The Behavior and Psychological Functioning of People at High Risk of Diabetes-Related Foot Complications

Purpose

The purpose of this review was to propose a model that describes the influences on the behavior and psychological functioning of people at risk for diabetes-related foot complications.

Methods

A literature search was conducted in Medline (1950-2005), CINAHL (1982-2005), and PsycInfo (1967-2005) databases and in reference lists of journal articles and relevant books. The search focused on published literature in the English language that was related to concepts such as diabetes-related foot complications, behavior, and psychology.

Results

The literature reviewed was arranged to reflect the reciprocal relationship between the personal, environmental, and behavioral factors of people at risk of diabetes-related foot complications. The model proposed uses the concept of reciprocal determinism to illustrate how these factors interact and influence the development of diabetes-related foot complications.

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Conclusion

The concept of reciprocal determinism may be useful when developing further investigation into educational and behavioral interventions in this clinical population.

Foot pathology as a consequence of diabetes such as lower limb amputation and foot ulceration is common, and the global burden is set to increase with the world facing an epidemic of type 2 diabetes.[1,2] A foot complication may be the most common reason for admission to the hospital in those with diabetes,[3] and the length of stay can be up to 59% longer than for people with diabetes admitted for a non-foot-related reason.[4]

Research over the past 25 years has demonstrated which individual pathophysiological factors are involved in the precipitating events leading to lower limb amputation and its common precursor, ulceration. The causal pathways[5] are invariably multifactorial, with peripheral neuropathy being crucial in the development of both conditions (ischemia is less important in the development of ulcers, but it is important in determining amputation).[6-9] Peripheral neuropathy is significantly associated with increased age, longer duration of diabetes, male sex, poor glycemic control, and presence of other microvascular complications.[10-12] Estimates of the prevalence of neuropathy vary, with suggestions that between 35% and 65% of people with diabetes are affected in some way.[10,11] Over time, neuropathy makes the foot insensitive to pain. This, in turn, leads to people not being able to associate pain (as a protective mechanism) with trauma to the skin of the foot (eg, from "repetitive stress") that may harmful.[13] Unrelieved repetitive stress on the skin can cause inflammation, decreased resilience, and eventually tissue necrosis.[7] Successful treatments of neuropathic ulcers using devices that decrease the stress and pressure on an ulcer provide evidence for the repetitive stress model,[14-16] and it is clear that reducing the repetitive stress on ulcers from normal day-to-day activity is crucial for healing.[17,18]

Despite this accepted knowledge about the causal pathways involved, the situation for some regions of the world remains unchanged,[1] and there are reports of high recurrence rates of foot problems such as ulceration, even in established, specialized foot clinics.[19-21] As such, it is becoming clear that the management of people with diabetes-related lower limb pathology takes place in a much wider psychobehavioral context than many professionals in the field realize. For chronic illnesses such as diabetes, patients are primarily responsible for the self-management of their illness, and this responsibility is "non-negotiable and inescapable."[22] On a daily basis, people with diabetes are confronted with an array of choices, and decisions must be made with respect to diet, exercise, medications, and monitoring. Management of a patient with diabetes requires an assessment of the possible behaviors that may occur in the course of an intervention and a realization that this behavior may be influenced by a range of factors linked with the individuals themselves and the environment a person is in.[23] This article reviews the behavioral and psychosocial factors involved in people with diabetes-related foot complications and proposes a model to aid the assessment and management of these factors relevant to the management of this clinical problem.

