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Confidence and clinical judgement in community nurses managing venous leg ulceration – a judgement analysis

ABSTRACT

Background: The variation in the management of venous leg ulceration in the UK is partly attributable to an uncertain clinical environment but the quality of judgements is influenced by the how well nurses' confidence and accuracy are aligned.

Objectives: To assess UK community nurses' confidence in the accuracy of their diagnostic judgements and treatment choices when managing venous leg ulceration.

Design: Judgement Analysis

Setting: UK community and primary care nursing services

Participants: 18 community non-specialist nurses working in district (home) nursing teams and general practitioner services and 18 community tissue viability specialist nurses.

Methods: Using judgement analysis methods, 18 community non-specialist nurses and 18 community tissue viability specialist nurses made diagnoses and treatment judgements about compression therapy for 110 clinical scenarios and indicated their confidence for each judgement. An expert panel made consensus judgements for the same scenarios and these judgements were used as a standard against which to compare the participants. Confidence analysis was used to assess the nurses' confidence about their diagnostic judgements and treatment choices.

Results: Despite being very experienced, both non-specialist nurses' and specialist tissue viability nurses' levels of confidence were not well calibrated with their levels of accuracy.

Conclusion: The results of this study are important as errors resulting from both over and under-confidence at the diagnostic phase of management may influence treatment choices, and thus increase the chances of treatment error.

KEY WORDS

   Community health nursing; Decision making; Judgement Analysis; Leg ulcer; Research; Varicose ulcer.

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HIGHLIGHTS

- The quality of diagnosis and treatment for venous leg ulcers is often suboptimal.

- UK specialist nurses are more accurate than non-specialist nurses.

- Nurses should be appropriately confident about their judgement accuracy.

- Both UK specialist and non-specialist nurses are under- and over-confident.

- Inappropriate levels of confidence may increase the chances of treatment error.

1. BACKGROUND

The management of leg ulcers is a complex and resource-intensive activity for community nurses (1) . Leg ulcers - non-healing wounds on the lower leg - are mostly due to venous insufficiency causing blood to pool in the lower leg. Some are caused by arterial insufficiency preventing sufficient blood reaching the skin of the lower leg. Other are due to a combination of both venous and arterial problems or complications due to other co-morbidities (2, 3). The optimal (and safest) treatments depend on being able to appropriately diagnose the cause(s) of a leg ulcer.

For venous leg ulceration uncomplicated by arterial disease, compression therapy is effective in promoting healing (4) but it is dangerous for patients with arterial or mixed leg ulcers as it further reduces the amount of blood getting to the skin. Research suggests that community nurses are less accurate than they could be when diagnosing and choosing treatments for venous leg ulcers (5) and many people do not receive a diagnosis of the cause of their leg ulceration (1).   The management of leg ulcers is an exemplar of a clinical problem surrounded by "irreducible" uncertainty: imperfect information often imperfectly presented and partially dependent on the information seeking skills of the clinician. Such skills are affected by clinicians' levels of confidence in the correctness of their clinical judgements.

Being over-confident or under-confident are features of clinical decision making (6, 7).   Clinicians with high confidence in a judgement are less motivated to seek more information to confirm or deny that judgement (8) or use information support systems such as practice guidelines (9). This can lead to inaccurate diagnostic judgements and inappropriate treatment choices.   The literature suggests that experienced nurses have a tendency towards over-confidence (10-12). Clinicians with low

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confidence in a judgement may seek the advice of clinicians with more expertise (13) which can delay care and have resource implications through inappropriate referrals.

2. METHODS

2.1. Aim

The aim of the study was to assess UK community nurses' confidence in the accuracy of their diagnostic judgements and treatment decisions as to whether or not to apply compression to treat leg ulceration.

