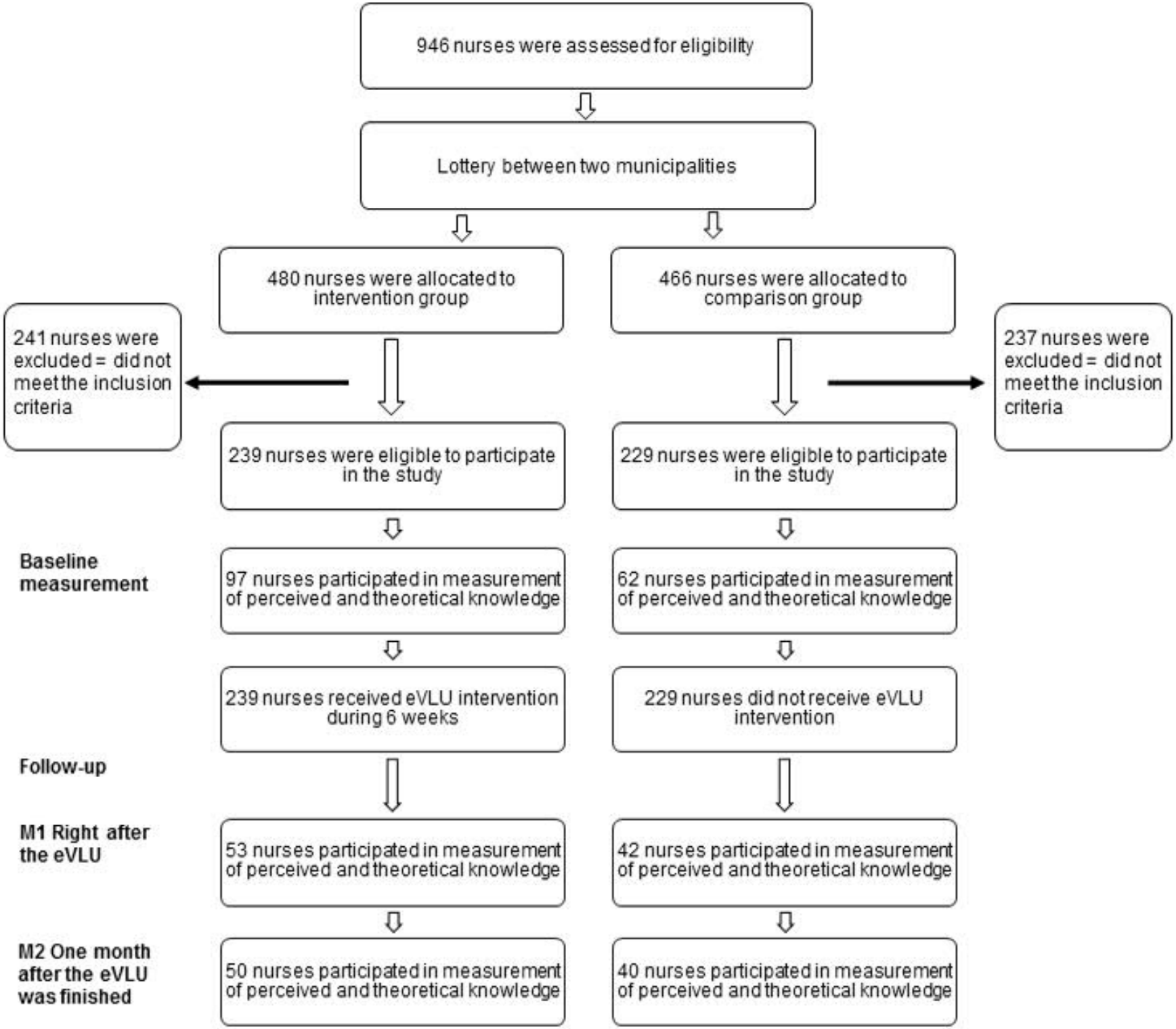
946 nurses were assessed for eligibility
Lottery between two municipalities
480 nurses were allocated to intervention group
466 nurses were allocated to comparison group
241 nurses were excluded = did not meet the inclusion criteria
237 nurses were excluded = did not meet the inclusion criteria
239 nurses were eligible to participate in the study
229 nurses were eligible to participate in the study
Baseline measurement
97 nurses participated in measurement of perceived and theoretical knowledge
62 nurses participated in measurement of perceived and theoretical knowledge
239 nurses received eVLU intervention during 6 weeks
229 nurses did not receive eVLU intervention
Follow-up
M1 Right after the eVLU
53 nurses participated in measurement of perceived and theoretical knowledge
42 nurses participated in measurement of perceived and theoretical knowledge
M2 One month after the eVLU was finished
50 nurses participated in measurement of perceived and theoretical knowledge
40 nurses participated in measurement of perceived and theoretical knowledge

