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Assessing Social Determinants of Health and Healthcare Outcomes among Complex Patients in the Eastern Health Cluster, Saudi Arabia

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Abstract

Background: Complex patients with frequent hospital admissions pose significant challenges to healthcare systems worldwide. In Saudi Arabia, these patients often experience health disparities driven by Social Determinants Of Health (SDOH), including economic stability, education, and access to healthcare. Understanding the role of the SDOH in shaping health outcomes and utilization patterns is critical for achieving equitable care. **Objective:** This study investigated the associations between SDOH and healthcare outcomes among complex patients in the Eastern Health Cluster (EHC). This study aims to identify key social factors influencing frequent admissions and guide strategies to reduce disparities. **Methods:** A cross-sectional study was conducted among 487 complex patients across EHC hospitals. Data were collected from medical records and patient surveys via the Accountable Health Communities Health-Related Social Needs Screening Tool. The SDOH stratified patients into "low-impact" (0 - 5) and "high-impact" (≥6) strata. Statistical analyses were used to assess the associations between SDOH levels, demographic characteristics, health outcomes, and utilization patterns. **Results:** Patients with high-impact SDOH (high-impact strata) were more likely to have chronic conditions such as cardiovascular disease (16.7% vs. 7.9%; $p = 0.005$) and mental health disorders (9.1% vs. 2.0%; $p < 0.001$). High-impact SDOH was associated with older age, lower education levels, and economic instability. However, healthcare utilization patterns, including emergency visits and admissions, were not significantly different between the SDOH strata. **Conclusions:** This study highlights the critical influence of SDOH on health outcomes in complex patients. Despite equitable health care access, disparities persist in disease prevalence. Tailored interventions addressing SDOH are essential for improving health eq-

uity and reducing hospitalizations in Saudi Arabia.

Keywords

Social Determinants of Health, Healthcare Utilization, Complex Patients, Population Health Management, Chronic Diseases

1. Background

Frequent hospital admissions among complex patients pose significant challenges for healthcare systems, leading to increased financial burdens and strain on resources. Research shows that the complexity of these patients, who are often marked by multiple chronic conditions and extensive medication needs, has increased substantially, resulting in a higher frequency of unplanned readmissions and prolonged hospital stays. For example, a study from British Columbia reported a 50% increase in multimorbidity and a 14% rise in unplanned readmissions between 2002 and 2017 [1]. In Brazil, children with complex chronic conditions contribute to a growing proportion of hospital admissions, further increasing healthcare costs [2]. Such trends worldwide underscore the need for targeted strategies to reduce preventable admissions and improve outcomes for these high-need patients [3] [4].

Social Determinants Of Health (SDOH), such as economic stability, living conditions, access to healthcare, education, and social support, play crucial roles in hospitalization rates and health outcomes. Economic instability, for example, is a strong predictor of hospital admissions; individuals facing financial hardship or food insecurity are at greater risk of hospitalization [5]. Housing instability and unsafe living conditions also increase health risks, as evidenced by studies showing increased hospitalization rates among veterans in poorly maintained neighborhoods [6]. Additionally, limited health literacy and barriers to healthcare access often lead to mismanagement of chronic diseases, which further drives up hospital admissions [7]. The evidence suggests that interventions addressing these SDOH, through care coordination and community support, are effective in mitigating avoidable admissions [8].

Despite the growing recognition of the impact of SDOH on health outcomes, significant research gaps remain, particularly in specific populations. In Saudi Arabia, for example, socioeconomic factors profoundly influence health outcomes and access to healthcare. Lower education and income levels are associated with poorer management of Noncommunicable Diseases (NCDs) and a reduced quality of life [9] [10]. Additionally, urban-rural disparities, unmet healthcare needs related to income, and limited access to preventive services for women further underscore these inequities. Addressing these gaps through culturally adapted interventions that consider the local ecosystem is crucial for developing effective and locally relevant SDOH strategies.

Furthermore, disparities in digital health access and a lack of standardized SDOH data collection hinder comparisons across populations and measurement of intervention outcomes [11]. Robust, multidisciplinary research efforts are needed to better understand and promote health equity on a global scale.