2.2. Theoretical Framework and Research Design

This study was nested within a judgement analysis which has been previously reported (5, 14). The judgement analysis compared the accuracy of the diagnostic judgements and treatment choices of UK community tissue viability specialist nurses and non-specialist nurses managing venous leg ulceration. Judgement analysis starts from the premise that the accuracy of a judgement depends on the judge's (i.e. nurse's) use of information present in a judgement environment and the uncertainty present in that environment (Cooksey 1996b). This theoretical model can be portrayed as a form of lens in which the nurse's judgement "focuses" the information contained in a clinical situation (Figure 1 – Supplementary data).

The left side in this model represents the 'ecology' or true state (e.g. the 'correct' diagnosis). Various information cues are linked to this side of the model (such as the appearance of the ulcer) and each cue carries a weight in terms of the contribution (importance) made to the judgement. The right side of the model represents the nurse's judgement of the situation (their diagnosis). A more detailed description of the component parts of a lens model can be found in the previous report of the judgement analysis (14). The relationship between the cues and the judgment and the cues and the ecology (15) is modelled using multiple regression. The lens model equation presents achievement in terms of accuracy (Ra) as a function of modelled knowledge (G), predictability (Re), cognitive control (Rs) and unmodelled knowledge (C).

2.3. Setting

Six UK primary care trusts in the north and south of England.

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2.4. Ethical considerations

Research governance approvals were granted by local NHS research governance committees and ethical approval was provided by University and local NHS ethics committees (REC Ref No 09/H1311/86).

2.5. Construction of the judgement task

The judgement task sought to mirror the UK prevalence of different types of leg ulceration (2, 3). The clinical records of 53 patients with venous leg ulceration and 33 patients with mixed/ arterial leg ulceration were randomly sampled from a trial data set (16). The records of 4 patients with ulcers of unusual aetiology were non-randomly selected from community nursing caseloads. Twenty records were replicated to achieve a total of 110 leg ulcer patient scenarios which were presented sequentially to form the judgement analysis task (17).

The judgement criteria and weights in the left (ecology) side of the Lens Mode were generated using nominal group consensus methods (18). Four community tissue viability specialist nurses with advanced knowledge and experience in managing leg ulceration from four different healthcare organisations formed a consensus panel. These nurses independently completed the online survey then these data were examined before the consensus meeting to identify areas of agreement and disagreement. At the consensus meeting the nurses were presented with their range of answers for each scenario and asked to agree a group answer. Complete agreement was reached for each scenario. A previous publication (5) gives a more detailed description of the construction of the judgement task.

2.6. Participants

The participants were registered nurses responsible for the care of at least one community-based patient with leg ulceration at the time of the research, or the care of at least two patients within the previous three months. These are the same participants as those in the previously reported judgement analysis (5)

The nurses were designated as specialist or non-specialist according to their job title. Tissue viability nurses were classified as 'specialist' while nurses working in general/ family practice and district/home care nurses were classified as 'non-specialist'. Data relevant to nurse decision making

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(19) and confidence (20-23) such as length of experience, level of education, knowledge, seniority, degree of clinical autonomy, and peer nomination as experts, were collected from all participants.

2.7. Sample size

A sample size calculation was undertaken to identify the number of participant nurses required. The study was powered to have an 80% chance of identifying a clinically significant difference in judgement accuracy of 0.2 in accuracy (Ra) between the two groups of nurses (24, 25). An effect difference of 0.2 would mean that an average tissue viability nurse would score higher (i.e. be more accurate) than 58% of the non-specialist nurse group (26). The calculation indicated a desired sample size of thirty eight participants with 19 participants in each group.

2.8. Data collection

The judgement analysis task of 110 scenarios containing key information that was deliberately variable was presented using an on-line survey tool (surveymonkey.com). Each nurse participant was asked to independently make a diagnostic judgement about the type of leg ulcer and a treatment decision as to whether or not to offer compression therapy. The participants were also asked to rank their level of confidence about the 'correctness' of each diagnosis and treatment judgement using a 1-10 Likert scale where '1' indicated 'not confident at all' and '10' indicated 'very confident'. The data were gathered in 2011 and 2012.

