



# The Impact of Social Determinants of Health on Diabetes Mellitus Outcomes

Hammad AY<sup>1\*</sup> and Abdalla MA<sup>2</sup>

<sup>1</sup>Omdurman Ahlia University, Sudan

<sup>2</sup>Al Neelain University, Sudan

\*Corresponding author: Almoeiz Yousif Hammad, Omdurman Ahlia University Faculty of Medicine, Khartoum, Sudan, Tel: +971555209757; Email: almoeiz7@gmail.com

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## Abstract

**Background:** Diabetes mellitus is a chronic metabolic disorder characterized by elevated blood glucose levels. It is a major public health concern, affecting millions of people worldwide. Diabetes can lead to a variety of complications, including heart disease, stroke, kidney failure, and blindness. Social determinants of health are the social and economic factors that influence health outcomes. These factors include income, education, housing, and access to healthcare. Research has shown that social determinants of health play a significant role in diabetes outcomes.

**Objective:** The objective of this study was to examine the impact of social determinants of health on diabetes mellitus outcomes.

**Methods:** This was a cross-sectional community-based study of adults with diabetes mellitus. Data was collected from a sample of adults with diabetes mellitus in a community setting. The data was analyzed using a variety of statistical methods, including descriptive statistics, bivariate analysis, and multivariate regression analysis.

**Results:** The study found that social determinants of health were significantly associated with diabetes mellitus outcomes. People with lower incomes, less education, and less access to healthcare were more likely to have poor diabetes outcomes, such as uncontrolled blood sugar levels, high blood pressure, high cholesterol levels, and diabetes complications.

**Conclusion:** The Darfur region has seen a significant increase in diabetes complications, particularly among young adults aged 24-29. The study revealed a gender disparity in the sample population, with males having a higher prevalence of complications compared to females. The high incidence of diabetes-related complications highlights the need for effective interventions and strategies to manage and prevent the condition. The Darfur region also had the highest incidence of diabetes-related complications, emphasizing the need for better healthcare resources. The findings suggest the need for targeted interventions, gender-sensitive healthcare, improved healthcare accessibility, early detection and prevention strategies, and addressing regional inequalities to improve the quality of life for individuals living with diabetes.

**Keywords:** Diabetes Mellitus; Social Determinants of Health; Health Outcomes; Health Disparities

**Abbreviations:** BP: Blood Pressure; LDL: Low-Density Lipoproteins.

## Introduction

Diabetes mellitus, a chronic metabolic disorder characterized

by elevated blood glucose levels, poses a significant global public health challenge with its far-reaching impact on millions of individuals. Complications associated with diabetes; including heart disease, stroke, kidney failure, and blindness, underscore the gravity of this condition and the urgent need for effective management [1]. Social

determinants of health, encompassing various social and economic factors such as income, education, housing, and healthcare access, are instrumental in shaping health outcomes, particularly in the context of diabetes. Extensive research has elucidated the profound influence of these determinants on the course of diabetes and its associated complications [2]. Numerous studies have explored the interplay between social determinants of health and diabetes outcomes, consistently revealing a clear correlation between lower socioeconomic status and adverse diabetes-related health indicators. Individuals with limited incomes, lower educational attainment, and reduced access to healthcare services are disproportionately affected by poor diabetes outcomes, as evidenced by multiple research findings [3]. For instance, a study featured in the esteemed journal *Diabetes Care* disclosed that individuals with lower incomes exhibit a higher likelihood of uncontrolled blood glucose levels and an increased risk of experiencing severe complications stemming from diabetes. Similarly, research published in *JAMA Internal Medicine* highlighted the heightened susceptibility of individuals with lower educational levels to suboptimal diabetes control and heightened rates of hospitalization due to diabetes-related complications [1,4].