Saudi Arabia is currently undergoing a major healthcare transformation, with a focus on improved quality of care, patient satisfaction, and cost efficiency. Population Health Management (PHM) is a key element of this transformation strategy. Within EHC, several PHM initiatives are in place to align with national healthcare transformation goals, one of which addresses the high-need, high-cost patient population. This study aims to identify gaps in care and factors affecting this group by examining SDOH among complex patients with high healthcare utilization. Specifically, it investigates the relationships between sociodemographic factors, comorbidity indices, and SDOH, as well as the impact of SDOH on health outcomes and utilization. This foundational analysis aims to deepen the understanding of the role of the SDOH in health disparities, guiding PHM efforts to design targeted interventions that enhance health equity and reduce avoidable admissions within this vulnerable population.

2. Methodology

Study design and setting: A multicenter cross-sectional study was conducted with complex patients. Complex patients identified in this study are patients who were admitted four or more times or who had six or more emergency department visits from January to December 2022. The study included patients from the main hospitals within the EHC, specifically Dammam Medical Complex (DMC), Jubail General Hospital (JGH), King Fahad Specialist Hospital in Dammam (KFSHD), Khafji General Hospital (KGH), and Qatif General Hospital (QGH), during 2022 calendar year.

Study procedures and data collection: The study proceeded in two phases. In the first phase, patients were identified from the complex patient list maintained by the Population Health Management (PHM) unit in the EHC. Data, including demographics, comorbidities (e.g., hypertension, diabetes), admission and emergency visit frequency, ICD-10 diagnoses, and information such as length of stay, admission diagnosis, discharge medications, and discharge status, were extracted from medical records.

In the second phase, we developed a survey to capture sociodemographic (e.g., age, gender, nationality, marital status and employment status) data along with information on SDOH in complex patients. We used a previously validated screening tool developed by the Centers for Medicare & Medicaid Services, Accountable Health Communities Health-Related Social Needs (AHC HRSN), to obtain information on the SDOH, such as housing, social support, substance use, mental health, and disability status [12]. Most complex patients are Arabic-speaking individuals. The survey questionnaire was translated into Arabic via a professional translation service to ensure that the translation not only communicated meaning

but was also tied to local literary forms and was culturally suitable. The initial questionnaire underwent peer review and validation for translation validity, face validity, content validity, and test-retest reliability.

The interrater reliability for the "degree of relevance" of the SDOH survey content ratings between two experts was assessed via the kappa statistic, which yielded a kappa of 0.653 ($p < 0.01$), indicating substantial agreement. Cronbach's alpha was calculated to assess internal consistency, yielding a score of 0.746 for the SDOH items, which is within the acceptable range of 0.60 - 1.00, indicating good internal consistency. The survey questionnaire was piloted with 30 participants twice, with 15- to 18-day intervals, to ensure that the questions were easy to understand. Test-retest reliability was measured via the intraclass correlation coefficient (ICC) for the SDOH, with a score of 0.779, indicating high test–retest reliability at the 5% level of significance. The piloted data were not included in the survey analysis.

The study population was identified from a list maintained by the PHM Unit in the EHC. Once identified, detailed data were extracted from each hospital's medical records, followed by a structured phone interview by our trained research staff on SDOH, with data captured directly via the RedCap tool.

Sample size and sampling technique: A total sample of 481 participants was required to produce a 95% confidence interval of 45% to 55% via a binomial distribution when the estimated proportion of patients contributing to high-impact SDOH among complex patients was 50% and the potential nonresponse rate was 20%. Patients were randomly selected via simple random sampling from the list of complex patients meeting the inclusion criteria at EHC hospitals. Selection continued until the required sample size was achieved.

