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# Medication Beliefs and Associated Factors Among Heart Failure Patients in Yemen and Role of Regimen Complexity: a Cross-Sectional Study

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**ABSTRACT:** Beliefs about medication influence treatment engagement and outcomes in patients with heart failure, yet evidence from low-resource settings such as Yemen remains limited due to under-supported health care systems and low monitoring in health services. To assess medication beliefs among heart failure patients in Yemen and examine factors associated with necessity and concern beliefs, including medication regimen complexity. A hospital-based cross-sectional study was conducted between December 2023 and February 2024 among heart failure patients attending cardiology outpatient clinics in Sana'a, Yemen after ethical approval from the hospital. Data were collected using structured questionnaires, including the Beliefs About Medication Questionnaire (BMQ-Specific) and the Medication Regimen Complexity Index (MRCI). Multivariable linear regression analyses were performed to identify predictors of medication beliefs. A total of 250 patients were included, with a mean age of 51.08±11.47 years, and 65.2% were male. The median total BMQ score was 38.0 (IQR:35–42). Higher necessity beliefs were independently associated with older age (B=0.046, p=0.029), higher educational status (B=−1.240, p=0.030), and a greater number of prescribed medications (B=0.802, p=0.001), whereas greater medication regimen complexity was negatively associated with necessity beliefs (B=−0.276, p=0.003). Regarding concern beliefs, employment status (B=2.605, p<0.001) and longer duration since diagnosis (>3 years) (B=−1.155, p=0.029) were significant predictors, indicating a mild but significant impact. No significant associations were observed between concern beliefs and age, gender, education, income, number of medications, or regimen complexity. Medication beliefs among heart failure patients in Yemen are shaped by both patient and treatment-related factors. The findings have important implications in clinical practice, both clinical pharmacists and cardiologist can consider patients' perspective to guide intervention design especially simplifying medication regimens and addressing patient-specific concerns.

**Keywords**: Heart failure; patient beliefs; medication regimen complexity; Yemen

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## INTRODUCTION

Heart failure (HF) is a complex syndrome caused by structural or functional cardiac abnormalities that impair the heart's ability to pump or fill effectively. Despite compensatory neurohormonal activation, left ventricular ejection fraction (LVEF) remains a key parameter for diagnosis, prognosis, and therapeutic guidance (Khan et al., 2022; Lund et al., 2022; Savarese et al., 2022). In the Middle East, heart failure continues to impose a substantial burden, with rehospitalization rates reported at 18% within three months and 40% within one year, while cumulative mortality reached 13% and 20% at the same time points, respectively (Hassan, 2015).

Medication adherence is essential for achieving optimal outcomes in HF; however, it is strongly influenced by patients' beliefs about their prescribed therapies. Evidence suggests that medication beliefs may be more predictive of adherence than demographic or clinical characteristics, accounting for nearly 20% of the variability in adherence behaviours (AlGhurair et al., 2012; Barry et al., 2023; Gatti et al., 2009; Percival et al., 2012, ). The Necessity–Concern Framework provides a theoretical basis for understanding this relationship, proposing that patients continuously weigh their perceived need for medication against concerns about potential adverse effects. Adherence is more likely when necessity beliefs outweigh concerns (Dias et al., 2014; Phillips et al., 2014; Wei et al., 2017, Yasin et al., 2024). Beyond adherence, medication beliefs are increasingly recognized as underlying determinants that shape treatment engagement and long-term outcomes. In HF, particularly the details of medication and adherence have not been adequately evaluated and are tightly connected to the complexity of treatment (Al-Ruthia et al., 2017).

The pharmacological management of HF typically requires polypharmacy, including diuretics, beta-blockers, angiotensin-converting enzyme inhibitors or angiotensin receptor blockers, and mineralocorticoid receptor antagonists. While clinically necessary, this approach often results in complex medication regimens characterized by high pill burden, frequent dosing schedules, and specific administration instructions (Ingersoll & Cohen, 2008; Mastromarino et al., 2014). Medication regimen complexity has emerged as a key therapy-related factor influencing patients' experiences with long-term treatment. Although complex regimens are essential to optimize clinical outcomes, they may impose substantial cognitive, practical, and organizational demands on patients, particularly those with multiple comorbidities (Kassaw et al., 2024). Previous research has primarily linked higher regimen complexity to reduced medication adherence due to challenges such as confusion, treatment fatigue, and daily disruption. This can influence medication beliefs in patients which are also influenced by the sociodemographics of Yemeni patients (Kassaw et al., 2024). However, lack of researched about regimen complexity shapes patients' beliefs about their medications, particularly perceptions of necessity, which play a central role in treatment engagement and long-term self-management (Kassaw et al., 2024).