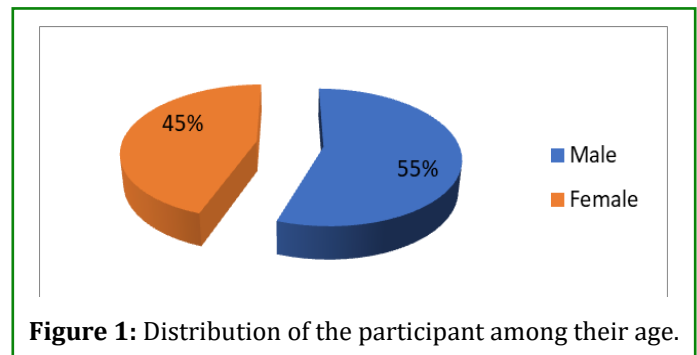
The mechanisms through which social determinants of health exert their influence on diabetes outcomes are multifaceted and intricate. Limited financial resources may hinder individuals from accessing essential diabetes management tools, such as nutritious food and prescribed medications, thereby impeding their ability to control the condition effectively. Furthermore, residing in neighborhoods lacking safe and affordable opportunities for physical activity can exacerbate the challenges faced by individuals with diabetes from disadvantaged backgrounds [5]. Individuals with lower educational attainment may struggle to grasp the intricacies of diabetes self-care practices and treatment regimens, potentially leading to subpar disease management. Additionally, a lack of health literacy and insufficient awareness of the significance of self-care measures may further compromise their ability to navigate the complexities of diabetes management efficiently. Inadequate access to health insurance and essential healthcare services further compounds the barriers faced by individuals with limited education in effectively managing their diabetes [3]. Furthermore, individuals with restricted access to healthcare facilities may encounter challenges in securing routine check-ups, essential screenings, and timely interventions crucial for diabetes management. The absence of adequate access to diabetes medications and treatments, often stemming from socioeconomic disparities, can significantly impede the optimal control of diabetes and increase the likelihood of adverse health outcomes for affected individuals [6,7].

## Research Methods

This was a cross-sectional community-based study conducted in various states of Sudan from January to April 2023. Data was collected from 224 adult participants aged 18 years or older who have been diagnosed with diabetes mellitus. Participants will be recruited from a variety of community settings. Data was collected from participants using a self-administered questionnaire. The questionnaire was collect information on the following demographic characteristics (e.g., age, gender, race/ethnicity, education level, and income), diabetes history (e.g., type of diabetes, duration of diabetes, medications, and complications), social determinants of health (e.g., income, education, housing, food security, access to healthcare, social support) and diabetes outcomes (e.g., glycemic control, blood pressure, cholesterol levels, diabetes complications). The data was be analyzed using a variety of statistical methods, including descriptive statistics, bivariate analysis, and multivariate regression analysis. The analysis was examining the association between social determinants of health and diabetes outcomes.

## Results

The sample population showed a notable imbalance in gender representation. This imbalance may have implications for the generalizability of the findings, as it suggests that the study may not accurately reflect the characteristics or behaviors of the overall population (Figure 1). Future research should aim to recruit a more balanced sample to ensure that the results are applicable to both men and women. Additionally, further investigation into the reasons behind this gender disparity could provide valuable insights into potential biases or societal norms that may be influencing participation rates. Ultimately, addressing this issue is crucial to ensure that research findings are representative and inclusive.



**Figure 1:** Distribution of the participant among their age.

Speaking of age groups, the majority of participants fell within the range of 36 to 41 years old. This specific demographic accounted for the highest number of attendees, showcasing a significant presence within the group.

Following closely behind were individuals aged 46, forming a substantial proportion of the participants. Additionally, the collective group was diverse in terms of age representation, encompassing a wide range of individuals from various age brackets. This multi-generational dynamic added depth and richness to the gathering, offering a vibrant mix of perspectives and experiences. The age distribution within

the participants reflected a balanced and inclusive setting, contributing to a dynamic and engaging atmosphere for interaction and exchange. Overall, the event benefited from the varied age groups present, creating a diverse and enriching environment that fostered mutual learning and understanding among participants (Table 1).