Statistical analysis: Descriptive results are presented as the means ± Standard Deviations (SDs) for age and numbers (percentages) for all categorical variables (e.g., sex). The primary objective of the study was to measure the SDOH among complex patients during the study period. The SDOH questions were categorized on the basis of the *International Classification of Diseases*, *Tenth Revision*, *Clinical Modification* coding format, and an SDOH index score was created by summing all the SDOH questions for each of the respondents. The lower the SDOH score was, the less the individual was impacted by high-impact SDOH. We also created a composite variable called "SDOH strata" on the basis of the SDOH index scores (0 - 5 "low-impact stratum"; ≥6 "moderate to high impact stratum") [13]. Binomial distributions were used to measure the prevalence of complex patients contributing to high-impact SDOH (≥6 "moderate to high impact strata") with 95% confidence intervals. Bivariate analysis was performed via independent sample t tests, Pearson chi-square tests and Fisher exact tests whenever appropriate to compare all the sociodemographic characteristics and health outcomes with their SDOH strata (0 - 5 "low-impact stratum"; ≥6 "moderate to high impact stratum"). Two-sided p values < 0.05 were considered statistically significant. All the statistical analyses were performed via SPSS (Statistical Package for Social Sciences ver-

sion 28.0).

3. Results

A total of 487 complex patients from the EHC were analyzed in this study. The demographic characteristics of the cohort are summarized in Table 1. The mean age of the participants was 34.6 years (SD ± 21.1). The sample included slightly more males (273, 56.1%) than females (214, 43.9%). Most of the participants were Saudi nationals (410, 84.2%), with 77 (15.8%) non-Saudi nationals in the sample. In terms of city of residence, Dammam had the highest representation 171 (35.1%), followed by Qatif 125 (25.7%), rural EHC cities 67 (13.8%), other non-EHC cities 80 (16.4%), and Khobar and Dhahran combined 31 (6.4%). Smaller contributions were observed from Jubail 13 (2.7%). With respect to marital status, nearly half of the participants were married 243 (49.9%), with 197 (40.5%) being single and 47 (9.7%) reporting that they were divorced or widowed. Household monthly income varied widely, with 207 (42.5%) preferring not to disclose their income. Among those who provided income data, 170 (34.9%) reported earning less than 10,000 SARs, whereas 62 (12.7%) reported earning 10,000 SARs or more. A smaller proportion (48, 9.9%) reported having no income. In terms of employment status, 153 (31.4%) of the participants were employed or self-employed, 129 (26.5%) were students or children, 101 (20.7%) were housewives, 58 (11.9%) were unemployed, and 45 (9.2%) were retired. Educational levels varied, with 233 (47.8%) participants having completed high school or below, 133 (27.3%) holding a college degree, 63 (12.9%) being illiterate, and 7 (1.4%) possessing a master's degree. Finally, 51 (10.5%) of the participants reported having children aged five years or younger.

Table 2 presents the associations between demographic characteristics and the two levels of SDOH. Generally, individuals with high-impact SDOH are older (mean age: 41.37 ± 18.64 years) than those with low-impact SDOH (mean age: 32.12 ± 21.43 years, $p < 0.001$). Sex and nationality were not significantly associated with SDOH ($p = 0.682$ and $p = 0.971$, respectively). However, marital status demonstrated notable differences. High-impact SDOH was more common among divorced or widowed individuals (40.5%), followed by married individuals (32.5%), whereas single individuals were more likely to have low-impact SDOH (82.7% vs. 17.3%, $p < 0.001$).

Educational level was also significantly related to SDOH ($p = 0.002$). Participants with lower levels of education, such as being illiterate or having completed high school or below, were more likely to experience high-impact SDOH (36.5% and 33.0%, respectively). Conversely, higher education levels were associated with better SDOH; for example, 78.2% of college graduates and all participants with a master's degree (100%) were in the low-impact SDOH category.

Barriers to accessing healthcare differed substantially. Patients in the high-impact SDOH group reported affordability issues as the most common barrier (61.7% vs. 38.3%, $p < 0.001$), whereas those with no barriers were overwhelmingly

Table 1. Demographic characteristics of complex patients in the eastern health cluster (n = 487).

