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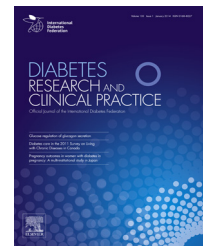
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## Illness beliefs predict self-care behaviours in patients with diabetic foot ulcers: A prospective study

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### ABSTRACT

**Aims:** Patients' illness beliefs are known to be influential determinants of self-care behaviours in many chronic conditions. In a prospective observational study we examined their role in predicting foot self-care behaviours in patients with diabetic foot ulcers.

**Methods:** Patients ( $n = 169$ ) were recruited from outpatient podiatry clinics. Clinical and demographic factors, illness beliefs and foot self-care behaviours were assessed as baseline (week 0). Foot self-care behaviours were assessed again 6, 12 and 24 weeks later. Linear regressions examined the contribution of beliefs at baseline to subsequent foot self-care behaviours, controlling for past behaviour (i.e., foot self-care at baseline) and clinical and demographic factors that may affect foot self-care (i.e., age and ulcer size).

**Results:** Our models accounted for between 42 and 58% of the variance in foot self-care behaviours. Even after controlling for past foot-care behaviours, age and ulcer size; patients' beliefs regarding the symptoms associated with ulceration, their understanding of ulceration and their perceived personal control over ulceration emerged as independent determinants of foot self-care.

**Conclusions:** Patients' beliefs are important determinants of foot-care practices. They may, therefore, also be influential in determining ulcer outcomes. Interventions aimed at modifying illness beliefs may offer a means for promoting self-care and improving ulcer outcomes.

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## 1. Introduction

Diabetic foot ulcers are a common complication of diabetes, affecting up to 25% of people with the disease [1]. The costs to health services are considerable. In 2010–2011 the English health service spent £639–662 million on diabetic foot care alone: equivalent to £1 in every £150 of total spending [2]. The burden of ulceration is also significant for patients, with the rate of depressive disorder in people with ulceration reported to be as high as 32% [3].

The personal and societal costs of diabetic foot ulcers have led to initiatives, such as educational and other more complex interventions, which seek to reduce the incidence and burden of ulceration [4,5]. The promotion of foot-related self-care behaviours is at the heart of most these approaches. Indeed, the central importance of self-care behaviours was echoed in a recent consensus statement issued by a multidisciplinary expert panel [6]. This panel advocated a range of behaviours for reducing foot complications such as ulceration, whilst also acknowledging that there is still very little evidence to support specific self-care practices.

This area of diabetes management is, however, thwarted by a lack of high quality evidence in two related areas. First, relatively little research has been undertaken into the factors which influence engagement with foot self-care. It is clear that patients often report limited knowledge and poor understanding of foot care practices [7,8]. Unfortunately, such observations have led investigators to focus, almost exclusively, on knowledge as the precursor to behaviour; and in turn to educational interventions as a means of improving foot self-care behaviours and reducing ulcer risk [4]. We know, however, that knowledge alone is a poor determinant of behaviour [9]; and that educational interventions have, at best, only short-term effects on self-care behaviours and no discernible effect on clinical outcomes [4]. Thus, if we are to develop effective interventions to promote foot self-care behaviours we need to shift the focus away from knowledge and towards other modifiable predictors of behaviour.

Although relatively little research has been conducted into other modifiable determinants of foot-self-care behaviours, many published studies point towards patients' beliefs as being potentially important determinants of foot-self-care practices [10–12]. The central role of patient beliefs in influencing outcomes in diabetes per se (e.g., glycaemic control, quality of life) is now well-documented [13,14]. In contrast, their role in influencing foot-care behaviours has been limited to cross-sectional and/or qualitative studies which necessarily limit the potential to interrogate causal pathways [10–12].

A second limitation is that much of the work in this area has focussed on the self-care practices of patients at risk of ulceration, rather than those with an ulcer. In view of evidence that patients without ulcers often do not see the relevance of foot-self-care [15], it seems unlikely that findings from patients without ulcers can be readily generalised to those contending with active ulceration.

We describe here results from a prospective observational study which examined the relationship between patients'

illness beliefs and their self-reported foot care practices. The design of the study allowed us to examine the role of illness beliefs whilst controlling for the effects of 'past behaviour' i.e., foot-care at study entry; as this is known to be the most influential determinant of current and future behaviour: [16,17]. Furthermore, we were also able to include in our model the effects of clinical and demographic variables which might be expected to influence engagement with self-care practices (i.e., age and ulcer severity as measured by ulcer size).