2.9. Data analysis

Confidence calibration techniques were used to analyse the relationship between the participant's confidence in their judgement or decision, and their level of judgement accuracy (27-29). Scatter plots of proportion of "correct" judgements (i.e. performance) with expressed confidence in performance (Petrusic and Baranski, 1997) were used to assess the relationship between nurses' confidence and their judgements.

3. RESULTS

3.1. The subjects

Eighteen community generalist nurses (GCNs) and eighteen community tissue viability specialist nurses (TVSNs) completed the judgement task (Table 1). Most of the participants had over 10 years nursing experience and both groups had spent a similar number of years caring for patients with leg ulcers. On average, the specialist nurses worked slightly more hours per week but they spent more

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than twice as much time than the generalist nurses on leg ulcer care and were more highly educated in terms of general post-graduate qualifications, leg ulcer related post graduate qualifications and non-medical prescribing qualifications. The groups varied little in relation to expertise as shown by job title and most participants were either specialist nurses or senior generalist nurses who had a high level of autonomy and usually worked with minimal supervision. When asked how others perceived their knowledge and skills regarding leg ulceration, three-quarters of the generalist group thought others perceived them as having considerable or advanced skills for leg ulcer care but a larger proportion of the specialist nurse group indicated that they thought that others viewed them as having advanced skills or expertise in leg ulcer care.

3.2. How did expertise affect the confidence of the community nurses in relation to the accuracy of their judgements and decisions?

Table 2 shows that a greater proportion of the specialist nurses' diagnoses were correct and they were, on average, more confident than the generalist nurses. The calibration score indicates the nurses' own assessment of their confidence in relation to the accuracy of their diagnoses. A score of 0.00 represents perfect calibration while 1.00 would indicate the worst possible lack of calibration. The calibration scores for diagnosis show poor calibration and no difference between the specialist nurses and the generalist nurses. Normalised resolution scores range from 0 to 1, with higher scores indicating greater ability to differentiate between correct and incorrect diagnoses. The normalised resolution scores for diagnosis show low ability and again no difference between the specialist nurses and the generalist nurses.

Figure 1 shows the confidence calibration curves for the specialist nurses' and the generalist nurses' diagnoses. Calibration curves plot the proportion of correct answers against the level of confidence indicated by the nurse. If a nurse's level of confidence about the accuracy of their judgements was perfectly correct this would show as a 45^0 degree line. A line below the 45^0 degree line indicates over-confidence while a line above the 45^0 degree line indicates under-confidence. Figure 1 shows that the nurses were less confident than was justified for diagnostic judgements where they indicated lower levels of confidence (below 45% confidence) but more confident than was justified where they indicated higher levels of confidence (above 45%).   The curves were very similar for both specialist and generalist nurses.

Table 3 shows that the specialist nurses had higher levels of confidence and a greater proportion of correct treatment judgements about high compression, compared to the generalist nurses.   The calibration scores show that both the specialist nurses' and the generalist nurses' own assessment of

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their confidence in relation to the accuracy of their diagnoses was fairly well calibrated with no difference between the groups. The normalised resolution scores show low ability to discriminate between correct and incorrect diagnoses and no difference between the specialist nurse and the generalist nurse groups.

Figure 2 shows the confidence calibration curves for the treatment choices of the specialist nurses' and the generalist nurses. The nurses were less confident than was justified for treatment choices where they indicated moderate or lower levels of confidence (below 60% confidence) but above this the relationship between confidence and accuracy became increasingly close and then very close where they indicated high levels of confidence (between 80-90% confidence).