Methods

The search for relevant literature in this specific area focused on published literature in the English language that was related to concepts of diabetes-related foot complications, behavior, and psychology. The following key words were entered and combined into the search engines Medline (1950-2005), CINAHL (1982-2005), and PsycInfo (1967-2005): *diabetic foot/angiopathies/neuropathies*, *diabetes mellitus*, *socioeconomic factors*, *social class*, *ethnic groups*, *poverty*, *social isolation*, *employment*, *quality of life*, *psychology*, *attitude to health*, *health knowledge*, *emotions*, *health behavior*, *patient compliance*, and *treatment refusal*. Text words also included *high-risk foot*, *neuropathic foot*, and *peripheral neuropathy*. Detailed review of reference lists of articles obtained and key texts was also scrupulously undertaken. When condensing the small amount of data obtained, it became apparent that the key concepts focused on the psychology, social situation, and behavior of people with diabetes-related foot complications. As such, to aid a coherent discussion of the literature, the information was arranged in a model based on the concept of reciprocal determinism.[24]

Behavioral Prevention of Foot Complications

Appropriately managing the pathophysiological aspects of diabetes-related foot complications using a multidisciplinary team has been shown to be effective in decreasing the incidence of complications such as amputation and ulceration.[25-27] Recent reviews have summarized the clinical management of these aspects in some detail.[28,29] There is also strong historical and anecdotal suggestion that certain behavior can prevent diabetes-related foot complications.

Patient education with respect to appropriate self-care may play a key role, although there is still no definitive randomized controlled trial (RCT) to prove its effectiveness. A recent review of 8 RCTs that investigated educational programs aiming to reduce the incidence of foot ulceration concluded that education appears to have a short-term positive impact on foot care behavior and may reduce the risk of foot ulcerations and amputations.[30] The education programs studied have used different education formats that range from a one-off lecture[31-33] to dedicated sessions on foot-specific education with systems put in place to aid in retention of knowledge and "compliance" of instruction.[34-36] Most focus in detail on "foot care," "protection," and "foot inspection."[31,33,34,37] These basic behavioral concepts are commonly included in patient education to prevent foot-related problems, albeit inconsistently.[38]

Other specific strategies to prevent foot problems for people with diabetes and peripheral neuropathy have been developed. Common "protective" advice given to a person with diabetes can include wearing appropriate footwear and orthotic devices to decrease the risk of repetitive stress on the plantar surface of the foot. A review of the benefit of the effectiveness of therapeutic footwear in preventing reulceration found encouraging descriptive evidence to support the effectiveness of footwear, but in a few exceptions, no benefit was found.[39] In a 2002 Cochrane review on pressure-relieving interventions, Spencer[40] concluded that orthotic devices are effective in preventing ulcers and in treating callous. Unfortunately, most of the research in this area is poor.[39,40] Another common piece of advice given to patients to protect their feet from repetitive stress is to monitor their activity, and emerging evidence suggests that activity levels may be a key factor in the predisposition to ulceration.[41,42] Despite the methodological challenges in studying this aspect of self-care,[43,44] the evidence suggests that it may be beneficial to "dose" activity in much the same way as a medication can be modulated.[43] Self-monitoring of the temperature of the skin is another strategy that shows some promise.[13,45] A case control study has found that people with peripheral neuropathy who monitored the temperature of their feet and reduced their activity in response to this monitoring had significantly fewer foot complications than those who did not.[46]

Actual Foot Care Behavior of People at Risk of Diabetes-Related Foot Complications

There is a reasonable understanding of the pathophysiology of ulceration and amputation, and there are effective strategies for reducing the likelihood of amputation. Nevertheless, the incidence of amputation remains high.[1] A possible explanation is that people with diabetic neuropathy do not actually employ the behavioral self-care strategies suggested.

There is some evidence to suggest that foot inspection is done poorly. Population-based studies have found that only 20% of participants with diabetes inspected their feet daily, and 23% to 25% never inspected their feet.[47,48] Furthermore, a large consecutive case series of people presenting with foot ulcerations to an established foot clinic found that up to 50% of 576 ulcers were not originally noticed by the individuals themselves.[49] The wearing of appropriately protective footwear is also not done particularly well. Two small cross-sectional studies from Europe have suggested that people at high risk of foot complications who were issued custom-made footwear to protect their feet found that only 22% wore their shoes all day and 53% most of the day.[50,51] Armstrong and colleagues[52] found that patients with neuropathic ulceration who were requested to wear a removable walking boot (RWB) at all times found that the participants only wore the RWB for an average of 28% of the total steps taken.

