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Relationship between material needs security and clinical outcomes in adults with type 2 diabetes in Lebanon

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ABSTRACT

Background: Despite their documented significance in type 2 diabetes (T2DM) management, social determinants of health (SDOHs) including material needs security are poorly studied in the Middle East and North Africa (MENA) region. This study aims to assess the relation between material needs security and clinical outcomes in Lebanese adults with T2DM.

Methods: Subjects with T2DM (n = 300) were recruited; demographic and material need variables were collected using self-reported questionnaires. Measured clinical outcomes included Hemoglobin A1c (A1C), systolic (SBP) and diastolic blood pressure (DBP). Regression models were used to examine associations between material needs security and clinical outcomes, controlling for relevant confounding variables.

Results: Most of the participants were men, married and with lower education levels. Having higher material needs security and being employed predicted better A1C levels ($p < 0.05$), whereas male sex was associated with poorer A1C($\beta = 0.52$, $p = 0.03$) and DBP($\beta = 3.06$, $p = 0.05$). Other predictors of DBP included older age and lack of confidence in filling out medical forms, reflecting lower health literacy.

Conclusions: Our study highlights the importance of material needs in achieving optimal T2DM outcomes T2DM in the MENA region. Further research is needed to understand potential pathways/mechanisms and options for effective interventions.

1. Introduction

According to the International Diabetes Federation [1], the number of people with diabetes is on the rise, and 79% of them live in low and middle income countries. Approximately 463 million of the world population, representing a prevalence of 9%, live with type 2 diabetes (T2DM), the most common and widespread type of diabetes. Adults with diabetes have a higher risk of cardiovascular disease and strokes, and cardiovascular diseases (CVD) are leading causes of death in adults with diabetes [2].

Key strategies to improve health outcomes in adults with type 2 diabetes is focused on clinical outcomes, including glycemic and blood pressure control [3]. However, current guidelines recommend incorporation of social determinants of health (SDOHs) into care plans for adults with type 2 diabetes [3]. According to the Center for Disease Control [3], SDOHs are circumstances of living, learning, working, and leisure conditions that may affect patients' health risks and outcomes. SDOHs in the context of diabetes management are significantly associated with glycemic control, self-care, access and processes of care [4]. These include formal education, health literacy, neighborhood safety and cohesion, social support, and the ability to meet material needs, which when addressed lead to sustained clinical benefits, rather than just short-term benefits [5,6]. A subset of SDOHs, material needs, refer to the basic needs necessary to maintain health and manage illness such as housing, utilities, telecommunications, transportation, food, medication and confidence in filling forms [7]. Material needs insecurities generally imply that resources are inadequate for an individual or household to maintain health and ameliorate illness [7]. Traditionally, material need insecurities have been viewed as being beyond the scope of standard medical care, which partially explains limited attainment of optimal outcomes for T2DM across populations [8,9]. It is well established that lack of health insurance, which results in increased out-of-

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pocket expenditures is associated with poor diabetes outcomes [10]. However, there is limited data on the individual or combined impact of material needs insecurity on clinical outcomes.

Lebanon is in the Middle East and North Africa (MENA) region and is a nation with very high prevalence of T2DM, of approximately 12.9 % [1]. In addition, Lebanon is one of the middle-income countries in the MENA region that has been facing significant economic upheaval that has impacted all sectors of the economy, including both the private and public sectors. Therefore, material needs insecurity is on the increase, yet there is limited data on how challenges with basic needs in the form of material needs insecurity impacts diabetes self-care and clinical outcomes [11]. The limited data on relationship between material needs insecurity and diabetes outcomes has impact on policy and strategies to improve diabetes outcomes in Lebanon and other countries in the MENA region. Therefore, the goal of this study was to collect primary data on social determinants of health and examine the independent association between material needs insecurity and clinical outcomes for type 2 diabetes. We hypothesized that material needs insecurity would be significantly associated with poor clinical outcomes for type 2 diabetes in a Lebanese population with T2DM.