Table 1 Socio-demographics of the participants of the study

	Intervention group (n= 69 - 98)			Comparison group n= 37-61)			
Socio-demographic	Mean (SD)	Min.	Max.	Mean (SD)	Min.	Max.	p-value
Age (years)	39.00 (11.88)	20.00	63.00	44.34 (12.91)	19.00	63.00	0.009
Work experience in social and health care after graduation to profession	9.36 (8.50)	0.33	39.25	13.66 (10.3)	0.42	33.75	0.007
Work experience in home health care/years mean	7.55 (7.46)	0.13	30.00	11.10 (9.85)	0.42	33.00	0.011
VLU nursing care experience years	5.70 (7.17)	0.00	30.00	8.28 (8.08)	0.42	28.00	0.095

p-values by F-test ANOVA, p-value is statistically significant at the <.05 level

Table 2 The congruence in VLU etiology and pathophysiology

	Intervention group						Comparison group					
	M0 (n=91-97) %	M1 (n=49-53) %	M0 - M 1 p	M2 (n=48-50) %	M1 - M2 p	M0 - M2 p	M0 (n=53-61) %	M1 (n= 40-42) %	M0 - M 1 p	M2 (n= 37-40) %	M1 - M 2 p	M0 - M2 p
A.I know the etiology of the ulcer I'm taking care of												
1. Acuteness	51.0	45.3	0.240	51.0	0.287	0.156	50.9	50.0	0.771	53.9	0.801	0.699
2. Cause - external bruise of skin	42.7	57.7	0.358	56.2	0.388	0.314	52.5	47.6	0.509	61.5	**0.040**	0.306
3. Cause - previous vein block	14.4	26.4	0.112	18.0	0.201	0.242	21.7	21.4	0.534	20.5	0.675	0.480
4. Edema in lower leg	62.1	65.4	0.442	74.0	0.675	0.145	68.3	71.4	0.699	71.8	0.172	0.102
5. VLU - varicose veins	41.2	43.4	0.139	48.0	0.377	0.156	45.9	47.6	0.565	63.2	0.075	0.253
6. VLU - picture selection	24.2	26.5	0.293	29.2	0.253	0.405	11.3	12.2	0.675	13.5	0.506	1.000
B. I know how VLU differs from arterial ulcer by appearance												
7. Patients with VLUs - varicose veins	37.8	47.2	0.144	51.0	0.247	**0.022**	28.3	33.3	0.559	42.5	0.238	0.213
8. VLU - depth	29.6	47.2	**0.034**	53.1	0.387	**0.010**	22.0	28.6	0.587	35.0	0.931	0.082
9. VLU - secretion	32.3	50.9	**0.050**	56.3	0.453	**0.044**	38.6	37.5	0.406	45.0	0.275	0.181
10. VLU - pedal pulses	10.4	18.9	**0.029**	16.3	0.464	**0.023**	12.1	14.6	0.249	20.0	0.275	0.083
11. VLU - location	36.5	54.7	0.110	58.3	0.669	0.087	28.8	33.3	0.623	52.5	0.558	0.240
C. I know how a necrotic ulcer looks like												
12. VLUs are not usually covered with necrotic tissue	41.8	64.2	0.138	62.0	0.369	0.206	37.9	42.9	0.565	55.3	0.261	0.392
D. I know what a fibrin coverage ulcer looks like												
13. VLUs are usually covered with fibrin tissue	53.7	71.7	0.265	72.0	0.187	**0.021**	56.7	73.8	0.172	60.0	0.176	0.506

p= p-value; McNemar -test, p-value is statistically significant at the <.05 level, A – D = Items about perceived knowledge, 1 – 13 = Items about theoretical knowledge in knowledge-test

