

# The consequences of anxious temperament for disease detection, self-management behavior, and quality of life in Type 2 diabetes mellitus

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## Abstract

**Objective:** The purpose of this study is to examine the consequences of anxious temperament for disease detection, self-management behavior, and quality of life in Type 2 diabetes mellitus (T2DM). **Method:** A sample of 204 individuals newly diagnosed with T2DM completed measures of anxious temperament, self-management behavior, and quality of life; participants also supplied a blood sample for glycated hemoglobin (A1C) analysis at initial diagnosis (baseline) and at 6-month follow-up (as indicators of disease progression at diagnosis and achieved glycemic control, respectively). **Results:** Anxious temperament was inversely associated with A1C at both baseline and at 6-month

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follow-up. However, the association between anxious temperament and A1C at follow-up was mostly accounted for by the association between anxious temperament and baseline A1C and not by the uptake of self-management behaviors after diagnosis. Higher levels of anxious temperament were also associated with an increased likelihood of having been diagnosed with a prediabetic condition but were associated with poorer quality of life at both time points. **Conclusion:** Anxious temperament appears to be a double-edged sword that may facilitate early detection but not subsequent behavioral or emotional adjustment to T2DM.

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## Introduction

Type 2 diabetes mellitus (T2DM) is a disorder of glucose metabolism that results in excess circulating blood glucose (hyperglycemia). In order to offset the potentially serious medical complications associated with prolonged hyperglycemia (e.g., cardiovascular disease, retinopathy, nephropathy, neuropathy, and mortality; [1,2]), both early

detection and appropriate self-management are imperative. To date, much research has focused on metabolic control following diagnosis, and indeed, psychological factors—including the presence of clinically significant psychopathology—can adversely impact glycemic control [3,4]. However, given that the early signs of diabetes are subtle and nonspecific, everyday personality dispositions that sensitize individuals to symptom perception, symptom amplification, or symptom reporting may facilitate early diagnosis [5], which is desirable from a disease management perspective [6–8]. As such, psychological factors may be implicated in both the initial detection of T2DM and its subsequent self-management.

One way of approximating the progression of diabetes at diagnosis and achieved glycemic control postdiagnosis is the degree of hyperglycemia that is evident. The most objective measure of hyperglycemia is the glycated hemoglobin (A1C)

*Abbreviations:* A1C, glycated hemoglobin; BAS, Behavioral Approach Scale; BIS, Behavioral Inhibition Scale; BMI, body mass index; T2DM, Type 2 diabetes mellitus.

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value [9]. A more elevated A1C value at diagnosis implies a delay in disease detection, while further elevation subsequent to diagnosis implies inadequate early management of the disease. In prior studies, A1C has been associated with certain psychological characteristics that may affect disease detection and management [10–15]. Of the many personality dimensions examined thus far, neuroticism—the propensity to feel generalized anxiety and other negative emotions—is the most consistent predictor of glycemia, as indexed by A1C [10,16,17]. Specifically, those with T2DM who have higher levels of neuroticism tend to have lower A1C. This effect has been attributed to heightened motivation among more anxious individuals to adopt self-management behaviors in order to avoid feared adverse health outcomes associated with disease progression [10]. However, to date, this hypothesized mediational model has not been tested empirically. In the current study, we endeavored to replicate the original anxiety–glycemia association observed in prior studies and to examine three potential mediational models to explain the effect.

#### *Anxious temperament and self-management*

According to Gray's Reinforcement Sensitivity Theory (RST), human behavior is governed by two separable, biologically based motivational systems that determine the sensitivity of the organism to punishments and rewards in the environment [18,19]. Given that the structure and function of these systems vary from individual to individual, the potency of each can also vary. It is this variability in potency that produces reliable individual differences in behavior that we know as personality. According to RST, the behavioral inhibition system (BIS) primarily drives sensitivity to punishments; those who have a strong BIS are prone to experience anxiety and demonstrate behavioral and cognitive tendencies that are inhibited and precautionary in nature (i.e., anxious in temperament). The behavioral approach system (BAS), on the other hand, drives sensitivity to rewards; those with a strong BAS are oriented toward hedonic experiences and tend to be behaviorally impulsive (i.e., impulsive in temperament). Such "hardwired" individual differences in emotionality, behavior, and cognition are evident at a very early age and manifest in many domains of life, including social interactions, academic achievement, and physical health trajectories [20,21].

It has been suggested that anxious temperament—reflecting the operation of the BIS—may be adaptive in the context of diabetes management, because it could generate appropriate concern over disease outcomes (i.e., diabetes-related morbidity and mortality) and motivate quick adoption of self-management behaviors (e.g., attention to dietary choices, consistency in exercise behavior, and superior treatment adherence) that in turn contribute to improved glycemic control [9]. This hypothesis would be consistent with previous findings of an inverse association between anxious temperament and A1C [10].

The mechanism by which anxiety relates to glycemia is potentially complex. For example, anxiety may facilitate attention to threat and thereby motivate behavioral avoidance responses [22]. However, both cognitive hypervigilance and behavioral avoidance can be adaptive or maladaptive. Adaptive avoidance behaviors will help an individual to avoid truly harmful objects and potentially dangerous situations. Defensive avoidance, on the other hand, functions primarily to reduce the activation of the aversive emotional state itself (i.e., anxiety) by avoiding behaviors or circumstances that elicit the emotion. This is a basic distinction, for example, between emotion-focused and problem-focused coping [23–25] and is a well-established mechanism by which anxiety can influence behavior in both adaptive or maladaptive ways [23,26]. As such, an argument could be made that anxiety could either motivate or demotivate self-management efforts, depending on the perspective adopted. To date, there has not been a direct test of the effect of anxious temperament on self-management behaviors, and so, such explanations remain hypothetical. Moreover, there are other ways in which anxious temperament may be associated with glycemia that do not involve self-management efforts; we turn to these next.

#### *Anxious temperament and disease detection*

T2DM is now recognized as a progressive disease with gradual onset. For individuals who eventually meet criteria for T2DM, hyperglycemia increases progressively over time without a clear point of acute dysregulation [2]. Given that the early signs of hyperglycemia such as fatigue and polyuria may be mild and nonspecific, there can be considerable variability in timeliness of help seeking for such symptoms. From this perspective, it is not surprising that a large number of cases go undiagnosed until significant microvascular complications have already developed. Based on backward extrapolation of the linear relationship between glycemia and retinopathy, it has been estimated that T2DM may be present for an average of 9 to 12 years prior to formal diagnosis [8], and as many as 50% of individuals with T2DM at any given time are unaware of it [7]. Despite the fact that screening is now common in older age groups in North America, and presumably the proportion of the population unaware of their status has fallen, there is still considerable variability in the presence and progression of diabetes-related medical complications in individuals with T2DM at time of diagnosis. Diagnosis at an early stage of disease progression, however, is important given that early detection is associated with more favorable disease outcomes over time [6].

Some of the variability in symptom onset and diagnosis could be attributed to such factors as access to services and the presence of routine screening in either the community or primary care settings. However, it is possible that patient characteristics account for some of the variability in early detection as well, particularly in countries where access to services is universal. For example, those who are prone to

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