2. Methods

2.1. Study population and procedure

A total of 300 Lebanese participants with T2DM from various primary health care centers (PHCs) located in Lebanon (Beirut, Mount Lebanon, and North Lebanon) were enrolled in the study. Inclusion criteria included age 18 years or older, clinical diagnosis of T2DM confirmed in the medical charts, and ability to communicate in Arabic. Subjects were excluded if they showed mental confusion during the interview, or they had reported alcohol or drug abuse/dependency, dementia, active psychosis, or acute mental disorders. After providing written consent, data was collected and included questionnaires, as well as measurements of Hemoglobin A1C (A1C), systolic (SBP) and diastolic blood pressure (DBP). The study protocol was reviewed and approved by the ethics committee at LAU (LAU institutional review board #LAU.SAS.MB2.24/Sep/2018).

2.2. Data collection

2.2.1. Clinical outcomes

The 3 main clinical outcomes (A1C, SBP and DBP) were assessed at the PHCs. A1C was measured by trained researchers using the portable A1C EZ 2.0 Glycohemoglobin Analysis System (BioHermes, Wuxi, China) that requires about 3 μl of blood samples collected by a finger prick. The FDA approved assay uses the boronate affinity chromatography technique that has no interference from abnormal hemoglobins. SBP and DBP were measured in mmHg by the registered nurse at the PHCs using a sphygmomanometer, after 5 min of rest sitting on a chair.

2.2.2. Demographics

Participant demographic characteristics were collected through a self-reported questionnaire. These included age in years, sex, marital status, education level, employment status, monthly household income in USD, availability of health insurance, and confidence in filling medical forms. Age was treated as both a continuous and categorical variable (18–49, 50–64, 65–94 years), income was treated as categorical (<500$; 500$ – 1499$; ≥1500$; not reported), while the other variables were treated as dichotomous (yes/no).

2.3. Material needs security variables

A self-reported questionnaire was used to assess material needs security variables that included: owning a home, having electricity, television, cable, telephone, air conditioner, heater, wireless-internet, computer, refrigerator, and owning a car as means of transportation. All material needs security questions had a "yes" and "no" response. The variables were coded as dichotomous variables with "yes" =1 and "no" =0. A summary material needs security variable was created by summing all the items and creating a continuous variable with a minimum score of 0 and a maximum of 11.

2.4. Statistical analysis

Continuous variables (age and sum of material needs security) were expressed as mean ± SD, while categorical variables (age, gender, marital status, education, employment, income health insurance, confidence in filling medical forms, and material needs security variables) were expressed as counts and percentages. Unadjusted and adjusted linear regression models were run to test for the unadjusted and adjusted associations between sum of material needs security and each of the clinical outcomes (A1C, SBP and DBP). For both unadjusted and adjusted regression analyses, outcomes (A1C, SBP & DBP) were treated as continuous variables. All analysis was run using Stata v.16. Significance was determined based on a two tailed alpha of $p < 0.05$.

3. Results

3.1. Characteristics of study participants

Table 1 presents the demographic characteristics of study participants. Average age was 60 years (SD = 12.07) and 52% were male. Most of the participants (73%) were married, 64% had less than high school education, 55% were unemployed, 53% did not have health insurance and 61% reported a household monthly income below 1500 USD, while 71% reported having no confidence in filling out medical forms.

Material Needs Security Variables are presented in Table 2. Most of the participants (64%) owned a house, had drinking water (84%) and cable (72%) and internet subscription (60%). Also, most possessed an air conditioner (61.67%), and a heater (82%), whereas only 37.7% had a computer. The vast majority reported owning a Television (99%), a Telephone (97%) and a refrigerator (93%), and everyone had electricity.

Table 1
Demographic characteristics of study participants.