## 2. Subjects, materials and methods

### 2.1. Patients

A convenience sample of patients with diabetes mellitus and a foot ulcer was recruited from outpatient podiatry clinics in secondary care. Patients were recruited into a longitudinal research programme examining psychological and behavioural aspects of diabetic foot ulceration. Ethics and relevant regulatory approvals were obtained from all hospital trusts from which patients were recruited and all participating patients provided written informed consent. The clinical team identified eligible patients and introduced them to the research. Patients willing to find out more about the study and/or participate were then introduced to a member of the research team who, in turn, provided further written and verbal information.

All clinics subscribed to a standard regimen of foot care, i.e., aggressive debridement at each visit, treatment of infections with antibiotics and the use of removable Scotchcasts and other footwear/devices for offloading ulcers on weight-bearing areas, minimising the likelihood of between-centre variations in treatment outcomes. Inclusion/exclusion criteria ensured the population consisted of patients with neuropathic or neuroischaemic ulcers. Patients were not eligible if they had: no palpable pulses on the affected foot; a history of any major (i.e., above ankle) or minor (i.e., greater than a single digit) amputation; known large vessel peripheral vascular disease (e.g. previous bypass surgery, angioplasty); advanced diabetic retinopathy with severe visual impairment; advanced nephropathy (e.g., on dialysis); other severe disabling medical conditions (e.g. stroke); or were being treated with platelet-derived growth factor, tissue engineered skin or total contact casts.

A total of 169 patients were recruited into the programme. Over the course of follow-up, 24 patients withdrew; 33 were lost to follow-up; 5 died and 16 had amputations. One-way ANOVAs and  $\chi^2$  analyses revealed that the patients who participated in all phases of the study did not differ significantly at baseline from those who withdrew, were lost to follow-up, died or had an amputation, on any of the reported clinical and demographic variables (data not shown). Complete data were available on each of the seven dimensions of illness beliefs for 121–125 patients at baseline. Data on foot self-care behaviours were available for 130 patients at baseline, 102 patients at week 6, 79 at week 12 and 74 at week 24.

### 3. Materials

#### 3.1. Illness beliefs

All participants completed the Brief Illness Perceptions Questionnaire (BIPQ) [18]. This instrument is derived from the highly influential self-regulatory model of illness [19] which asserts that patients form illness beliefs (also referred to as representations or cognitions) when contending with a health threat and that these beliefs play a central role in determining patients' emotional and behavioural responses to their illness. Accordingly, illness beliefs can be expected to be influential determinants of foot-self-care behaviours. The version of the BIPQ used in the present study [18] captured patients' beliefs regarding their foot ulcer in the following key domains (see also Table 1): identity (the experience of symptoms related to the condition); consequences (beliefs regarding the expected effects of the condition); timeline (beliefs regarding the likely chronicity of the condition); personal control (beliefs regarding one's ability to manage the condition); treatment control (beliefs regarding the effectiveness of treatment in managing the condition); coherence (patients' comprehension or understanding of their condition) and emotional responses (perceived emotional impact of the condition). The range of scores for each subscale was 0–10, with higher scores indicating a stronger belief in the relevant domain. The concurrent and predictive validity of the instrument has been reported elsewhere [18]. Reliability coefficients cannot be computed for the subscales in this instrument as each subscale is captured by a single item.

#### 3.2. Self-care behaviours

All patients completed the foot care subscale from the Summary of Diabetes Self-care activities (SDSCA) measure [20]. This brief self-report instrument exhibits robust reliability and validity [20] and assesses several core areas of self-care in diabetes. The items relating to foot self-care behaviours measured the frequency of checking of feet; inspecting inside of shoes; washing feet; soaking feet and drying between toes in the previous 7 days. The range of scores for each response was between 0 and 7, with higher scores indicating greater

frequency of the given behaviour. In accordance with guidance of the scale's authors, responses to the item measuring soaking of feet were reversed and the mean of scores across all 5 items was then computed and used in all subsequent analyses. Alpha reliability coefficients indicated good levels of reliability for the foot care subscale at each stage, ranging from 0.61 to 0.69.