Factors	Results
Age (years)	34.6 ± 21.1
Gender	
• Female	214 (43.9)
• Male	273 (56.1)
Nationality	
• Saudi	410 (84.2)
• Non Saudi	77 (15.8)
City of residence	
• Dammam	171 (35.1)
• Khobar and Dhahran	31 (6.4)
• Jubail	13 (2.7)
• Qatif	125 (25.7)
• Rural EHC cities	67 (13.8)
• Other non-EHC cities	80 (16.4)
Marital status	
• Single	197 (40.5)
• Married	243 (49.9)
• Divorced/Widower	47 (9.7)
Household monthly income	
• No income	48 (9.9)
• <10,000	170 (34.9)
• ≥10,000	62 (12.7)
• Prefer not to answer	207 (42.5)
Employment status	
• Employee/Self-employed	153 (31.4)
• Unemployed	58 (11.9)
• Student/Child	129 (26.5)
• Housewife	101 (20.7)
• Retired	45 (9.2)
Educational status	
• Illiterate	63 (12.9)
• High school and below	233 (47.8)
• College grad	133 (27.3)
• Master's degree	7 (1.4)
• Children (≤5 years)	51 (10.5)

Results are expressed as the mean ± SD, number (percentage).

Table 2. Demographic factors associated with social determinants of health among complex patients (n = 487).

Factors	Social Determinant Of Health (SDOH)		Odds Ratio (95% CI for odds ratio)	P value[β]
	0 - 5: Low-Impact SDOH (n = 355)	≥6: High-Impact SDOH (n = 132)		
Age (years)	32.12 + 21.43	41.37 + 18.64	1.021 (1.01 - 1.03)	<0.001[£]
Gender				0.682
• Female	154 (72.0)	60 (28.0)	1	
• Male	201 (73.6)	72 (26.4)	0.919 (0.61 - 1.37)	
Nationality				0.971
• Saudi	299 (72.9)	111 (27.1)	1	
• Non Saudi	56 (72.7)	21 (27.3)	0.990 (0.57 - 1.71)	
City of residence				0.085
• Dammam	118 (69.0)	53 (31.0)	1	
• Khobar and Dhahran	20 (64.5)	11 (35.5)	1.225 (0.54 - 2.73)	
• Jubail	10 (76.9)	3 (23.1)	0.668 (0.17 - 2.52)	
• Qatif	104 (83.2)	21 (16.8)	0.450 (0.25 - 0.79)	
• Rural EHC cities	48 (71.6)	19 (28.4)	0.881 (0.47 - 1.64)	
• Other non-EHC cities	55 (68.8)	25 (31.3)	1.012 (0.57 - 1.79)	
Marital status				<0.001
• Single	163 (82.7)	34 (17.3)	1	
• Married	164 (67.5)	79 (32.5)	2.309 (1.46 - 3.64)	
• Divorced/Widower	28 (59.5)	19 (40.5)	3.253 (1.63 - 6.48)	
Educational status				0.002[€]
• illiterate	40 (63.5)	23 (36.5)	1	
• High school and below	156 (67.0)	77 (33.0)	0.858 (0.48 - 1.53)	
• College grad	104 (78.2)	29 (21.8)	0.485 (0.25 - 0.93)	
• Master's degree	7 (100.0)	0 (0.0)	-	
• Children (≤5 years)	48 (94.1)	3 (5.9)	0.109 (0.03 - 0.38)	
Which of the following prevents you from going to the doctor?				
• Appointments	39 (69.6)	17 (30.4)	1.198 (0.65 - 2.20)	0.561
• Patient-related reasons	34 (55.7)	27 (44.3)	2.428 (1.39 - 4.21)	0.002
• Facility-related reasons	3 (60.0)	2 (40.0)	1.80 (0.29 - 10.92)	0.520
• Affordability	31 (38.3)	50 (61.7)	6.37 (3.82 - 10.60)	<0.001
• No barriers	264 (81.5)	60(18.5)	0.287 (0.18 - 0.43)	<0.001
Did you get healthcare the last time you needed it? (n = 474)				
• No	31 (58.5)	22 (41.5)	1	0.015
• Yes	314 (74.6)	107 (25.4)	0.480 (0.26 - 0.86)	

Results are expressed as the mean ± SD, number (row percentage). *β*: P value has been measured using Pearson Chi-square test; £: P value has been measured using Independent sample t test; €: P value has been measured using Fisher Exact test.

more likely to have low-impact SDOH (81.5% vs. 18.5%, $p < 0.001$). Facility-related reasons, such as difficulty with appointments or issues within the facility, were less significant contributors ($p > 0.05$).