Patients with HF commonly take between two and nine prescribed medications daily, corresponding to an average of approximately 10 doses per day, excluding over the counter and complementary therapies (Cobretti et al., 2017; Hajjar et al., 2007). The chronic and progressive nature of HF, combined with the high prevalence of comorbid conditions, necessitates sustained and often intricate pharmacotherapy, further increasing treatment complexity (Masoudi & Krumholz, 2003). olypharmacy represents only one dimension of regimen complexity; additional contributors include multiple dosage forms,

varied dosing frequencies, and detailed administration instructions (Beezer et al., 2022; Choudhry et al., 2011).

High medication regimen complexity has been consistently associated with adverse outcomes, including medication nonadherence, adverse drug reactions, prescribing errors, hospitalizations, drug–drug interactions, increased healthcare costs, reduced quality of life, functional decline, and higher mortality (Fröhlich et al., 2010; Hajjar et al., 2007; Schoonover et al., 2014). A systematic review of 54 studies by Pantuzza et al. (2017) demonstrated that greater regimen complexity is generally associated with poorer adherence to pharmacotherapy, although limited evidence suggests that complexity may improve adherence under specific circumstances (Pantuzza et al., 2017).

Despite ongoing advances in pharmacotherapy and demographic and epidemiological shifts marked by population aging and a growing burden of chronic disease, consensus regarding the relationship between medication regimen complexity and Beliefs remains elusive (Advinha et al., 2014). This lack of agreement persists across multiple studies, highlighting the need for continued investigation as treatment regimens become increasingly intricate (Ferreira et al., 2015; Stange et al., 2013). Moreover, much of the existing research has focused on specific patient groups or isolated components of regimen complexity, limiting the generalizability of findings (Claxton et al., 2001; Ferreira et al., 2015). Importantly, studies examining the impact of treatment regimen complexity on beliefs about medication in heart failure populations are scarce, particularly in developing countries (Abdelbary et al., 2023). Currently, there is a lack of evidence regarding the effect of medication regimen complexity on patients' beliefs about their medications among individuals with heart failure in Yemen. This study therefore seeks to explore how the complexity of prescribed treatment regimens influences medication beliefs in this population. The hypothesize that greater treatment regimen complexity is associated with stronger concerns and more negative beliefs about medications among patients, independent of sociodemographic and clinical factors.

## METHODS

### *Research design, Location, and duration*

A hospital-based observational cross-sectional study was conducted between December 19, 2023, and February 17, 2024, among patients with heart failure attending cardiology outpatient clinics in Sana'a, the capital city of Yemen. The study was implemented across three major healthcare institutions: Al-Thawra Modern General Hospital (a public hospital) and two private facilities, namely the University of Science and Technology Hospital and Azal Hospital. These three hospitals exhibit the highest incidence of heart failure relative to other hospitals, considering the diverse demographics of the research subjects. Data was collected using self-administered questionnaires, a method selected for its practicality and efficiency in capturing patient-reported information during routine clinical visits, where time availability was limited.

### *The criteria for participant inclusion and exclusion*

The study included adults aged 18 years and above who had a confirmed diagnosis of heart failure and were receiving ongoing pharmacological treatment. Eligible participants were required to have attended at least one follow-up visit within the previous six months to ensure they were not assessed during an initial consultation. All participants needed to be capable of providing informed consent. Patients were excluded if they had

cognitive impairments or other conditions that could compromise the reliability of self-reported data, including severe language limitations or significant communication disorders. Pregnant women were also excluded due to the special characteristics of pregnancy and its supply of uncomplicated therapeutic care, bias is likely to increase. As pregnancy is frequently accompanied by additional comorbid conditions such as dyslipidemia, diabetes, and hypertension that necessitate individualized treatment approaches and may substantially differ from standard heart failure management, potentially confounding the assessment of medication beliefs.