4. DISCUSSION

Although the literature suggests that experienced nurses have a tendency towards over-confidence (Baumann et al., 1991, Hamers et al., 1997, Yang, 2009) in this study nearly all the nurse participants had high levels of experience but displayed *both* over-confidence and under-confidence. The specialist nurses were, on average, more accurate and more confident than generalist nurses about their diagnostic judgements and treatment decisions about whether or not to apply compression. However, both groups of nurse participants were more confident than was justified for diagnostic judgements in which they indicated a higher level of confidence. They were less confident than was justified for the diagnostic judgements in which they indicated a lower level of confidence. For the treatment decisions, they were less confident than was justified for decisions for which they indicated a lower level of confidence. Furthermore, the nurses' ability to discriminate between their correct and incorrect judgements for both the diagnostic and treatment judgement was low and overall the nurses had poor insight into their ability to make accurate diagnoses and treatment choices.

Both over-confidence and under-confidence can negatively impact on clinical decision making. In this study, the under-confidence and over-confidence for diagnosis is troubling since diagnosis is such an important cue driving safe and effective treatment choices. Under-confident nurses are likely to make incorrect diagnoses and the resulting diagnostic errors are, logically, likely to be transferred into treatment errors. An over-confident nurse may offer compression when it is unlikely to be beneficial and may even be harmful. However, a nurse aware of the risk of applying high compression to an arterially compromised leg but lacking confidence in the accuracy of their diagnoses of venous leg ulceration might prefer to withhold compression, even though they are

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aware that compression is likely to be highly beneficial for venous leg ulceration. This might partly explain the sub-optimal levels of treatment accuracy that were achieved in the judgement analysis in which this study was nested (5, 14)

When people have high confidence in a judgement they are less motivated to seek more information to confirm or deny that judgement (Kruglankski et al., 1991). So over-confident nurses may be less motivated to use information support systems such as practice guidelines (Friedman et al., 2005). By contrast, under-confident clinicians may seek the advice of more expert colleagues or consult sources of information such as text books or online data sources (Thompson et al., 2004) so under-confidence can be beneficial in driving clinicians to seek additional evidence-based information. However, if humans are the preferred source of information (Thompson et al., 2004) but these 'experts' are themselves under-confident, this may increase the risk of inappropriately conservative diagnoses and treatment judgements. This is likely to increase referral rates to other clinicians which may increase costs to health care providers and patients. This may be particularly true in a situation such as leg ulceration where feedback on accuracy (such as the correct diagnosis) is not easily available.

In this study there was only a moderate level of calibration between the nurses' own assessment of their confidence in their own judgement and the probability of that judgement being correct. Previous studies have found miscalibration is linked to increased task difficulty (Petrusic and Baranski, 1997, Yang, 2009). The confidence calibration statistics suggest that diagnosing venous leg ulcers and choosing whether or not to use compression therapy is difficult. There was a lower level of calibration for the diagnostic task than for the treatment task, which suggests that diagnosis might be more difficult than choosing whether or not to use compression.

4.1. Limitations and strengths

Internal validity was increased by selecting real patient clinical records as the basis for scenarios that reflected the diagnostic labels used in the UK population for people with leg ulcers. The inclusion of most of the cues reported as relevant by the literature and their presentation in naturally occurring measurement units of information (such as wound photographs and actual ABPI measurements) also increased internal validity. However, ecological validity was reduced by the need to use written/ photographic scenarios rather than real patient consultations. Some nurses suggested that they were less confident because the simulation prevented them gathering the full range of information they would seek in actual clinical practice and they felt unable to use their usual sources of support (such as colleagues' opinions) even though they had been advised that they could do so. It is

possible that the judgement task in this study is over-simplified and thus inadequately representative. Complete data were obtained from all participants and the inclusion of twenty replicated scenarios within the judgement task enabled predictive validity and judgement consistency to be checked.

External validity (in judgement analytic terms) was increased by using a number of scenarios sufficient for stable logistic regression estimates. The recruitment of an adequate number of nurses regularly making these sorts of judgements in real life also increased external validity but the use of non-random sampling resulted in a sample that may not represent the nurse population who undertake assessment and treatment of leg ulceration (30). Most of the generalist nurse participants had high levels of seniority, autonomy and clinical experience, and were perceived as having advanced knowledge and skills in leg ulcer care. They may not be representative of the generalist community nursing population who care for patients with leg ulcers. Furthermore, although the tissue viability specialist nurses were sampled from across the UK, the generalist nurses were only sampled from one geographical region in the UK so the results may not accurately estimate the level of achievement of UK generalist community nurses in general. Caution should be exercised when seeking to extrapolate these results to the wider population. It is also worth noting that the data was gathered in 2011 and 2012. However, recent data (1) suggests that UK leg ulcer care has not significantly improved since then so these results are likely to still have validity.