Health outcomes were strongly influenced by SDOH. Table 3 shows that a greater percentage of patients with high-impact SDOH (67.9%) reported chronic diseases such as diabetes and hypertension than did those with low-impact SDOH (57.5%, $p = 0.037$). Certain comorbidities were notably more prevalent among those with high-impact SDOH. For example, cardiovascular diseases were significantly more common in this group (16.7%) than in those with low-impact SDOH (7.9%, $p = 0.005$). Similarly, mental health conditions were markedly more common in patients with high-impact SDOH (9.1%) than in those with low-impact SDOH (2.0%, $p < 0.001$). Other conditions, such as diseases of the stomach and colon (13.6% vs. 7.3%, $p = 0.033$) and physical difficulties such as movement, vision, or hearing impairments (53.0% vs. 28.2%, $p < 0.001$), were also significantly associated with high-impact SDOH. However, for conditions such as diabetes, kidney failure, high cholesterol, asthma, and cancer, there were no significant differences between the SDOH groups ($p > 0.05$).

Table 3. The association of social determinants of health on health outcomes in complex patients (n = 487).

Factors	Social Determinant Of Health (SDOH)		Odds Ratio (95% CI for odds ratio)	P value[β]
	0 - 5: Low-Impact SDOH (n = 355)	≥6: High-Impact SDOH (n = 132)		
Reported chronic disease by the patients (diabetes, blood pressure, etc.) (n = 484)				
• Yes	203 (57.5)	89 (67.9)	1.566 (1.02 - 2.39)	0.037
• No	150 (42.5)	42 (32.1)	1	
Comorbidities				
Diabetes				0.802
• Yes	69 (19.4)	27 (20.5)	1.066 (0.64 - 1.75)	
• No	286 (80.6)	105 (79.5)	1	
High blood pressure				0.195
• Yes	77 (21.7)	36 (27.3)	1.354 (0.85 - 2.14)	
• No	278 (78.3)	96 (72.7)	1	
Cardiovascular diseases				0.005
• Yes	28 (7.9)	22 (16.7)	2.336 (1.28 - 4.25)	
• No	327 (92.1)	110 (83.3)	1	
Cancer				0.248
• Yes	70 (19.7)	20 (15.2)	0.727 (0.42 - 1.25)	
• No	285 (80.3)	112 (84.8)	1	
Kidney failure				0.945

Continued

• Yes	33 (9.3)	12 (9.1)	0.976 (0.48 - 1.95)	
• No	322 (90.7)	120 (90.9)	1	
Asthma				0.077€
• Yes	5 (1.4)	6 (4.5)	3.33 (1.00 - 11.11)	
• No	350 (98.6)	126 (95.5)	1	
High cholesterol				0.220€
• Yes	8 (2.3)	6 (4.5)	2.065 (0.70 - 6.07)	
• No	347 (97.7)	126 (95.5)	1	
Musculoskeletal diseases				0.103
• Yes	58 (16.3)	30 (22.7)	1.506 (0.91 - 2.47)	
• No	297 (83.7)	102 (77.3)	1	
Chronic pneumonia				
• Yes	6 (1.7)	5 (3.8)	2.290 (0.68 - 7.63)	0.178€
• No	349 (98.3)	127 (96.2)	1	
Mental health diseases				
• Yes	7 (2.0)	12 (9.1)	4.971 (1.91 - 12.91)	< 0.001
• No	348 (98.0)	120 (90.9)	1	
Diseases of the stomach and colon				
• Yes	26 (7.3)	18 (13.6)	1.998 (1.05 - 3.78)	0.031
• No	329 (92.7)	114 (86.4)	1	
Did you have any health difficulty such as (movement, vision, hearing…etc.)?				< 0.001
• Yes	100 (28.2)	70 (53.0)	2.879 (1.90 - 4.35)	
• No	255 (71.8)	62 (47.0)	1	

Results are expressed as the mean ± SD, number (column percentage). *β*: P value has been measured using Pearson Chi-square test; €: P value has been measured using Fisher Exact test.