	M (SD)
Age	60.29 (12.07)
	N (%)
Age (years)	
18–49	51 (17)
50–64	149 (49.67)
65–94	100 (33.33)
Sex	
Female	144 (48)
Male	156 (52)
Marital status	
Married	219 (73)
Not married	81 (27)
Education (years)	
< high school grad	173 (63.84)
≥ high school grad	98 (36.16)
Employment	
Employed	134 (44.67)
Unemployed	166 (55.33)
Income	
<500$	91 (30.3)
500$ – 1499$	92 (30.67)
≥1500$	30 (10)
Not reported	87 (29)
Health Insurance	
Yes	139 (46.8)
No	158 (53.2)
Confidence in filling out forms	
Yes	86 (28.76)
No	213 (71.24)

Table 2
Material Needs Security Variables of study participants.

	N (%)
Own Home	
Yes	108 (36)
No	192 (64)
Have Electricity	
Yes	300 (100)
Have Drinking water	
Yes	252 (84)
No	48 (16)
Have Television	
Yes	298 (99.33)
No	2 (0.67)
Have Cable subscription	
Yes	216 (72)
No	84 (28)
Have Telephone	
Yes	292 (97.33)
No	8 (2.67)
Have Air Conditioning	
Yes	185 (61.67)
No	115 (38.33)
Have Heater in Home	
Yes	246 (82)
No	54 (18)
Have Wireless-internet subscription	
Yes	180 (60)
No	120 (40)
Have Computer	
Yes	113 (37.67)
No	187 (62.33)
Have Refrigerator	
Yes	280 (93.33)
No	20 (6.67)
Means of transportation: Car	
Yes	(153, 51)
No	(147,49)
	M (SD)
Sum of Material Needs Security	9.02 (2.2)

About half of the participants owned a car for transportation. The average sum of material need security variables was 9 (SD = 2.2) out of 11.

3.2. Regression models of associations with A1C, SBP and DBP

Table 3 provides the unadjusted relationship between the sum of material needs security and the clinical outcomes. Significant negative correlations were found with A1C (β = −0.10, p = 0.018) and SBP (β = −1.18, p = 0.01). Adjusted multivariate analyses accounting for all potential covariates are presented in Table 4. Having material needs security (β = −0.11, p = 0.042), being male (β = 0.52, p = 0.03) and employed (β = −0.51, p = 0.04) were associated with A1C after controlling for relevant confounding variables. As for blood pressure, age (β = −0.19, p = 0.002), male sex (β = 3.06, p = 0.05), and lack of confidence in filling out health forms (β = −3.71, p = 0.02) were independently associated with DBP. However, none of the variables were significantly associated with SBP.

Table 3
Unadjusted linear regression model of associations of Material Needs Security with A1C, SBP and DBP.

Variables	A1C		SYSBP		DBP	
	β	p-value	β	p-value	β	p-value
Sum of Material Needs Security	−0.10	0.018*	−1.18	0.01*	−0.45	0.13

* Significant values p < 0.05.

Table 4
Adjusted multiple linear regression model with A1C, SBP and DBP.

Variables	A1C		SYSBP		DBP	
	β	p-value	β	p-value	β	p-value
Sum of Material Needs Security	−0.11	0.042*	−0.96	0.10	−0.25	0.47
Age	−0.01	0.13	−0.02	0.78	−0.19	0.002*
Sex						
Male (ref)	0.52	0.03*	4.11	0.10	3.06	0.05*
Marital status						
Married (ref)	0.32	0.18	1.92	0.44	−1.42	0.35
Education						
≥ high school grad (ref)	−0.02	0.9	2.44	0.34	0.16	0.91
Employment status						
Employed	−0.51	0.04*	0.94	0.72	−0.61	0.7
Income						
500$ − 1499$	0.01	0.9	−3.47	0.26	0.36	0.84
≥1500$	−0.34	0.43	−4.79	0.29	−2.29	0.41
Not reported	−0.09	0.7	3.97	0.18	3.27	0.07
Insurance						
Yes	−0.26	0.22	−3.9	0.08	−1.61	0.25
Confidence in filling out forms						
No	−0.08	0.76	0.01	0.99	−3.71	0.02*

Each model adjusted for material needs security, age, sex, marital status, education, employment status, monthly income, insurance, and confidence in filling out health forms.
* Significant values p < 0.05.

