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Medication adherence and clinical outcomes among Libyan patients with chronic diseases: A comparative study of public and private healthcare sectors

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HOW TO CITE THIS

Abstract: Medication non-adherence remains a major barrier to optimal management of chronic diseases worldwide, leading to increased morbidity, hospitalizations, and healthcare costs. In Libya, data on adherence and its determinants are limited, particularly when comparing the public and private healthcare sectors. This descriptive cross-sectional study assessed medication adherence among 400 adult Libyan patients with chronic conditions attending a public outpatient clinic at Tripoli Medical Center and a private clinic, Al-Mustaqbel Al-Mushreq, over a three-month period. A structured Patient Compliance Questionnaire (PCQ) was administered to evaluate adherence behaviors, clinical outcomes, and patient perceptions. Chi-square tests, t-tests, and logistic regression analyses were applied to identify factors associated with adherence. The mean age of participants was 57.4 ± 0.9 years, with balanced gender distribution. Significant differences were observed between sectors: patients in the private sector reported higher adherence to medication and monitoring schedules ($P<0.05$), greater perceived improvement since diagnosis ($P<0.01$), and fewer concomitant diseases ($P<0.05$). Logistic regression identified older age (OR 1.05, 95.0% CI 1.02-1.08), longer duration of medication use (OR 1.07, 95.0% CI 1.01-1.14), and unemployment or retirement status (OR 1.54, 95.0% CI 1.10-2.17) as positive predictors of adherence, whereas poor self-perceived health status was associated with lower adherence (OR 0.68, 95.0% CI 0.49-0.94). These findings highlight the influence of socio-demographic and clinical factors on medication-taking behaviors and underscore the importance of targeted interventions. Integration of clinical pharmacy services, including patient education, counseling, and follow-up, may improve adherence and health outcomes in Libyan chronic disease populations. Strengthening public sector resources and implementing adherence-focused strategies are essential to reducing disparities and enhancing overall care quality.

Introduction

Chronic diseases, including hypertension, diabetes, and cardiovascular disorders, pose a significant global health burden, contributing to increased morbidity, mortality, and healthcare costs [1-5]. Effective management of these conditions requires long-term adherence to prescribed medications, lifestyle modifications, and routine monitoring. However, non-adherence remains a pervasive issue worldwide, with estimates suggesting that nearly

50.0% of patients with chronic conditions fail to take medications as prescribed [6-8]. This suboptimal adherence leads to poor disease control, higher rates of complications, frequent hospitalizations, and additional economic strain on healthcare systems [9-11]. In developing countries such as Libya, adherence data are limited, and healthcare delivery is complicated by disparities between public and private sectors, resource constraints, and variable patient education levels [12-14]. Socio-demographic factors, polypharmacy, treatment complexity, and patient beliefs significantly influence adherence behaviors [15-17]. Understanding these determinants is critical for designing effective interventions to improve patient outcomes.

Clinical pharmacy services have increasingly been recognized as pivotal in addressing medication non-adherence. Pharmacists play a central role in patient education, medication reconciliation, counseling, and monitoring, thereby bridging gaps between patients and healthcare providers [5, 18-22]. Evidence demonstrates that pharmacist-led interventions, including individualized counseling, adherence assessment, and follow-up, improve medication-taking behaviors, reduce treatment errors, and enhance clinical outcomes in chronic disease populations [23-29]. In the Libyan context, however, the integration of clinical pharmacists into routine care remains limited, and systematic evaluation of their impact on adherence is scarce [27, 30, 31]. Given these challenges, evaluating adherence patterns and their determinants across public and private healthcare sectors is essential to inform targeted strategies. This study aimed to assess medication adherence among Libyan patients with chronic diseases, compare outcomes between public and private sector patients, and identify socio-demographic and clinical predictors of adherence. The findings are intended to guide the development of clinical pharmacy-driven interventions that enhance adherence, optimize therapeutic outcomes, and reduce health disparities in Libya.

Materials and methods

Study design and setting: A descriptive cross-sectional study was conducted over three months (November 2023 to January 2024) in two healthcare settings in Tripoli: a public outpatient clinic at Tripoli University Hospital and a private clinic, Al-Mustaqbel Al-Mushreq, Tripoli, Libya.

Participants: The study included 400 adult patients (≥18 years) with at least one chronic condition requiring regular follow-up. Patients with acute illness or newly diagnosed without stable follow-up were excluded. Participants were evenly distributed between the two sectors. The sample size was to ensure adequate statistical power for detecting differences in medication adherence between public and private healthcare sectors, as well as for analyzing key determinants such as age, disease duration, education, and employment status. This sample size was calculated to provide sufficient precision (95.0% confidence level, margin of error ≤5.0%) and to account for potential non-response or incomplete questionnaires. Including participants enabled meaningful subgroup analyses, enhancing the reliability and generalizability of the findings to the Libyan chronic disease population.

Data collection: Medication adherence and related factors were assessed using a Patient Compliance Questionnaire (PCQ), specifically developed and validated for this population with expert input from clinical pharmacy specialists. The PCQ included demographics, clinical characteristics, adherence behaviors, and patient perceptions of treatment outcomes. Face-to-face interviews were conducted by trained researchers to ensure confidentiality and standardization.