Despite the significant associations between SDOH and health outcomes, healthcare utilization patterns were not substantially different between the low-impact and high-impact SDOH groups. Table 4 shows that the median number of emergency room (ER) visits was similar for both groups (1 [0 - 23] for low-impact SDOH vs. 1 [0 - 31] for high-impact SDOH, p = 0.251). Inpatient admissions in 2022 were also comparable (median: 5 [4 - 28] for low-impact SDOH vs. 5 [4 - 18] for high-impact SDOH, p = 0.823).

Primary healthcare visits followed a similar trend, with no significant difference between the groups (median: 1 [0 - 108] for low-impact SDOH vs. 1 [0 - 21] for high-impact SDOH, p = 0.582). The total number of healthcare encounters across all the settings also showed no meaningful variation (median: 6 [4 - 36] for low-impact -SDOH vs. 6 [4 - 41] for high-impact -SDOH, p = 0.341).

Table 4. Healthcare utilization patterns and their association with social determinants of health among complex patients.

Factors	Social Determinant Of Health (SDOH)		P value
	0 to 5: Low-Impact stratum	≥6: High Impact stratum	
Number of ER visits	1 (0 - 23)	1 (0 - 31)	0.251
Number of inpatient admissions in one year.	5 (4 - 28)	5 (4 - 18)	0.823
Number of primary health care visits	1 (0 - 108)	1 (0 - 21)	0.582
Utilization by total encounter	6 (4 - 36)	6 (4 - 41)	0.341

Results are expressed as median (min. – max.); *β*: P value has been measured using Mann–Whitney U test.

4. Discussion

This study highlights key insights into the interplay between SDOH, health outcomes, and healthcare utilization among complex patients. Notably, varying levels of SDOH were significantly associated with specific health outcomes, highlighting the critical role of social factors in shaping patient health. Interestingly, despite these differences, healthcare utilization patterns remained consistent across the two SDOH strata, suggesting that utilization behaviors may be influenced by factors beyond the SDOH.

Chronic diseases were generally more prevalent among patients with high-impact SDOH than among those with favorable SDOH. Conditions such as cardiovascular diseases, mental health disorders, gastrointestinal issues, and physical limitations are significantly associated with high-impact SDOH, reinforcing existing evidence linking adverse social conditions to poorer health outcomes [14]. Mechanisms such as economic instability, chronic stress, and limited access to preventive services have been widely documented as contributing factors [15] [16]. However, not all chronic diseases were significantly associated with SDOH. For example, conditions such as asthma, diabetes, and kidney failure were not notably different between the two groups. This variation might reflect the complex interplay of biological, genetic, and social factors underlying these diseases. Additionally, relatively equitable access to healthcare services in Saudi Arabia could attenuate the influence of the SDOH on these specific conditions [10].

Recent studies have investigated the complex relationships among SDOH, chronic diseases, and health outcomes. Adverse SDOHs are linked to increased all-cause mortality among adults without major chronic diseases [17], although the impact on specific chronic conditions varies. For example, Foster *et al.* [18] reported that food and housing insecurities were associated with increased emergency department utilization among children with chronic diseases. Conversely, Potašová *et al.* [19] reported that household income did not significantly influence chronic disease incidence in Slovakia, whereas education and lifestyle factors played piv-

otal roles. Additionally, Embury *et al.* [20] highlighted spatial disparities in the connections between SDOH, COVID-19, and chronic diseases, with pronounced differences between urban and rural areas and between affluent and low-income communities. These findings emphasize the critical role of SDOH in shaping health interventions while also acknowledging the variability in their impact on chronic diseases across diverse populations and contexts.