A small number of studies have attempted to investigate foot care behaviors in relation to foot outcomes and have used foot care categories such as self-foot examination, foot hygiene, and nail care as their basis.[53-55] A cohort study aimed at identifying the specific behaviors associated with lower extremity lesions found that the only behavioral factor that predicted ulceration was "not applying lubricant to the feet."[54] A smaller case control

study found a 2½ times risk of ulceration for those who performed poorly in self-examination and foot hygiene.[53] In a small study from Germany, Chantelau and Haage[50] looked at footwear use and recurrent ulceration and found that those who did not wear their shoes as advised had significantly more ulcer recurrence after 2 (38% vs 8%) and 4 years (100% vs 54%). However, an earlier small but well-controlled case control study has suggested that preventative foot care behaviors are not significant in the risk of lower extremity amputation.[56]

The evidence suggests that people at risk of diabetes-related foot complications such as foot ulceration often fail to effectively self-manage their condition and engage in relatively risky activities. Understanding the factors that contribute to these suboptimal behavioral outcomes is important if ulceration and amputation rates are to be decreased significantly.

Understanding the Patient With Diabetes

Behavior has often been conceptualized as a function of environmental, personal, and biological factors—a biopsychosocial approach. Environmental factors are the prompts, sanctions, and incentives that have an immediate influence on behavior. Personal factors include past learning; social, economic, and demographic characteristics; and biological factors. These factors interact with one another over time to produce particular behavioral outcomes for individuals within specific settings—a process known as reciprocal determinism.[24] Social cognitive theory (SCT) is the best-known and researched model for understanding these interactions.[57]

Fundamental to SCT is the concept of human agency, where individuals are proactively involved in their own development, adaptation, and change.[57] In SCT, the extent to which individuals do so is mediated by their perceptions that they are able to act effectively for particular purposes (self-efficacy).[58] There is strong evidence that shows that self-efficacy beliefs contribute significantly to levels of motivation, emotional well-being, and personal accomplishments; without them, there is little incentive to act or persevere in the face of difficulties.[58] Self-efficacy has been shown to be an explanatory framework in a wide range of health issues.[59-61] Self-efficacy has also been found to be an effective predictor of adherence to diabetes treatment regimes.[62]

The reciprocal determinism model is useful to help organize the growing body of research that has investigated the personal, environmental, and behavioral aspects of people at high risk of diabetes-related foot complications. This approach allows the inclusion of the multitude of factors that influence the behavior and foot health outcomes of people at high risk of diabetes-related foot complications.

Reciprocal Determinism and People at Risk of Diabetes-Related Foot Complications

The following discussion reviews the personal, behavioral, and environmental factors that influence the relationship between diabetes and foot complications (Figure 1). Behavioral factors that influence the likelihood of diabetes-related foot complications have been reviewed earlier. In the proposed model, behavior (failure to monitor and protect feet) is critical to the development of complications. Social cognitive theory proposes that personal and environmental factors directly influence behavior as follows.

Personal Factors

Personal factors can be conceptualized as demographic, cognitive, and biological in nature. Demographic factors include age, gender, education, location, and socioeconomic status. Cognitive factors include beliefs, knowledge, and attitudes. Biological factors include the presence of disease such as peripheral neuropathy (these have been commented on earlier).

In the proposed model, demographic factors such as age and gender are best conceptualized as mediating variables. For example, age is related to both biological factors that influence the development of disease and change in social and environmental conditions over time. Similarly, educational level is a mediating influence on cognitive factors that affect the development of disease. In a sense, demographic factors are indicators of fixed attributes and history that influence current cognition (knowledge, attitudes, and behavior). They therefore only influence current behavior and diabetic complications indirectly. A number of studies have investigated the relationship between demographic factors and diabetes.