Table 3 The congruence in patient assessment, VLU healing and infection

		Intervention group						Comparison group					
Subscale		M0 (n=96-97) %	M1 (n= 42-53) %	M0-M1 p	M2 (n=49-50) %	M1-M2 p	M0-M2 p	M0 (n= 56-62) %	M1 (n=42- 42) %	M0-M1 p	M2 (n= 38-40) %	M1-M2 p	M0 - M2 p
Assessment	**A. I know why nutritional status must be followed if patient has an ulcer**												
	1. Need of energy	71.4	84.9	**0.007**	84.0	0.506	**0.029**	60.0	83.3	0.107	77.5	0.513	0.368
	2. Healing - protein	83.7	92.5	0.062	92.0	0.223	0.287	75.8	90.5	0.102	90.0	0.223	0.261
	B. I know what ABPI is												
	3. ABPI - nutrition	16.5	37.7	**0.003**	36.7	0.246	**0.001**	10.3	16.7	0.363	30.0	0.199	**0.033**
Healing	**A. I know how to assess healing**												
	1. Ulcer size measurement - assessment of healing	71.4	83.0	0.152	78.0	0.480	0.317	74.2	85.7	0.705	90.0	0.317	0.096
	2. Ulcer size measurement frequency	40.6	59.6	0.133	48.0	0.340	0.193	29.0	26.2	0.565	30.8	0.368	0.440
	3. Patients ability to move - healing	68.4	77.4	0.275	72.0	0.326	0.501	72.6	81.0	0.525	82.5	0.506	0.193
	4. Guidance to wound care expert	8.16	9.43	0.155	4.0	0.370	0.319	4.8	7.1	0.572	10.0	0.368	0.261
	B. I know the stages of healing												
	5. Inflammation stage	20.4	28.3	0.357	32.7	0.072	0.090	12.3	21.4	0.572	25.0	0.198	**0.029**
	6. Proliferation stage	26.8	52.8	0.111	44.0	0.363	0.144	28.6	23.8	0.513	23.7	0.549	0.319
	C. I know the signs of ulcer healing												
	7. Occurrence of bacteria - infection	29.5	39.6	**0.035**	38.8	0.172	**0.017**	15.0	23.8	0.476	40.0	**0.050**	**0.024**
	8. Increase in ulcer size - infection	81.6	88.7	0.255	86.0	1.00	0.478	75.8	83.3	0.176	90.0	0.368	0.189
Infection	**A. I know the signs of ulcer infection**												
	1. Ulcer infection - secretion	71.4	79.3	0.168	78.0	0.521	0.308	75.4	76.2	0.392	70.0	0.705	0.129
	2. Colonization with bacteria	22.7	43.4	**0.044**	46.9	0.129	**0.012**	22.0	26.2	0.370	30.0	0.082	0.172
	B. I know when to take bacterial sample from the ulcer												
	3. Bacterial sample - clinical signs of infection	36.1	43.1	0.751	46.0	0.677	0.513	45.9	40.5	0.480	47.5	0.801	0.506
	C. I know how to take bacterial sample from the ulcer												
	4. Bacterial sample - right after the dressings are removed	44.3	58.5	0.092	57.1	0.558	0.197	31.7	28.6	0.206	27.5	0.513	0.331
	D. I know how bacteria affect the ulcer												
	5. Infection - pain	59.8	71.2	0.130	72.0	0.565	0.164	67.7	64.3	0.767	67.5	0.392	0.458

p= p-value; McNemar -test p-value is statistically significant at the <.05 level, A – D = Items about perceived knowledge, 1 – 8 = Items about theoretical knowledge in knowledge-test