5. CONCLUSION

Our sample of UK community nurses had inappropriate levels of confidence when diagnosing venous leg ulceration and when choosing whether or not to apply compression therapy. Although the tissue viability specialist nurse specialists were more accurate than the non-specialist community nurses in both diagnosing venous leg ulceration and choosing whether or not to apply compression, both groups of nurses showed similar levels of under-confidence and over-confidence. Under-confidence and over-confidence can carry high costs in terms of clinical decision making particularly around inappropriate treatment choices and inappropriate referrals which have implications for quality of care and increased costs. The` under-confidence and over-confidence around diagnosis is particularly worrying since diagnosis is such an important cue for choosing treatment.

Although this study was conducted in the UK, accurate and confident diagnostic judgements and treatment choices for people with leg ulcers is a global issue. This study suggests that targeting

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nurses' confidence and calibration may be a fruitful component of interventions to improve the care of people with leg ulceration and reduce unwarranted variation.

Table 1 Demographic Characteristics

		Types of Nurses							
		Generalist Community Nurses (GCNs)				Tissue Viability Specialist Nurses (TVSNs)			
		n	%	Mean	SD	n	%	Mean	SD
Gender	Female	18	100			18	100		
	Male	0	0			0	0		
Area of Practice	General practice	9	50			0	0		
	District Nursing	9	50			0	0		
	Tissue Viability Specialist	0	0			18	100		
Mean Age (in years)				48	4.13			45	10.34
Nursing Experience	0-2 years	1	6			0	0		
	2-5 years	0	0			1	6		
	5-10 years	2	10			4	22		
	>10 years	15	84			13	72		
Mean Leg Ulcer Experience (in years)				12	5.27			13	6.56
Mean Hours Per Week Nursing				30	7.90			35	4.56
Mean Hours Per Week on Leg Ulcer Care				7	6.26			15	6.92
Nursing Qualifications	Nursing degree	2	11			8	44		
	Post graduate qualification	4	22			8	44		
Prescribing Qualifications	Nurse Prescriber	5	28			6	33		
	Non-medical Prescriber	2	11			7	39		
Leg Ulcer Education	Study Days	12	67			6	33		
	Diploma level	5	28			5	28		
	Degree level	1	6			6	33		
	Master's level	0	0			1	6		
Job Title	Staff Nurse	2	11			0	0		
	Sister/ Team leader	16	90			0	0		
	Specialist Nurse	0	0			18	100		
Level of Supervision	Usually	2	11			2	11		
	Sometimes	3	17			1	6		
	Occasionally	6	33			3	17		
	Rarely / Never	7	39			12	67		
Allocated Time per Leg Ulcer Treatment	10 minutes	1	6			0	0		
	20 minutes	1	6			0	0		
	30 minutes	4	22			1	6		
	40 minutes	2	11			2	11		
	As long as is needed	10	56			15	83		
Level of Perceived Expertise	Some skills	3	17			1	6		
	Considerable skills	11	61			2	11		
	Advanced skills	3	17			8	44		
	Expert	1	6			7	39		

