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Adherence to Self-Care Behaviors among Patients with Type 2 Diabetes—The Role of Risk Preferences

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ABSTRACT

Objectives: To examine whether the degree of risk aversion is associated with adherence to disease self-management among adults with type 2 diabetes. **Methods:** This was a cross-sectional study of patients with type 2 diabetes ($n = 408$) aged 21 to 70 years who presented for routine visits in the diabetes clinic at a university medical center in Beer-Sheva, Israel. The authors used validated questionnaires to estimate adherence, risk preferences, motivation, self-efficacy, impulsivity, perceptions about the disease and the interpersonal process of care, and demographic and socioeconomic characteristics, in addition to retrieving data from computerized patient medical records of clinical indicators of disease severity. Multivariable linear and ordered-logit models examined predictors of adherence to each self-care behavior. **Results:** Multivariable analyses revealed that, compared with others, risk-seeking patients reported lower general adherence ($\beta = -0.32$; $P \leq 0.05$), and specifically, lower adherence to

healthful eating plan ($\beta = -0.48$; $P \leq 0.1$), consumption of low-fat food ($\beta = -0.47$; $P \leq 0.1$), exercise ($\beta = -0.73$; $P \leq 0.05$), blood glucose monitoring ($\beta = -0.69$; $P \leq 0.05$), and foot care ($\beta = -0.36$; $P \leq 0.1$). Risk-seeking patients did not report lower consumption of fruits and vegetables ($\beta = -0.19$; $P > 0.1$). Because 96% of the study population reported optimal adherence to medication, determinants of this behavior could not be analyzed. **Conclusions:** Risk preference is associated with adherence to self-care behaviors. Identifying risk seekers may enable practitioners to target these patients with tailored strategies to improve adherence, thus more efficiently allocating scarce health care resources.

Keywords: adherence, diabetes, risk preferences.

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Introduction

The growing incidence and prevalence of diabetes imposes high social and economic burden worldwide [1]. The overall prevalence of this disease in Israel is 9.6% among adults aged 18 years and older [2], and health maintenance organizations bear the significant direct costs of its treatment and complications [3]. New strategies of providing diabetes care are continually being introduced throughout the world to improve disease control. One of the most widely accepted is the chronic care model [4], which consists of four necessary elements for provision of quality chronic care: 1) self-management education and support, 2) delivery system design, 3) clinical information systems, and 4) decision support. Ongoing self-management of diabetes is critical in preventing long-term complications and includes proper medication use, diet, physical activity, blood glucose monitoring, foot care, and periodic health checkups [5].

Nonadherence to self-care behaviors stems from a number of patient-related factors, including a decrease in motivation, self-efficacy, health literacy, and impaired disease perception [6].

From an economic perspective, nonadherence may be related to the degree of a patient's present bias and/or risk aversion [7]. People with a strong preference for short-term rewards are considered impulsive and less likely to endure the discomfort associated with adherence to self-care behaviors that lead to long-term better health. Similarly, it is assumed that risk-seeking individuals are less likely to adhere to self-care behaviors because they underestimate the harmful consequences of their behavior.

Traditionally, suboptimal self-management has been attributed to an information gap, in addition to lack of patient skills and confidence, and this has been addressed by educational programs, reminders, and patient empowerment through guidance and corrective feedback [4]. Although the outcomes of such interventions in diabetes have generally been positive, they have differed considerably across trials, and often results have been modest at best [8,9]. According to the behavioral economic approach, individuals may be prone to irrational decision making because of several decision biases such as present bias [10]. Financial incentives are sometimes used to promote healthy

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behaviors because they provide tangible and immediate rewards for behaviors that will result in long-term health gains assumed to be otherwise underweighted. The effectiveness of these incentives has been measured across behaviors such as smoking cessation [11,12], weight loss [13,14], physical activity [15], preventive care [16,17], and medication usage [18]. Their effectiveness, however, appears to be mostly short-term or insignificant, and a scalable approach to calibrate optimal incentive design is lacking [19,20]. Thus, further exploration of patients' decision-making mechanisms is still warranted.

The purpose of the present study was to analyze whether the degree of risk aversion is associated with adherence of adult diabetic patients to self-care behaviors—namely, to examine whether risk aversion (seeking) is associated with higher (lower) adherence in the presence of factors with well-established influence on adherence. Little consensus exists about how to estimate risk preference in the health domain, and thus far, empirical evidence has focused on health-related behaviors such as smoking, not using seatbelt, and uptake of preventive screening tests in the general population [21–24]. Research on the association between risk preferences and adherence to chronic disease self-management remains sparse. In fact, Sloan et al. [25] found no significant association between them in diabetic patients. They estimated risk tolerance by using a single choice between two jobs: one with certain income and another with a 50% chance of doubling income and 50% chance of reducing it by one-third, one-fifth, or one-half. In contrast, the present study based its analysis on a different measure of risk preference conducted separately for each self-care behavior. Insights from these analyses of patients with diabetes, as a model of chronic disease, may improve the ability of health systems to timely identify patients prone to low adherence and to provide efficient intervention tools to improve health outcomes.