***Sample Size and Sampling Approach***

Participants were recruited using convenience sampling, a pragmatic approach commonly employed in hospital-based studies where patients are easily accessible and willing to participate. This strategy enabled timely and cost-efficient enrollment during routine outpatient clinic visits, which were conducted between 08:00 AM and 02:00 PM. The approach also accounted for fluctuations in daily attendance of heart failure patients, which may vary due to appointment rescheduling or non-attendance. This has been implemented to minimize bias in the study by creating explicit inclusion criteria, increasing sample size, and diversifying data collection places and times.

Sample size estimation was performed using a formula designed to detect correlations between study variables with a 95% confidence level. A correlation coefficient of r = 0.24, representing the midpoint value reported in previous research (Ma et al., 2020), was applied because it has clinically significant results regarding the relationship between medication complexity and adherence.

$$\boldsymbol{n = \left[\frac{Z_{a/2} + Z_B}{0.5 \ln[(1+r)/(1-r)]}\right]^2 + 3}$$

The calculation incorporated a standard normal value of Z_(a/2)= 1.96 and a statistical power constant of Z_B= 0.842 Based on these parameters, the minimum required sample size was estimated to be 134 participants.

***Data collection procedure and methods***

The study primarily relied on structured, paper-based questionnaires as the main method of data collection. The questionnaire was organized into multiple sections, each addressing a specific domain: sociodemographic characteristics, patients' beliefs about medication, and details regarding their current medication regimen. The sociodemographic section collected information on variables such as age, gender, marital status, educational attainment, employment status, income, and the duration since the heart failure diagnosis.

***Beliefs About Medication Questionnaire (BMQ-Specific)***

The Beliefs About Medication Questionnaire (BMQ-Specific) was employed to evaluate patients' perceptions regarding their heart failure medications. This instrument captures two central dimensions: the perceived necessity of prescribed treatment and concerns related to potential adverse effects. The Necessity subscale comprises five items, whereas the Concern subscale includes six items, with responses recorded on a 5-point Likert scale (Horne et al., 1999). The BMQ-Specific has been extensively validated and demonstrates strong reliability across diverse populations and languages. In the current study, the tool exhibited high internal consistency, confirming its suitability for assessing medication beliefs in this context. Comparable reliability and validity have been reported in previous research, including studies conducted in Sweden, Jordan (Cronbach's alpha > 0.7), and China, underscoring the robustness of the BMQ-Specific as a cross-cultural

measure (Alsous et al., 2017; Bai et al., 2022; Emilsson et al., 2020; Supramaniam et al., 2019). Although BMQ subscale scores were derived from ordinal Likert items, the summed scores were treated as continuous variables, consistent with common practice in psychometric research. Assumptions of linear regression were evaluated prior to analysis. Visual inspection of histograms and Q–Q plots indicated that residuals were approximately normally distributed, and diagnostic residual plots suggested acceptable linearity and homoscedasticity.

***Medication complexity***

The Medication Regimen Complexity Index (MRCI) is a validated tool consisting of 65 items designed to evaluate the complexity of a patient's medication regimen (George et al., 2004). It assesses multiple aspects, including the number of medications prescribed, the types of dosage forms, dosing schedules, and specific administration instructions, such as food-related considerations. The MRCI is divided into three sections: Section A (32 items) addresses dosage forms, Section B (23 items) evaluates dosing frequency, and Section C (10 items) covers additional instructions. The overall complexity is calculated by summing the scores from all sections, with higher scores reflecting more complex regimens. This instrument has also been successfully adapted into Arabic, demonstrating strong interrater and test-retest reliability (Aksoy et al., 2023; George et al., 2004; Hirsch et al., 2014; Mansur et al., 2012).