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| Table 2. Calibration analysis for diagnosis Tissue viability specialist nurses vs. Generalist community nurses	All nurse participants (n = 36)		TVSNs (n= 18)		GCNs (n= 18)			
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**t(df 34)**	**Sig (2-tailed)**
Proportion correct (%)	72.85	9.16	77.93	6.89	67.78	8.42	-3.96	<0.01
Confidence level (%)	67.77	13.62	72.53	12.97	63.01	12.87	-2.21	0.03
Over / Under Confidence %	-5	NA	-5	NA	-5	NA	-0.13	0.90
Calibration	0.57	0.17	0.58	0.13	0.57	0.21	-0.21	0.83
Normalised Resolution	0.21	0.12	0.18	0.11	0.24	0.14	-0.06	0.95
N Observations per nurse		110		110		110		

| Table 3. Calibration analysis for treatment Tissue viability specialist nurses vs. Generalist community nurses	All Nurse participants (n = 36)		TVSN (n= 18)		GCN (n= 18)			
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**t(df 34)**	**Sig (2-tailed)**
Proportion correct (%)	73.00	8.20	76.66	6.01	69.34	8.59	-2.96	0.01
Confidence level (%)	68.21	13.26	73.32	12.65	63.10	12.12	-2.47	0.02
Over / Under Confidence %	-5.08	NA	-3.34	NA	-6.24	NA	0.70	0.49
Calibration	0.26	0.10	0.27	0.10	0.26	0.11	-0.04	0.96
Normalised Resolution	0.21	0.14	0.18	0.15	0.24	0.13	1.42	0.16
N Observations per Nurse		110		110		110		

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Fig 1. Confidence calibration curve for diagnosis Tissue viability specialist nurses vs. generalist community nurses
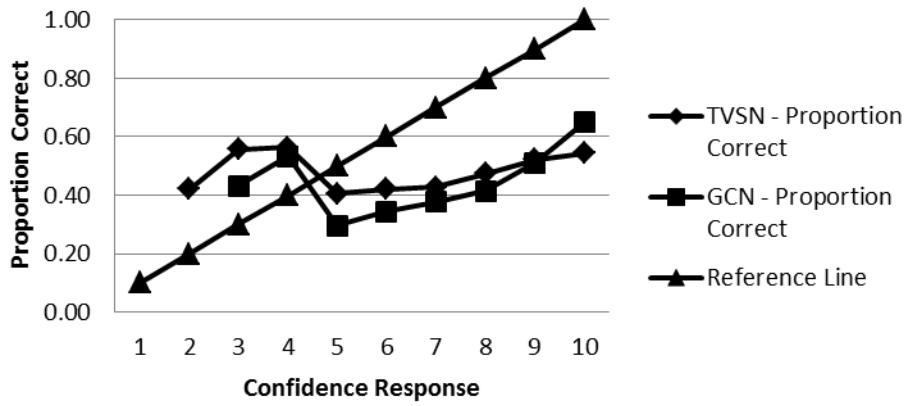
Fig 2. Confidence Calibration Curve for Treatment Tissue Viability Specialist Nurses vs Generalist Community Nurses
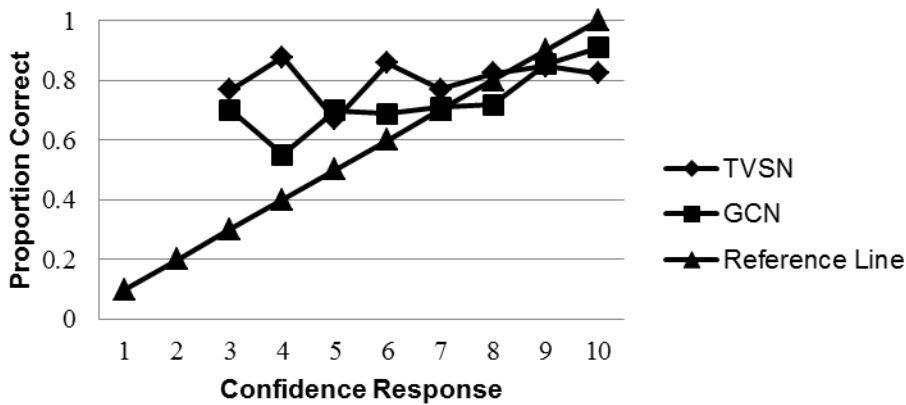
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