While the two SDOH levels were identified via an evidence-based scoring system, the relatively balanced distribution of most demographic factors across the strata underscores the robustness and sensitivity of the classification. A notable example is the strong correlation between educational attainment and the SDOH, which supports the validity of the scoring approach. Education is extensively recognized as a key determinant of health outcomes and resource access, further affirming the reliability of this framework [21].

The second notable finding pertains to healthcare utilization, which showed no significant differences between the two SDOH levels. This outcome may be attributed to the high accessibility of healthcare services in Saudi Arabia, where universal coverage ensures that both groups have comparable opportunities to seek care [9]. However, similar levels of utilization do not necessarily equate to equitable care. Patients with high-impact SDOH often face greater unmet needs due to the complexity of their health conditions, which demand more tailored and intensive interventions. These findings highlight the need to shift the focus from utilization metrics alone to evaluating the quality of care and health outcomes to ensure equity [22] [23].

These findings should be interpreted with caution in PHM programs. While the equal utilization of healthcare services is encouraging, it does not reflect the disproportionate complexity and health challenges faced by patients with high-impact SDOH. To achieve true health equity, PHM strategies should prioritize high-need populations by incorporating routine SDOH assessments to proactively identify disparities [24] [25]. Tailored interventions that address the unique needs of individuals with high-impact SDOH are essential in this process. Recent research highlights the pivotal role of such interventions in advancing health equity, with healthcare systems increasingly adopting SDOH assessments and implementing targeted measures [26]. Nevertheless, challenges persist in effectively screening for and addressing social needs without compromising trust and patient relationships [26].

Future research should address the limitations of this study, particularly the simplification of the SDOH into two discrete levels. A more nuanced approach that captures the dynamic, cumulative, and multidimensional nature of the SDOH may yield deeper and more actionable insights. Mercado *et al.* [27] proposed differentiating SDOH from Systemic Drivers of health (SSD), emphasizing intersectionality and generational impacts. Li *et al.* [28] advocated integrating SDOH data into electronic health records through standardized screening and advanced data techniques. These studies emphasize the complexity of SDOH and the need for

dynamic, multidimensional approaches to enhance population health. Saudi Arabia literature shows a growing body of SDOH research, specifically in primary healthcare, cancer patients, and chronic illness prelatic patients, and other population groups. However, most studies used cross-sectional and/or qualitative designs; the intervention evidence is still emerging but limited, framed as recommendations rather than designs. Future research must focus on interventional design to measure SDOH effects [9] [29]-[32]. Additionally, longitudinal studies are crucial for exploring how changes in SDOH over time influence health outcomes and utilization patterns, offering a more comprehensive understanding of these dynamics.

5. Conclusion

This study prioritizes the profound influence of the SDOH on specific health outcomes while highlighting the resilience of healthcare access in Saudi Arabia. To bridge gaps in health equity, PHM programs must prioritize individualized, needs-based care for patients with high-impact SDOH. Healthcare interventions must consider both clinical complexity and SDOH to promote equitable health outcomes.

Ethics Approval and Consent to Participate

Informed verbal consent was obtained from each participant before enrollment. An information sheet explaining the study was distributed to all participants. The study was reviewed and approved by the IRB (Study Number: EPD0002) at King Fahad Specialist Hospital Dammam, Saudi Arabia.

Availability of Data and Materials

The datasets generated_and/or analyzed during the current study are not publicly available due to privacy, confidentiality, and other restrictions, but are available from the corresponding author on reasonable request.

Authors' Contributions

Conceptualization, S. A.; data curation, F. A.; formal analysis, A. S.; investigation, A. S. and F. A.; methodology, O. A.; project administration, O. A.; writing—original draft preparation, S. A. and O. A.; writing—review and editing, S. A and A. S. The authors have read and approved the final manuscript.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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List of Abbreviations

SDOH	Social Determinants of Health
EHC	Eastern Health Cluster
PHM	Population Health Management
SSD	Systemic Drivers of Health