***Data entry and statistical analysis***

Data were entered into IBM SPSS Version 20 and checked for completeness before analysis. Categorical variables were summarized using frequencies and percentages, while continuous variables were described using means with standard deviations or medians with interquartile ranges (IQR) for skewed distributions. The primary outcome in this study was patients' beliefs about medication, measured using the Belief About Medication Scale (BMQ). Overall BMQ scores, as well as the necessity and concern subscales, were summarized using medians and IQRs, reflecting the ordinal nature of the responses. Individual questionnaire items were also analyzed with medians and IQRs to capture variability in perceived medication necessity and concerns. Associations between BMQ scores and categorical variables were assessed using the Mann–Whitney U test, while Spearman's rank correlation was applied for continuous variables. Variables showing a potential association with BMQ scores in univariate analysis ($p < 0.25$) were included in a multiple linear regression model to identify independent predictors of medication beliefs. Statistical significance for the multivariate model was set at $p < 0.05$, and variables not meeting the univariate threshold were excluded from the final analysis.

***Ethical consideration***

Ethical approval for the study was granted by the Ethics Committees of AL-Nasser University and AL-Thawra Hospital (reference numbers NU-REC-M2302 and No. 5-2023). Written informed consent was obtained from all participants after they were provided with detailed information regarding the study aims, procedures, potential benefits, and associated risks. Participants were informed of their right to withdraw from the study at any time without penalty. All collected data were anonymized and securely stored to maintain confidentiality and uphold research integrity.

## RESULT AND DISCUSSION

### *Sociodemographic and health-related characteristics*

A total of 250 patients with heart failure who met the inclusion criteria were included in the analysis. The sample was predominantly male (65.2%), with a mean age of 51.08 ± 11.47 years. The average age of patients in this study was lower than that typically reported in heart failure populations in high-income countries, where the average age often exceeds 65 years. This difference may reflect the demographic and epidemiological characteristics of low- and middle-income countries, where cardiovascular risk factors such as hypertension and diabetes tend to occur earlier and may not be optimally controlled. In addition, Yemen has a relatively young population structure and faces challenges in accessing preventive cardiovascular care, which may contribute to the earlier onset of heart failure. Similar patterns have been observed in other developing and Middle Eastern countries.

Most participants were educated (72.8%), and the median number of prescribed medications was six. Nearly two-thirds of the patients (69.6%) had been living with heart failure for several years. Approximately half of the participants (53.6%) reported a monthly income below 100,000 Yemeni Riyals (equivalent to less than USD 200). Additional demographic and clinical characteristics are summarized in Table 1.

### *Beliefs about Medication*

As shown in Table 2, the overall Belief About Medication scale yielded a median score of 38.0 with an interquartile range (IQR) of 35–42. The items "I sometimes worry about the long-term effects of my medications" and "I sometimes worry about becoming too dependent on my medications" demonstrated the highest median scores (4.0, IQR = 4–4), indicating that medication-related concerns were common among participants. Conversely, the statement "Without my medications, life would be impossible for me" recorded the lowest median score (3.0, IQR = 2–4). The broader interquartile range observed for this item suggests greater variability in patients' perceptions of medication necessity.

By synthesizing item-level data, the findings reveal a dominant belief profile in which strong concerns about treatment coexist with moderate perceptions of need. Although patients recognize the therapeutic importance of the prescribed regimen, persistent concerns about long-term side effects and potential dependence remain prominent. This discrepancy between beliefs about need and concerns may give rise to ambivalence toward treatment adherence, a phenomenon previously associated with suboptimal adherence in chronic disease management. These insights underscore the importance of tailored educational interventions that comprehensively address both the clinical benefits and perceived risks associated with heart failure pharmacotherapy.

### *Medication Complexity*

As presented in Table 3, the Medication Regimen Complexity Index (MRCI) was used to evaluate the complexity of participants' medication regimens by examining dosage forms (MRCI-A), dosing frequency (MRCI-B), and additional administration instructions (MRCI-C). Variability in dosage forms was limited, with a mean score of 1.16 (SD = 0.54). In contrast, dosing frequency demonstrated substantial variability, reflected by a mean of 6.54 (SD = 1.91). The component related to additional instructions also contributed notably

to regimen complexity, with a mean score of 6.07 (SD = 1.83). Collectively, the mean total MRCI score was 13.75 (SD = 3.79), indicating that patients were managing medication regimens characterized by considerable diversity and complexity.

This value is comparable to those reported in previous heart failure populations, where mean MRCI scores typically range from approximately 10 to 18 depending on disease severity and treatment intensity. Within this context, a mean score of 13.75 suggests a moderate-to-high level of regimen complexity. Such complexity is clinically meaningful, as prior research has linked similar MRCI ranges with increased treatment burden and greater risk of medication management difficulties in patients with chronic cardiovascular disease.