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18 - 23	6	2.7	2.7	2.7
	24 - 29	33	14.7	14.7	17.4
	30 - 35	28	12.5	12.5	29.9
	36 - 41	94	42	42	71.9
	41 and more	63	28.1	28.1	100
	Total	224	100	100	

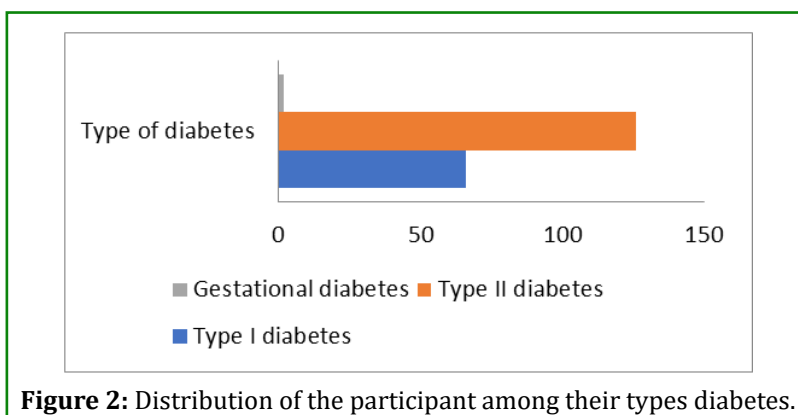
**Table 1:** Distribution of the participants among their age group.

The results showed that the satisfactory history of the majority of participants exceeded five years by 27.7% (Table 2). In the research study, it was found that a significant portion of the participants, specifically over half of them, were diagnosed with type 2 diabetes. The prevalence of type 2 diabetes was notable among the study subjects, indicating a considerable impact of this condition within the group. This finding sheds light on the importance of addressing the challenges and implications associated with managing type 2 diabetes within the population under study. The high representation of individuals with type 2 diabetes suggests a pressing need

for effective interventions and strategies to better manage and control this chronic disease. These results underscore the urgency of prioritizing interventions aimed at preventing and managing type 2 diabetes in order to improve the overall health outcomes and well-being of individuals affected by this prevalent condition. The substantial prevalence of type 2 diabetes among the study participants emphasizes the significant burden this disease places on both individuals and healthcare systems, highlighting the importance of continued research and targeted efforts to address and mitigate the impact of diabetes in the broader community (Figure 2).

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than 1 year	38	17	17	17
	1 - 2 years	76	33.9	33.9	50.9
	2 - 4 years	48	21.4	21.4	72.3
	5 and more	62	27.7	27.7	100
	Total	224	100	100	

**Table 2:** Distribution of the participants among their Period of illness.



**Figure 2:** Distribution of the participant among their types diabetes.

In a study examining complications associated with diabetes, it was discovered that individuals with type 1 diabetes were

the most affected group, with an increase in complications experienced by 14.7% (Table 3).

Yes		Present of any complications from diabetes				Total
		No	I don't know	May be		
Type of Diabetes	Type I diabetes	33	2	0	31	66
	Type II diabetes	0	94	32	0	126
	Gestational diabetes	0	1	1	30	32
Total		33	97	33	61	224

**Table 3:** Type of diabetes \*Present of any complications from diabetes Cross tabulation.

Remarkably, the age group of 24-29 years emerged as particularly vulnerable to the complications of diabetes, highlighting a concerning trend in this demographic (Table 4).

Furthermore, the data revealed a gender disparity, showing a higher prevalence of complications in males compared to females (Table 5).

18 - 23		Age group				Total	
		24 - 29	30 - 35	36 - 41	41 and more		
Present of any complications from diabetes	Yes	2	30	0	0	1	33
	No	3	3	28	62	1	97
	I don't know	0	0	0	1	32	33
	May be	1	0	0	31	29	61
Total		6	33	28	94	63	224

**Table 4:** Present of any complications from diabetes \*Age group Cross tabulation.

These findings shed light on the importance of targeted interventions and tailored healthcare strategies for managing diabetes and reducing its associated complications. By understanding the specific groups at higher risk, healthcare providers and policymakers can work towards promoting better outcomes and improving the overall quality of life for

individuals living with diabetes. It is imperative that further research delves into the underlying factors contributing to these disparities, paving the way for more effective prevention and management strategies to address the complex challenges posed by diabetes and its complications on a population level.