#### 3.3. Procedure

Patients participated in a prospective observational study conducted over 24 weeks and were assessed at baseline (week 0) and 6, 12 and 24 weeks later. At baseline, clinical and demographic data were collected on all participants to characterise the cohort. This included age, glycosylated haemoglobin (HbA1c) levels and ulcer size. Size of ulcer involved placing a disposable transparent film over the ulcer and tracing the topical area of the ulcer. The tracing was then placed on a digital tablet (Visitrac: Smith and Nephew, London, UK) and the area of the ulcer was re-traced with a stylus to produce a measurement of absolute ulcer area (in mm<sup>2</sup>). Participants completed self-report measures of illness beliefs [18] and foot self-care behaviours [20] at baseline. The measure of foot self-care behaviours was repeated 6, 12 and 24 weeks later.

#### 3.4. Statistical analyses

One way ANOVAs and  $\chi^2$  were conducted to examine differences between patients who were included in the analyses and those who were not. Linear regressions examined the role of illness beliefs in predicting foot self-care. Initial regression models were constructed to examine the role of illness beliefs alone; with the main models adjusting for the role of patient age, ulcer size and self-care behaviour scores at baseline (i.e., previous foot self-care behaviour).

## 4. Results

#### 4.1. Participant characteristics

Table 2 summarises the clinical and demographic characteristics of all patients at baseline. This reveals that the mean age of patients was 61 years; the majority were male ( $n = 128$ ); had a diagnosis of type 2 diabetes ( $n = 117$ ); an average HbA1c of 8.7 (72 mmol/mol) and a mean ulcer size of 17.5 mm<sup>2</sup>. Descriptive data for the measures of illness beliefs and foot self-care behaviours are also presented in Table 2. The maximum score for each belief dimension is 10. Accordingly, our results indicate that, overall, patients reported few symptoms (identity beliefs); considered that their ulcers had moderately severe consequences for them (consequence beliefs) and were likely to last a moderately long time (timeline beliefs). They also reported stronger beliefs in the effectiveness of treatment to manage their condition (treatment control beliefs), compared with their beliefs in their own ability to do this (personal control beliefs). The data also indicate that patients reported having a moderate understanding of their ulcers (coherence beliefs) and associated them with modest levels of distress

**Table 1 – Overview of illness belief domains.**

Belief domain	Definition
Identity	Symptom experience
Consequences	Beliefs regarding the expected effects of ulceration
Timeline	Beliefs regarding the chronicity of ulceration
Personal control	Beliefs regarding one's personal ability to manage the ulcer
Treatment control	Beliefs regarding the effectiveness of treatment to manage the ulcer
Coherence	Perceived understanding of ulceration
Emotional responses	Perceived emotional impact of ulceration

**Table 2 – Summary of patient characteristics.**

	Mean (standard deviation)/frequency	N
Age	61.1 ( $\pm$ 11.6)	169
Gender	128 male	169
Diabetes type	Type 1 = 47; type 2 = 117	164
Baseline ulcer area (mm <sup>2</sup> )	17.5 ( $\pm$ 32.1)	153
Baseline HbA1c %	8.7 ( $\pm$ 1.8)	157
HbA1c (mmol/mol)	72 ( $\pm$ 19)	
Consequences	6.5 ( $\pm$ 2.2)	121
Timeline	6.1 ( $\pm$ 1.9)	123
Personal control	6.1 ( $\pm$ 2.5)	122
Treatment control	8.2 ( $\pm$ 1.4)	123
Identity	3.1 ( $\pm$ 2.9)	124
Coherence	6.2 ( $\pm$ 2.2)	125
Emotional responses	5.5 ( $\pm$ 2.8)	125
Foot self-care at baseline	5.0 ( $\pm$ 1.3)	130
Foot self-care at week 6	5.2 ( $\pm$ 1.4)	102
Foot self-care at week 12	5.3 ( $\pm$ 1.4)	79
Foot self-care at week 24	5.0 ( $\pm$ 1.3)	74

(beliefs regarding emotional impact). The data on foot self-care behaviours revealed moderate levels of self-care (maximum score = 7) and evidence of considerable stability in these behaviours over the 24 week observation period.