4. Discussion

In a convenience sample of Lebanese adults with T2DM, this study examined material needs security, an important social risk factor, as an independent correlate of A1C and blood pressure in a low to middle income country in the Middle East and North Africa (MENA) region. Material needs security was reasonably high in our population including owning a home, having access to electricity, drinking water, television with cable subscription, telephone, air conditioning, heating, wireless internet, computer, refrigerator, and a car as means of transportation. Our findings revealed that higher material needs security (sum of material needs) was significantly associated with lower A1C and systolic blood pressure (SBP) indicating that higher material needs is associated with better glycemic and blood pressure control. However, after adjusting for relevant confounding factors, the relationship between higher material needs security was only significant for glycemic control, indicating that higher material needs security remained significantly associated with better glycemic control. In addition, the study showed that older age, being male and not having confidence in filling forms were strong and independent correlates of blood pressure control.

Although social determinants of health and social risk factors are well studied in the USA and Europe, there is limited data on the association between social determinants of health, specifically material needs security in the MENA region [12–14]. This study is the first to examine material needs security in this region and sets the stage for future larger scale studies to examine potential pathways for these relationship and intervention strategies that account for local and cultural contexts. The study was based on primary data collection from a diverse population in an understudied population. In addition, the surveys were translated into Arabic and delivered by bilingual research assistants to ensure cultural adaptation and enhance participants understanding the survey questionnaires. Our finding that higher material needs security was significantly associated with better glycemic control suggests that limited material needs may be an impediment to optimal diabetes management for lower income/under-resourced household and individuals with diabetes [12], could be responsible for higher prevalence of T2DM [13], and increased T2DM related complications

[8,12,14] in this population.

Our study also revealed that older age and having low confidence in filling medical forms were significantly associated with lower DBP. In older age, a low DBP has been associated with increased risk of cardiovascular events, especially in frail older people [15]. Furthermore, studies have shown a strong association between low health literacy and self-efficacy and poor diabetes outcomes [16,17], including elevated blood pressure [18]. Even though we cannot establish causality, the co-existence of older age and low health literacy may collectively worsen blood pressure control. Regarding sex, our study showed that being male is an independent correlate of both glycemic and blood pressure control. Our finding is consistent with a study from Lebanon that identified age, sex, T2DM, and income level as independent correlates of high blood pressure [19]. In line with this, Dawson and colleagues (2021) [18] tested a conceptual model of SDOHs and found age and sex to be directly associated with elevated systolic blood pressure.

Additionally, consistent with prior findings, our results showed that socioeconomic factors, such as employment, affect health status [20]. Studies have found associations among increased incidence, prevalence, and burden of disease with increasing levels of poverty and hunger, and lower levels of income, education, and socioeconomic status [17].

4.1. Limitations

Although this study has several important findings, there are limitations worth noting. First, the study cannot speak to causality since it is a cross-sectional study. Second, recall bias is a potential limitation, although reliability of the survey items has been established in other studies. Finally, the use of a convenience sample and the relatively small sample size may affect generalization of the results.

5. Conclusion

In a convenience sample of Lebanese adults with T2DM, this study examined material needs security, an important social risk factor, as an independent correlate of A1C and blood pressure in a low to middle income country in the Middle East and North Africa (MENA) region. Our findings revealed that higher material needs security (sum of material needs) was significantly associated with lower A1C and systolic blood pressure (SBP) indicating that higher material needs is associated with better glycemic and blood pressure control. In addition, the study showed that older age, being male and not having confidence in filling forms were strong and independent correlates of blood pressure control. Although social determinants of health and social risk factors are well studied in the USA and Europe, there is limited data on the association between social determinants of health, specifically material needs security in the MENA region [12–14]. This study is the first to examine material needs security in this region and sets the stage for future larger scale studies to examine potential pathways for these relationship and intervention strategies that account for local and cultural contexts [17].

6. Financial Disclosures

No financial disclosures are reported by the authors of this paper.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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