Yes		Present of any complications from diabetes			Total	
		No	I don't know	May be		
Gender	Male	30	59	3	32	124
	Female	3	38	30	29	100
Total		33	97	33	61	224

**Table 5:** Gender \* Present of any complications from diabetes Cross tabulation.

The research findings revealed a significant correlation between the availability of medical services and the

decreased likelihood of experiencing complications among participants (Table 6).

No complication		Diabetes complications: experienced any of the following complications from diabetes						Total
		Heart disease and cataract	Heart disease , DKA , cataract	Heart disease ,DKA	Heart disease ,Stroke , DKA	DKA		
Access to healthcare: Regular healthcare provide	Yes	32	31	0	1	32	0	96
	No	0	0	0	0	3	0	3
	Sometimes	33	30	30	0	1	31	125
Total		65	61	30	1	36	31	224

**Table 6:** Access to healthcare: Regular healthcare provide \* Diabetes complications: experienced any of the following complications from diabetes Cross tabulation.

Furthermore, a notable observation was made regarding the disproportionate impact of complications on individuals hailing from the region of Darfur. This highlights the critical role of access to quality healthcare in safeguarding health outcomes. Specifically, individuals residing in Darfur faced the highest incidence of complications, underscoring the pressing need for improved healthcare resources in the

area. These insights underscore the necessity of bolstering medical infrastructure and services in regions like Darfur to ensure better health outcomes for residents. It is evident from the study that enhancing access to medical care can lead to a tangible reduction in complication rates, particularly in underserved areas like Darfur.

Yes		Present of any complications from diabetes				Total
		No	I don't know	May be		
Accommodation	Northern and river Nile state	2	30	0	5	37
	red sea , Gedaref and Kassala	1	4	0	27	32
	Blue Nile and sennar	1	1	1	29	32
	Geziera, White Nile and Khartoum	1	0	32	0	33
	Kordofan	2	62	0	0	64
	Darfur	26	0	0	0	26
Total		33	97	33	61	224

**Table 7:** Accommodation \* Present of any complications from diabetes Cross tabulation.

As such, policymakers and healthcare providers should prioritize initiatives aimed at improving healthcare accessibility in regions where vulnerable populations are most at risk of complications. Comprehensive efforts must be undertaken to address the specific healthcare needs of communities like those in Darfur to mitigate the impact of health complications and promote overall well-being. Upon analyzing our data, we have uncovered a significant correlation between the duration of illness and the emergence of complications (Table 8). Our results specifically reveal that young individuals, particularly children around the age of 5, are at the highest risk for experiencing complications related to their condition. This association between the timing of disease onset and the likelihood of complications highlights the crucial importance of timely intervention and

targeted preventive measures. It underscores the critical window of vulnerability that exists within this age group, necessitating heightened vigilance and tailored healthcare strategies to mitigate the impact of potential complications. By recognizing and addressing this heightened risk period, healthcare providers can better anticipate and manage complications, ultimately improving outcomes for young patients facing illness. The intricate relationship between disease duration and complication risk underscores the complexity of pediatric healthcare and emphasizes the need for proactive and vigilant monitoring to safeguard the well-being of affected individuals. By fostering a deeper understanding of these intertwined factors, we can enhance our ability to deliver timely and effective interventions that protect and support the health of our youngest patients.