**Table 1.** Sociodemographic and health-related characteristics

| **Descriptive and health-related statistics** | **Frequency (%)** |
|---|---|
| ***Gender*** | |
| Male | 163 (65.2) |
| Female | 87 (34.8) |
| ***Age,*** mean (SD) | 51.08 (11.47) |
| ***Education Level*** | |
| Illiterate | 68 (27.2) |
| School | 107 (42.8) |
| High education | 75 (30.0) |
| ***Marital Status*** | |
| Single | 15 (6.0) |
| Married | 221 (88.4) |
| Divorced | 4 (1.6) |
| Widowed | 10 (4) |
| ***Employment status*** | |
| ***Employed*:** | **106 (42.4)** |
| Government & non-government | 54 (21.6) |
| Self-employed | 52 (20.8) |
| ***Unemployed:*** | **144 (57.6)** |
| Student | 7 (2.8) |
| Housewife | 65 (26.0) |
| Unable to work | 72 (28.8) |
| ***Monthly income*** | |
| < 100,000 YR[1] | 134 (53.6) |
| 100,000 - 200,000 YR | 76 (30.4) |
| > 200,000 | 40 (16.0) |
| ***Time when diagnosed with heart failure*** | |
| > 6 months to < 1 year | 86 (34.4) |
| 1 to 3 years | 88 (35.2) |
| > 3 years | 76 (30.4) |
| ***Number of medications,*** median (IQR) | 6 (5-7) |

[1]Yemeni Rial

**Table 2.** Descriptive statistics of the belief about medication scale

| Belief about medication questionnaire items | | Median | IQR |
|---|---|---|---|
| **Necessity** | | | |
| 1- | Without treatment I am sick. | 3,0 | (3-4) |
| 2- | Without my medications, life would be impossible for me. | 3,0 | (2-4) |
| 3- | Medication usage is crucial for maintaining my health. | 4,0 | (3-4) |
| 4- | My medication is essential for my future health. | 3,0 | (3-4) |
| 5- | My medication prevents my condition from worsening. | 4,0 | (4-4) |
| **Concern** | | | |
| 6- | I sometimes worry about relying too much on my medications. | 4,0 | (4-4) |
| 7- | My life is disrupted by my medications. | 3,0 | (2-4) |
| 8- | My medications remain a mystery to me. | 3,0 | (2-4) |
| 9- | I worry about having to take medications. | 4,0 | (3-4) |
| 10- | I sometimes worry about the long-term impacts of my medications. | 4,0 | (4-4) |
| 11- | These medicines result in undesirable side effects for me. | 4,0 | (3-4) |
| **Belief about medication scale** | | **38,0** | **(35-42)** |

Note: Each statement uses a scale of 1 to 5, where 1 means Strongly Disagree; 2 means Disagree; 3 means Uncertain; 4 means Agree; and 5 means Strongly

**Table 3.** Descriptive statistics for the Medication Regimen Complexity Index

| ***Medication Regimen Complexity Index*** | **Mean** | **SD** |
|---|---|---|
| Dosage forms (MRCI-A) | 1.16 | 0.54 |
| Dosing frequency (MRCI-B) | 6.538 | 1.909 |
| Additional instructions (MRCI-C) | 6.068 | 1.838 |
| ***Medication Regimen Complexity Index*** | **13.75** | **3.789** |

## Multivariate Analysis of Factors Associated with Medication Beliefs in Patients with Heart Failure

Multivariate analysis demonstrated that several factors were significantly associated with patients' medication beliefs regarding their treatment (Table 4), with all associations reaching statistical significance ($p < 0.05$). Regarding belief about medication (*necessity)*, age showed a positive and statistically significant association (B = 0.046, $p$ = 0.029), indicating that older patients perceived a higher necessity for their medications. This finding is consistent with the results reported by (Rafhi et al., 2025), who observed that older adults tend to hold stronger beliefs in the necessity of their medications for

maintaining health. Education status was also significantly associated, with illiterate patients reporting lower necessity beliefs compared to educated patients (B = −1.240, $p$ = 0.030). In the Yemeni sociocultural context, low education is closely connected to limited health literacy, which reduces patients' understanding of health condition and disease progression, leading medications to be viewed as necessary only when symptoms are present (Laradhi et al., 2025). Religious belief of illness as destiny from God, while psychologically meaningful, may also lessen the perceived role of medical treatment if not integrated with biomedical understanding. In addition, patients with lower education status often rely on family and traditional sources of information, including herbal remedies, which can conflict with sustained medication use (Laradhi et al., 2025, Alfaqeeh et al., 2025, Safwana Al-Tahesh et al., 2026) .