Methods

Participants

This cross-sectional descriptive study used a convenience sample of patients with type 2 diabetes ($n = 457$) who presented for routine visits in the diabetes clinic at Soroka University Medical Center between October 2011 and August 2013. The inclusion criteria were as follows: 1) age should be 21 to 70 years, 2) should have a diagnosis of type 2 diabetes mellitus (*International Classification of Diseases, Ninth Revision* code 250.xx, excluding type 1 diabetes mellitus codes 250.x1 and 250.x3), and 3) should be a Hebrew, Arabic, or Russian speaker. The study was 80% powered to distinguish odds ratio = 2.3, assuming that the risk-seeking group would comprise 15% of the study population (following Anderson and Mellor [21]). Nevertheless, 13 participants completed less than 55% of the questionnaire, and another 36 did not complete the measure of risk preference because of misunderstanding the instructions and, thus, were excluded from the analyses. Therefore, the final sample comprised 408 participants. Compared with the final sample that was included in the analyses, a higher proportion of patients excluded were Bedouin (49.0% vs. 25.7%; $P = 0.002$), had no formal education (40.6% vs. 10.2%; $P < 0.001$), had larger family size (6.8 vs. 4.5; $P = 0.002$), were covered only by mandatory national universal health insurance (34.4% vs. 19.8%; $P = 0.050$), and had higher glycated hemoglobin (9.6 vs. 8.7; $P = 0.022$). Bedouin ethnicity, larger family size, and lower literacy may have led to underrepresentation of risk-averse patients in the analyses. The study objective, however, was not to estimate the distribution of risk preferences among patients, but rather to examine the

association between these preferences and adherence to self-care behaviors. In addition, groups were comparable regarding age, sex, family status, disease duration, disease severity score, employment status, and income. No significant differences were observed between the excluded 36 patients and the included 408 patients in the levels of adherence to each self-care behavior. Moreover, multivariable models in which the risk preference variable was substituted with a dichotomous one referring to whether the patient had a missing value of risk preference (yes/no) revealed similar results as those presented in the analyses herein. Thus, the missing values most likely did not affect the results.

Procedure

The authors reviewed patient medical records for a diagnosis of type 2 diabetes mellitus and for retrieval of clinical indicators estimating disease severity. Clinic research staff approached patients and gave them a description of the study objectives and questionnaire. After a patient's written informed consent, he or she was interviewed. Participants who were established immigrants or native Israelis were interviewed in Hebrew, Bedouins in Arabic, and recent immigrants from the former Soviet Union in Russian. The study was approved by the Institutional Helsinki Committee (No. 10546).

Measures

Adherence to self-care behaviors

The researchers elicited adherence to these behaviors using the Summary of Diabetes Self-Care Activities [26], a validated 12-item questionnaire. It included two items for each of the following: a healthful eating plan, fruits and vegetables and low-fat food consumption, exercise (30 minutes of physical activity and participation in specific exercise sessions), blood glucose monitoring (testing in general and testing the number of times recommended), foot care (checking feet and inspecting inside shoes), and medication (taking the recommended medications and in the recommended amount). Respondents indicated how many days of the week (0–7) they performed each activity. The mean number of days for all items, with an internal consistency of 0.58, measured adherence. Similar to other studies [26], the interitem correlations within scales ranged between 0.50 and 0.95, with the exception of the internal consistency of the items referring to fruits and vegetables and low-fat food consumption (0.04). Thus, adherence to these two items was measured separately.

Risk preference

The lottery choice task [27], a task widely used to capture risk posture, assessed this preference, yet the authors applied it in a unique context of chronic disease self-management. In this task, subjects made 10 hypothetical choices between lottery A and lottery B. The former choice paid either 24 Israeli shekels (ILS) or 19.2 ILS (according to the exchange rate, US \$1 equals approximately 4 ILS). The latter choice paid either 46.2 ILS or 1.2 ILS. Because the payoffs in lottery A were less variable, it presented a relatively safe choice, whereas lottery B was relatively riskier. The 10 choices differed in terms of the probability of winning the higher prize in each lottery. In a pilot study, the study population had difficulty conceptualizing the probabilities using a 10-sided die. Therefore, the probability of earning the higher prize in each lottery in our measure was depicted as a colored portion of a pie chart (see Appendix 1). The study design did not include actual payment to participants. This task enabled estimation of the upper and lower bounds of the relative risk parameter assuming a utility function of constant relative risk aversion. Coefficient of

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