	Present of any complications from diabetes				Total	
		Yes	No	I don't know		May be
Period of illness	less than 1 year	1	4	31	2	38
	1 - 2 years	0	46	2	28	76
	2 - 4 years	1	45	0	2	48
	5 and more	31	2	0	29	62
Total		33	97	33	61	224

**Table 8:** Period of illness \* Present of any complications from diabetes Cross tabulation.

## Discussion

The findings of this study suggest that social determinants of health play a significant role in diabetes mellitus outcomes. People with lower incomes, less education, and less access to healthcare were more likely to have poor diabetes outcomes, such as uncontrolled blood sugar levels, high blood pressure, high cholesterol levels, and diabetes complications. Study made by Rebekah et al showed that racial or ethnic differences in the clinical outcomes for diabetes, including glycemic, blood pressure (BP) and lipid control, continue to persist. In addition, the literature review shows that the role of social determinants of health on outcomes, and the possible role these determinants play in disparities have largely been ignored [3]. Psychosocial factors, such as self-efficacy, depression, social support and perceived stress, show consistent associations with self-care, quality of life and glycemic control. Neighborhood factors, such as food insecurity, social cohesion and neighborhood esthetics have been associated with glycemic control. Perceived discrimination has also been associated with self-care and the psychological component of quality of life [8]. A systematic review by Walker examined whether social determinants of health have an impact on health outcomes in type 2 diabetes. Medline was searched for articles that were published in English targeted adults, ages 18 + years, had a study population which was diagnosed with type 2 diabetes, the study was done in the United States, and the study measured at least one of the outcome measures glycemic control, cholesterol (LDL), blood pressure, quality of life or cost. Using a reproducible strategy, 2,110 articles were identified, and 61 were reviewed based on inclusion criteria [9]. Twelve were categorized as Economic Stability and Education, 17 were categorized as Social and Community Context, 28 were categorized as Health and Health Care, and three were categorized as Neighborhood and Built Environment. Based on the studies reviewed, social determinants have an impact on glycemic control, LDL, and blood pressure to varying degrees [10]. The impact on cost and quality of life was not often measured, but when quality of life was investigated, it did show significance. More research is needed to better characterize the direct impact of social

determinants of health on health outcomes in diabetes [11]. Other study by Fisher suggests that a direct relationship between psychosocial determinants of health and glycemic control. Although associated with self-care, the relationship between social determinants of health and glycemic control is not mediated by self-care. Development of interventions should take psychosocial factors into account as independent influences on diabetes outcomes, rather than as indirect influences via self-care behavior [12,13].

## Conclusion

In conclusion, the study highlighted a significant gender disparity in the sample population, indicating potential limitations in the generalizability of the findings to the broader population due to an imbalance that may reflect societal norms or biases affecting participation rates. This issue underscores the need for future research to recruit more balanced samples and further explore the reasons behind gender disparities. Additionally, the study showcased a diverse age distribution among participants, with a prominent presence of individuals aged 36 to 41, contributing to a dynamic and inclusive environment. A notable finding was the high prevalence of type 2 diabetes among more than half of the participants, revealing the considerable impact of this condition. This underscores the urgent need for effective interventions and strategies to manage and prevent type 2 diabetes, highlighting its significant burden on affected individuals and the healthcare system. Prioritizing efforts to address this prevalent condition is crucial for improving health outcomes and ensuring that research findings are representative and inclusive of the community. A study on diabetes complications in the Darfur region revealed a significant increase in complications, particularly among individuals with type 1 diabetes. Young adults, particularly those aged 24-29, were identified as particularly susceptible to these complications. Gender disparity was observed, with males having a higher prevalence of complications compared to females. Access to medical services was found to be a significant factor in reducing complications among those with diabetes. The Darfur region also had the highest incidence of diabetes-related complications, emphasizing

the need for better healthcare resources. The duration of illness was found to be a critical factor in the emergence of complications, with young individuals, particularly around the age of 5, at the highest risk.

The findings suggest the need for targeted interventions, gender-sensitive healthcare, improved healthcare accessibility, early detection and prevention strategies, and addressing regional inequalities. Implementing a multi-faceted approach that includes education, enhanced surveillance, increased resource allocation, and research into underlying factors contributing to the disparities can significantly improve the quality of life for individuals living with diabetes and reduce the occurrence of severe complications, ensuring more equitable health conditions across Sudan's diverse demographic landscape.

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