#### 4.2. The role of illness beliefs in predicting foot self-care behaviours

Linear regression analyses were conducted to examine the role of illness beliefs in predicting self-reported foot self-care at 6, 12 and 24 weeks. The initial model examined the contribution of illness beliefs alone on foot self-care behaviours (i.e., not including the effects of past behaviour, age and ulcer size). This revealed that beliefs measured at baseline accounted for a moderately high proportion of variance in foot care behaviour: week 6: 16%, week 12: 21% and week 24: 23%.

Analyses for the main model controlled for patient age, ulcer size at baseline and self-care behaviour scores at baseline (i.e., previous foot self-care behaviours). The results showed that at each time point the overall model was statistically significant accounting for between 42 and 58% of the variance in foot self-care behaviours (week 6 model:

$R^2 = 0.42$ ,  $F = 4.03$ ,  $p < 0.0001$ ; week 12 model:  $R^2 = 0.50$ ,  $F = 4.13$ ,  $p = 0.001$ ; week 24 model:  $R^2 = 0.58$ ,  $F = 0.46$ ,  $p < 0.0001$ ).

When examining the contribution of individual beliefs in the main model (adjusting for past behaviour, age and ulcer size), the data revealed that identity ( $p = 0.02$ ) and coherence ( $p = 0.02$ ) beliefs were significant independent predictors of foot self-care at 6 weeks. In other words, patients who were more likely to report engaging in foot self-care behaviours at 6 weeks, were those who, at study entry, had reported experiencing more symptoms but also a poorer understanding of their ulcers. A similar pattern was evident at 12 weeks (identity ( $p = 0.04$ ) and coherence ( $p = 0.08$ ) beliefs); with the patients reporting greater engagement with foot self-care behaviours at 12 weeks, being those characterised by more self-reported symptoms and a poorer understanding of foot ulceration at study entry. Finally, at 24 weeks, the measures of personal control ( $p = 0.04$ ) and identity ( $p = 0.04$ ) emerged as significant independent predictors, with the measure of coherence approaching significance ( $p = 0.06$ ) (see Table 3). Thus, greater engagement with self-care behaviours at 24 weeks was observed in patients who, at baseline, reported more symptoms, a poor understanding of their condition, but also perceived they had greater personal control over their ulcers.

## 5. Discussion

Foot self-care practices are assumed to be important determinants of ulcer outcomes [6]. The dominant focus of research in this field has been patients who are at risk of ulcers, but ulcer free; and also on knowledge as the primary determinant of these behaviours. However, it cannot be assumed that evidence from ulcer-free patients is generalisable to patients with ulcers. Furthermore, we know that knowledge is likely to be, at best, a necessary but not sufficient determinant of behaviour [9]. This has led to interest in other potentially modifiable determinants, including patients' beliefs; and data from cross-sectional and qualitative studies suggest they may indeed play a central role.

The present paper reports results from analyses designed to examine the role of illness beliefs in predicting subsequent foot self-care behaviours in patients with diabetic foot ulcers.

**Table 3 – Linear regressions examining the role of illness beliefs in predicting foot self-care behaviours at weeks 6, 12 and 24.**

	Predictors of week 6 foot self-care		Predictors of week 12 foot self-care		Predictors of week 24 foot self-care	
	Standardised $\beta$	$p$	Standardised $\beta$	$p$	Standardised $\beta$	$p$
Consequences	-0.19	0.25	0.08	0.67	0.09	0.66
Timeline	-0.04	0.78	-0.24	0.10	-0.15	0.28
Personal control	0.18	0.10	0.08	0.53	0.28	0.04
Treatment control	-0.09	0.41	-0.05	0.70	0.15	0.26
Identity	0.36	0.02	0.33	0.04	0.34	0.04
Coherence	-0.28	0.02	-0.21	0.08	-0.23	0.06
Emotional responses	0.08	0.58	-0.22	0.21	-0.28	0.16
Baseline foot self-care	0.49	<0.0001	0.54	<0.0001	0.53	<0.0001
Baseline ulcer area	-0.41	0.70	0.09	0.47	0.17	0.20
Age	0.00	1.00	0.11	0.36	-0.12	0.31

We observed that, even after controlling for previous self-care behaviours (foot-care at week 0), several illness beliefs emerged as significant predictors of subsequent behaviour. Our explanatory models accounted for up to 58% of the variance in self-care practices. Furthermore, analyses in which the effects of previous behaviour, age and ulcer size were excluded revealed that illness beliefs alone accounted for up to 23% of the variance in self-care behaviours. This is significantly greater than the accounted variance reported in studies examining the effects of beliefs on other self-care behaviours in diabetes [17].