**Table 4.** Multivariate analysis of factors associated with heart failure medication adherence

| **Description** | | **Belief About Medication** | | | |
|---|---|---|---|---|---|
| **Variable** | | **Multivariate analysis** | | | |
| | | **Belief (*Necessity*)** | | **Belief (*Concern*)** | |
| | | **B** | **P value** | **B** | **P value** |
| ***Age*** | | 0.046 | 0.029* | 0.007 | 0.775 |
| ***Gender*** | Male<br>Female | 0.109 | 0.828 | -0.063 | 0.910 |
| ***Education Status*** | Illiterate<br>Educated | -1.240 | 0. 030* | 0.383 | 0.539 |
| ***Marital Status*** | Married<br>Single | -0.752 | 0.265 | 0.840 | 0.256 |
| ***Employment*** | Unemployed<br>Employed | 0.250 | 0.624 | 2.605 | 0.000* |
| ***Income*** | < 200,000 YR<br>> 200,000 YR | 0.444 | 0.484 | 0.000 | 1.000 |
| ***Diagnosed Time (years)*** | < 3<br>> 3 | 0.262 | 0.585 | -1.155 | 0.029* |
| ***Number of Medications*** | | 0.802 | 0.001* | -0.080 | 0.753 |
| ***Medication regimen complexity*** | | -0.276 | 0.003* | 0.118 | 0.238 |

In addition, a higher number of medications was positively associated with necessity beliefs (B = 0.802, $p$ = 0.001). Similar findings were reported in a 2017 Irish study among older adults with polypharmacy, where patients receiving multiple medications demonstrated stronger necessity beliefs than concerns (Clyne et al., 2017). while greater medication regimen complexity was negatively associated with necessity beliefs (B = −0.276, $p$ = 0.003). Although direct evidence linking regimen complexity to necessity beliefs is limited, previous studies have consistently shown that high medication regimen complexity in patients with multimorbidity adversely affects medication adherence (Kassaw et al., 2024). Complex regimens may increase treatment burden, cognitive load, and daily disruption, which can lead to frustration and confusion and subsequently weaken patients' perceptions of the overall value and necessity of their medications. Complex medication regimens can affect treatment adherence through several perspective (Fuller et al., 2021). Regimens involving multiple medication may increase the risk of adverse effects, and patients who experience side effects may choose not to take all prescribed medications. In addition, complex regimens are particularly challenging for geriatric patients, who may forget the purpose and dosing instructions of each medication. Moreover, when patients do not receive clear and detailed information about their therapies, this complexity can lead to confusion, uncertainty, and ultimately reduced adherence (Fuller et al., 2021, Farrell et al., 2013).

Gender, marital status, employment, income, and duration of diagnosis were not significantly associated with necessity beliefs. This aligns with findings from (Clyne et al., 2017; Rafhi et al., 2025), which showed that sociodemographic and lifestyle factors were largely non-significant once clinical and treatment-related variables were considered, highlighting the dominant role of age and polypharmacy in shaping medication necessity beliefs.

With respect to belief about medication *(concerns)*, employment status was a significant predictor, with employed patients reporting higher levels of concern compared to unemployed patients (B = 2.605, $p$ < 0.001). Consistent with Li's findings, employed individuals may experience greater logistical and psychological burdens in managing medications alongside work commitments, which can exacerbate concerns regarding treatment intrusiveness and daily disruption (Li, 2024). In other cases, employee with shift-based work schedule commonly experience poor sleep quality and quantity which can impair alertness and cognitive perfomance that negatively affect medication concern and adherence (Lee SY et al. 2022).