The prevalence of diabetes is rising, and this in some parts may be due to aging populations, particularly in

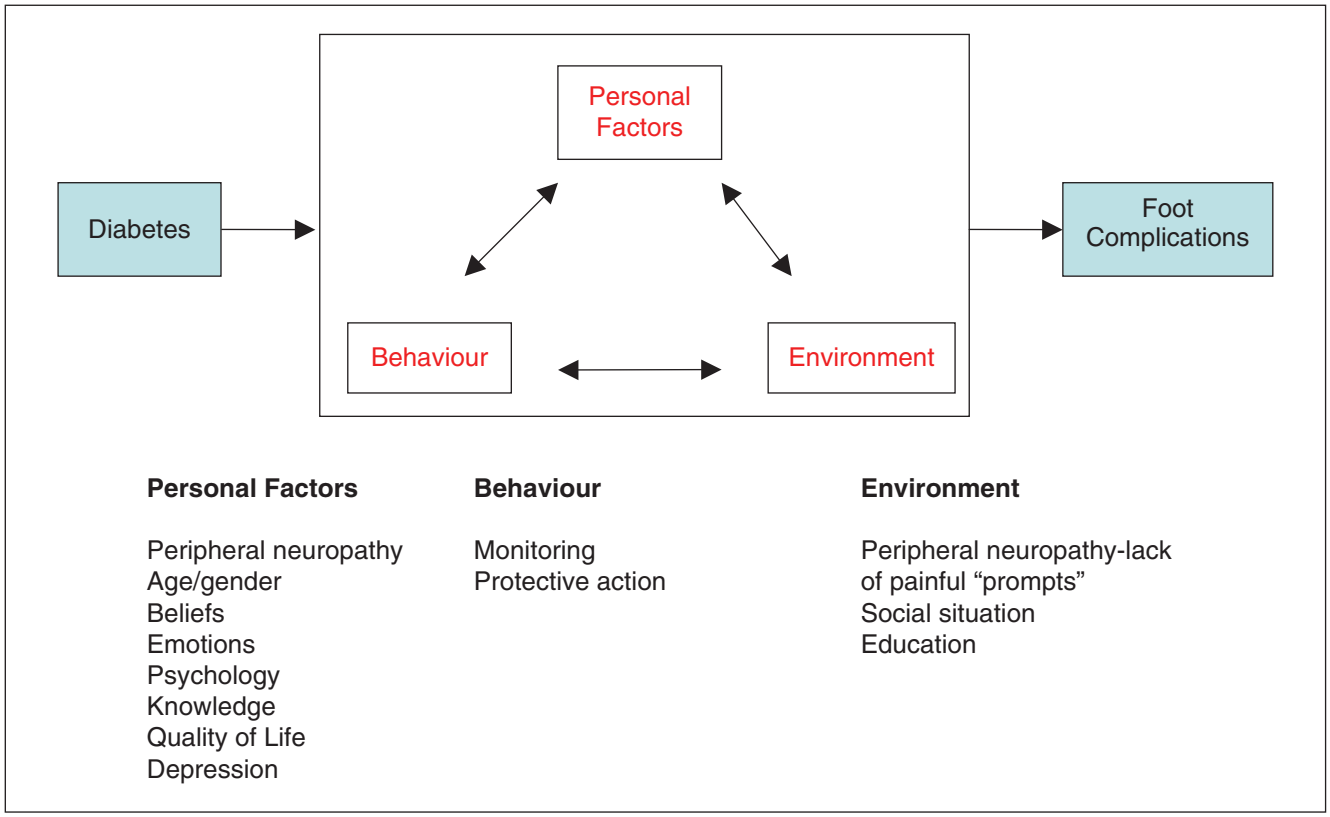

Figure 1. The influences on the psychological functioning of people at high risk of diabetes-related foot complications.

people diagnosed with type 2 diabetes.[63] As people get older, they find it more difficult to look after their own feet; elderly people have been shown to have difficulty inspecting the bottom of their feet and undertaking appropriate nail care.[64] The personal characteristic of being male may also influence foot morbidity and behavior. Population-based cohort and case control studies have found that men have higher levels of peripheral neuropathy,[10] foot ulceration,[6] and lower limb complications.[65-67] It is unclear why this preponderance exists, but there are suggestions that there may be a biological influence (longer nerve fibers) influencing the development of peripheral neuropathy.[67] On a more sociocultural level, men are less likely to undertake general health initiatives—they seek access to health services less than women do, perceive that they have less time for their own health, and will engage in fewer health-promoting activities.[68]