These findings have several important implications for approaches to managing diabetic foot disease. First, as has been found for other outcomes in diabetes (e.g., glycaemic control, quality of life: [13,14]), the data suggest that patients' beliefs are important determinants of foot-care practices. As such, they may also be influential in determining ulcer outcomes such as ulcer risk, healing and recurrence. In view of evidence that, even very brief interventions [21,22] can result in significant changes in beliefs; and that these changes can, in turn, improve outcomes such as adherence to medication, mood and return to work [21–23]. It may be that interventions focussed on modifying patients' beliefs could provide an effective means of not only improving foot self-care practices, but also foot ulcer outcomes.

A second, and related, issue is that our analyses revealed that several specific beliefs emerged as significant independent predictors of foot self-care. In particular, patients who reported fewer symptoms and less personal control, but a greater understanding of their ulcers were less likely to report foot self-care behaviours. As the key drivers for self-care behaviours, these beliefs may be appropriate targets for future interventions. However, they also highlight two particular challenges. First, many patients with diabetic foot ulcers experience a degree of neuropathy which means that they are likely to experience few or no symptoms associated with their ulcers. This is clearly problematic if the experience of symptoms is an influential determinant of self-care behaviour. It may, therefore, be necessary to consider broadening patients' understanding of ulcer-related symptoms, so that they are not reliant on typical cues such as pain and discomfort; but instead are cued to look for symptoms such as signs of inflammation and exudate.

The third issue relates to the seemingly counterintuitive finding that patients who reported a greater understanding in relation to their ulcers were less, not more, likely to engage in foot self-care. This observation may reflect the fact that, while patients' consider they have an understanding of their condition, their understanding may in fact be flawed and not correspond with clinical evidence. Previous research supports this view. A qualitative study involving patients with diabetes, but no history of ulceration [8], reported that patients' beliefs regarding the causes of foot ulcers led them to engage in self-care practices that were not only counter to medical advice but could serve to increase, rather than decrease, the risk of ulceration. It is unclear whether patients with active ulceration may be similarly vulnerable to erroneous beliefs. But our findings may explain, in part, why educational interventions often

fail to improve foot care practices or ulcer outcomes in this patient group [4]. Educational interventions are necessarily based on clinical evidence. But evidence from other diseases has shown that when patients underlying beliefs regarding their condition and/or its treatment do not concur with clinical evidence they are less likely to engage in appropriate self-care practices [24,25]. In other words, if there is a mismatch between what patients believe is important, and what they are being asked to do, they are more likely to have negative beliefs about treatment and will be less likely to follow health care advice. Thus, our data highlight the importance of ensuring that patients are equipped with accurate information, but also that erroneous information and understanding is also challenged.

When interpreting the findings from this research it is appropriate to note a potential limitation in our design. Our assessment of foot-care behaviour was derived from the SDSCA [20]. The main strengths of this instrument are that it has been used widely; it includes behaviours assessed in other similar instruments (e.g., Nottingham Assessment of Functional Footcare [26]); and also behaviours that are usually examined in studies examining the foot-care practices of patients at risk of developing ulcers [11]. However, the focus of the SDSCA is on generic foot-care behaviours in diabetes, rather than behaviours that may be specific to patients with active ulceration. To our knowledge a specific instrument does not exist. Thus, while one might expect generic foot-care practices to be correlated with the specific foot-care practices encouraged in patients with active ulceration; it should be noted that foot-care behaviours specific to patients with active ulcers were not assessed.

In summary, this study provides a prospective examination of the role of illness beliefs in predicting foot self-care behaviour in people with diabetes and active ulceration. We have provided evidence which suggests that beliefs regarding symptoms, personal control and perceived understanding of the condition are key determinants of self-care practices. Indeed, the influence of beliefs on foot care practices was found to greatly exceed the influence of behaviour reported in other areas of self-care in diabetes [17]. The strength of these findings is underscored not only by the prospective design, but the inclusion of past behaviour and patient characteristics that may influence the performance of self-care behaviours.

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### Conflicts of interest

The authors do not have any conflicts of interest to declare.

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