Table 4 The congruence in topical care and compression treatment

		Intervention group						Comparison group					
Subscale		M0 (n=95-98) %	M1 (n=51-53) %	M0 - M1 p	M2 (n=48-50) %	M1- M2 p	M0 - M2 p	M0 (n=57-62) %	M1 (n= 41-42) %	M0 - M1 p	M2 (n= 39-40) %	M1 - M2 p	M0- M2 p
Topical care	**A. I know what aseptic working means in ulcer care**												
	1. Changing dressings - sterile procedure	29.6	35.3	0.157	43.8	0.317	0.132	27.4	28.6	0.157	27.5	0.157	0.607
	B. I know how to cleanse ulcer bed												
	2. Cleansing - chlorhexidine	52.6	46.2	0.699	51.0	0.333	0.534	52.5	61.9	0.550	52.5	0.572	0.706
	3. Cleansing - hydrogen peroxide	66.0	60.4	0.649	65.3	0.572	0.267	64.4	78.6	0.543	60.0	0.261	0.706
	4. Enzymatic cleansing - all ulcers	13.5	34.0	**0.040**	29.2	0.368	**0.009**	10.5	23.8	0.321	22.5	0.946	**0.026**
	C. I know the principles of how to choose topical care supplies												
	5. Ulcer care - cause of the ulcer	46.9	56.6	0.761	62.5	0.954	0.343	56.5	61.0	0.539	65.0	0.506	0.506
	6. VLUs - same topical care treatments	49.0	50.9	0.900	61.2	0.284	0.359	50.0	58.5	0.558	70.0	0.392	0.358
	7. Ulcer dressings – secretion evaporation	50.0	56.6	0.870	66.7	0.472	0.164	62.3	71.4	0.497	70.0	0.801	0.406
	8. Ulcer dressings - moisture evaporation	28.6	37.7	0.600	26.5	0.679	0.293	38.7	41.5	0.380	32.5	0.549	0.139
	9. Ulcer dressings – warmth evaporation	31.6	43.4	0.288	42.9	0.766	0.196	46.8	51.2	0.449	50.0	0.675	0.649
	10. Dressing materials - contact allergy	45.4	50.9	0.484	60.0	0.504	**0.045**	58.1	66.7	0.605	62.5	1.000	0.704
	D. I know how to use the topical care supply I have chosen												
	11. VLU - daily treatment	65.3	67.9	0.685	75.5	0.721	0.215	66.7	71.4	0.406	70.0	0.506	0.558
	12. Topical care product - most important treatment for VLU	18.6	13.5	0.753	25.0	0.088	0.133	11.5	26.2	0.142	28.2	0.565	0.089
	13. Dressing change - pain	59.8	55.8	0.635	63.3	0.347	0.187	41.0	53.7	0.753	37.5	0.135	0.710
Compression	**A. I know why compression treatment is implemented**												
	1. Compression - VLU healing	74.2	94.3	0.076	94.0	0.717	0.068	62.3	78.1	0.122	82.5	0.261	0.199
	B. I know when to implement compression treatment												
	1. Compression - all patients with VLU	42.7	50.9	0.216	46.9	0.406	0.172	24.6	19.1	0.293	32.5	0.136	0.133
	2. ABPI -value - safe compression safely	6.3	20.8	**0.036**	22.0	0.721	**0.024**	4.9	9.5	0.572	20.0	**0.046**	**0.022**
	3. Finishing compression	57.9	77.4	0.139	72.0	0.644	0.416	48.4	64.3	0.287	67.5	0.287	0.174
	C. I know how to implement compression treatment												
	1. Compression - most important treatment for VLU	45.8	71.7	**0.012**	66.0	0.801	0.127	38.7	52.4	0.109	52.5	0.387	0.215
	2. Graduated compression	45.8	64.2	**0.009**	60.0	0.753	**0.023**	50.0	57.1	0.291	66.7	0.618	0.238
	3. Compression - 24 hours daily	53.7	64.7	**0.034**	52.0	0.300	0.191	51.6	59.5	0.340	52.5	0.261	0.168
	4. Pressure socks	14.6	18.9	**0.036**	16.3	0.513	0.189	10.0	4.8	0.525	12.5	0.135	0.112
	5. Elastic bandages	20.8	22.6	**0.039**	26.0	0.766	0.054	16.1	22.0	0.558	28.2	0.135	0.096
	6. Inelastic bandages	19.0	28.3	**0.003**	32.0	0.846	**0.019**	24.2	28.6	0.545	25.6	0.160	**0.048**

p= p-value; McNemar -test p-value is statistically significant at the <.05 level, A – C = Items about perceived knowledge, 1 – 13 = Items about theoretical knowledge in knowledge-test