Cognitive variables are a product of history and the more immediate environment. In the proposed model, they are important because they determine whether behavior is likely to occur in a given setting, under particular circumstances.[57] Particularly pertinent to SCT are self-efficacy beliefs. Two small cross-sectional studies have used self-efficacy as a framework to evaluate the confidence that people with diabetes have in undertaking preventative foot care behaviors.[69,70] In general, the participants of both studies were very confident they could undertake foot care behaviors. The high confidence levels found appear at odds with what is known about how people with diabetes actually behave toward their feet. Prospective studies in this area are required to examine actual behavior in addition to self-efficacy beliefs and to also monitor foot health outcomes. The recently developed Patient Interpretation of Neuropathy (PIN) Questionnaire is a welcome development in the field of foot-related beliefs.[71] The PIN is based on the commonsense model of illness and measures the cognitive and emotional representations a person with peripheral neuropathy has with respect to his or her foot condition.[72,73] Five cognitive (identity, cause, timeline, controllability, and consequences) and 2 emotional (fear of consequences and anger at health professionals) domains are investigated to assess how patients interpret peripheral neuropathy, respond emotionally, and make decisions

regarding foot self-care.[71] The comprehensive psychometric analysis of the tool was undertaken with 495 people with peripheral neuropathy, and the resultant 39-item questionnaire is the only statistically reliable and valid questionnaire that examines neuropathy-specific personal beliefs. Initial results suggest that "misperceptions" of neuropathy (eg, that neuropathy is a circulatory problem) are associated with poorer outcomes and more inappropriate foot care behaviors.[71]

According to the reciprocal nature of human functioning, not only do personal beliefs influence behavior, but the effects of actions can also determine personal beliefs.[57] Most people have a long history of not needing to systematically monitor and protect their feet prior to the onset of neuropathy because pain and discomfort automatically prompted these behaviors. In the absence of pain, it is difficult to learn to automatically monitor and protect feet as an ordinary part of daily life. Not surprisingly, over time, a number of people with neuropathy fail to monitor and protect their feet and often develop foot problems as result. With repeated experience and failures, they can develop a self-perception that they have little capacity to affect the outcomes of their disease.[74] People who have repeated problems with issues such as neuropathy and foot ulceration have been shown to have a decreased quality of life[75-80] and depression.[81,82]

Environmental Factors

Environmental factors include the social and physical setting in which people live, work, and play. The social and physical environment influences behavior and cognition primarily through antecedents and consequences associated with behavior. In effect, where positive or reinforcing consequences follow behavior, perceptions of self-efficacy increase, and it is more likely to occur in the future. The circumstances where successful behavior occurs become cues for its occurrence in the future. In particular, the social situation of a person is very important when considering how the environment can influence behavior. The reactions of others (eg, spouses, friends, and other people with diabetes) are important in shaping the behavior of people with diabetes. Several studies have found associations between low socioeconomic position[83-85] and social isolation[47,55,86] with diabetes-related foot complications. Unfortunately, most of the studies do not investigate the causal relationship between social factors and behavior in detail.[87] However, it seems likely that friends and family are important in that they can promote or discourage behavior by providing consequences, such as praise or complaints, or modeling successful behavior (in the case of other patients) and providing a value for good health.[74]

Conclusion

The critical feature of the proposed model is how personal and environmental factors influence behavior and in turn how behavior influences the likelihood of diabetes-related foot complications. The model proposes that demographic variables predispose individuals to particular beliefs, attitudes, and knowledge. These, in turn, influence whether appropriate behavior (monitoring and protection) will occur. The environment (and in particular the social consequences that occur before and after behavior) has an immediate impact on behavior and subsequent cognition. This reciprocal process shapes appropriate foot care behavior over time.

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