Moreover, duration since diagnosis was also significantly associated with concern beliefs, with patients diagnosed for more than three years reporting lower levels of medication-related concerns (B = −1.155, p = 0.029). This finding is supported by previous research among patients with hypertension, which demonstrated that longer disease duration was associated with lower concern. As patients gain experience with long-term therapy over time, concerns regarding potential harm, side effects, and long-term consequences of medications may diminish, likely due to increased familiarity, adaptation, and reassurance from sustained treatment use (Alhewiti, 2014).

Furthermore, no significant associations were observed between medication concern beliefs and age, gender, education status, marital status, income, number of medications, or medication regimen complexity. The lack of association with age is supported by multivariable analyses in previous studies, which demonstrated that although age may influence overall medication adherence, it does not independently

predict concern beliefs once psychological and perceptual factors are accounted for (Alhewiti, 2014). Similarly, the absence of an association between concern beliefs and the number of medications or regimen complexity is consistent with evidence suggesting that treatment complexity is more strongly related to unintentional non-adherence, such as forgetfulness, rather than intentional non-adherence driven by concerns about medication harm or dependency (Alhewiti, 2014). This distinction highlights that concern beliefs represent a stable cognitive and emotional construct that may exist independently of the objective burden of the medication regimen. In addition, gender and education status were not significant predictors of concern beliefs, in line with descriptive and multivariable findings from prior research showing that although these factors may influence adherence behaviors, they do not substantially alter patients' underlying concerns regarding medication safety or long-term effects (Alhewiti, 2014).

Overall, this study offers new insights into the factors influencing medication beliefs among patients with heart failure in Yemen, with particular emphasis on the impact of medication regimen complexity. To our knowledge, this is the first investigation in the Yemeni setting to explore how clinical characteristics and treatment-related factors jointly influence patients' perceptions of medication necessity and concerns, thereby addressing a significant gap in the literature. The results indicate that necessity beliefs are mainly shaped by age, educational attainment, the number of prescribed medications, and regimen complexity, whereas concern beliefs are more strongly associated with employment status and duration of illness. These findings underscore the multifaceted nature of medication beliefs and lend further support to the Necessity-Concerns Framework, suggesting that necessity and concern perceptions are influenced by distinct underlying determinants. Thus, our results extend prior study by providing a more comprehensive and contextually grounded understanding of medication beliefs by consider a sociocultural context and health-system condition among Yemeni population.

Nevertheless, several limitations should be considered when interpreting these findings. The cross-sectional nature of the study limits the ability to establish causal relationships between patient-related factors and medication beliefs. In addition, the use of self-reported data may be subject to recall bias and social desirability bias, particularly in healthcare settings where electronic medical records and prescription systems are not consistently implemented. The relatively small sample size and the use of convenience sampling may further restrict the generalizability of the results to the broader population of heart failure patients in Yemen. Moreover, the study did not account for other potentially influential variables, such as adverse drug reactions, health insurance status, quality of physician–patient communication, and psychological factors, which may also shape patients' medication beliefs.

## CONCLUSION

This study demonstrates that medication beliefs among heart failure patients in Yemen are shaped by both treatment-related and patient-specific factors. Higher medication regimen complexity was associated with lower necessity beliefs, while age, education, and polypharmacy strengthened perceived necessity. Medication concerns were mainly influenced by employment status and disease duration. Beyond describing these relationships, the findings have important implications in clinical practice, both clinical pharmacists and cardiologist can consider patients' perspective to guide intervention

design. In particular, simplifying complex regimens, providing belief-focused counseling, and addressing particular concerns through individualized education may enhance adherence level and optimize heart failure management in this setting.

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**AUTHOR CONTRIBUTION**

RA: Research concepts; study design; conducted cross-sectional study; data collection; manuscript preparation.
UF: Literature search; data analysis, manuscript preparation and editing.
IDAADC: Manuscript review, literature search.
FR: Data analysis, manuscript preparation.
AM: Conducted cross-sectional study; data collection
SRO: Data analysis, manuscript preparation.

**ETHICS APPROVAL**

Ethical approval for the study was granted by the Ethics Committees of AL-Nasser University and AL-Thawra Hospital (reference numbers NU-REC-M2302 and No. 5-2023).

**CONFLICT OF INTEREST**

None

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