Ethical approval: The study protocol was reviewed and approved by the Institutional Scientific Committee for Research of the Department of Pharmacology and Clinical Pharmacy, Faculty of Pharmacy, University of Tripoli (Approval code: UOT/2022/DA-PCQ). All participants were informed about the objectives of the study, and written informed consent was obtained prior to participation. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Statistical analysis: Data analysis was performed using SPSS version 25. Descriptive statistics summarized demographic and clinical characteristics. Differences between public and private sectors were evaluated using Chi-square or Fisher's exact tests for categorical variables and *t*-test or Mann-Whitney U test for continuous variables. One-way ANOVA was applied for multi-group comparisons. Spearman's correlation examined relationships between ordinal/continuous variables. Logistic regression identified independent predictors of adherence. A *P<0.05* was considered significant. Odds ratios (ORs) were recomputed based on the collected data.

Results

All 400 distributed questionnaires were completed, achieving a full response rate of 80.0% from the initially targeted 500 patients. Participants were equally distributed across public (n=200) and private (n=200) healthcare settings. The mean age of the study population was 57.4±0.9 years, with a balanced gender distribution (49.5% male, 50.5% female). Analysis of demographic and clinical characteristics revealed significant differences between the two sectors. Patients attending the public clinic demonstrated a broader variation in educational attainment compared to the private sector (mean educational score: 1.9±0.05 vs. 1.6±0.04, *P<0.05*), which may influence understanding of treatment regimens and adherence behaviors. Concomitant disease prevalence was higher in the public sector (62.0% vs. 54.0%, *P<0.05*), suggesting more complex therapeutic requirements. Conversely, duration of medication use was slightly longer among private sector patients (5.8±0.50 years vs. 5.3±0.6 years, p ≈ 1.04 × 10-17), indicating potential experience with chronic disease management, although the extremely low *P*-value reflects the sensitivity of the large sample size rather than a clinically meaningful difference. Employment status also differed significantly, with more unemployed or retired patients in the public sector (58.0% vs. 45.0%; *P<0.05*) (**Table 1**).

Table 1: Demographic and clinical characteristics

Characteristic	Public (n=200)	Private (n=200)	P-value
Age (years, mean±SE)	56.5±0.60	58.2±1.51	0.15
Gender (M/F)	98/102	101/99	0.78
Education level*	1.9±0.05	1.6±0.04	0.04
Comorbidities (%)	62	54	0.03
Duration of medication use (years)	5.3±0.6	5.8±0.5	<0.001
Employment (unemployed/retired %)	58	45	0.04

*Higher scores indicate higher educational attainment

Adherence-related responses further highlighted sector disparities. Private sector patients reported higher self-perceived improvement since diagnosis (1.13±0.05 vs. 1.00±0.03, *P<0.01*) and demonstrated greater commitment to periodic monitoring tests (1.35±0.03 vs. 1.30±0.04, *P<0.05*). Difficulty remembering medication doses was slightly more reported among private sector patients (2.6±0.08 vs. 2.4±0.07, *P<0.05*), but overall compliance regardless of perceived condition was higher in the private sector (4.0±0.05 vs. 3.8±0.06, *P<0.05*) (**Table 2**). These findings indicate that private sector patients, despite minor challenges in medication recall, generally maintain better adherence patterns and perceive greater benefits from treatment.

Table 2: Adherence-related responses

Item	Public (mean±SE)	Private (mean±SE)	P-value
Difficulty remembering dose	2.4±0.07	2.6±0.08	0.03
Commitment to monitoring tests	1.30±0.04	1.35±0.03	0.04
Self-reported improvement	1.00±0.03	1.13±0.05	0.01
Compliance regardless of perception	3.8±0.06	4.0±0.05	0.02

Logistic regression analysis identified several independent predictors of adherence across the total cohort. Older age was positively associated with higher adherence (OR 1.05, 95.0% CI 1.02-1.08, $P<0.002$), suggesting that older patients may establish more consistent medication routines. Longer duration of medication uses also predicted better adherence (OR 1.07, 95.0% CI 1.01-1.14, $P<0.03$), reflecting familiarity with chronic therapy. Unemployment or retirement status was associated with improved adherence (OR 1.54, 95.0% CI 1.10-2.17, $P<0.01$), possibly due to greater availability for self-care and fewer competing responsibilities. In contrast, patients reporting poor self-perceived health status were less likely to adhere (OR 0.68, 95.0% CI 0.49-0.94, $P<0.02$), highlighting the psychological and motivational factors influencing treatment behaviors. Educational level did not reach statistical significance in the regression model (OR 1.12, 95.0% CI 0.95-1.32, $P=0.15$), although descriptive comparisons suggested its potential role in sector differences (**Table 3**). Overall, these results demonstrate that socio-demographic, clinical, and psychological factors interact to shape adherence behaviors. The disparities between public and private sectors underscore the importance of targeted interventions, particularly those led by clinical pharmacists, to support patients in achieving optimal therapeutic outcomes.

Table 3: Logistic regression analysis

Predictor	OR	95% CI	P-value
Age (per year)	1.05	1.02-1.08	0.002
Duration of therapy	1.07	1.01-1.14	0.03
Employment (unemployed/retired)	1.54	1.10-2.17	0.01
Poor self-perceived health	0.68	0.49-0.94	0.02
Education level	1.12	0.95-1.32	0.15

Discussion

This study provides valuable insights into the determinants of medication adherence among Libyan patients with chronic diseases and highlights notable disparities between public and private healthcare sectors. The results demonstrate that patients attending private facilities reported higher levels of adherence compared to those in the public sector. Several factors may explain this observation. Private facilities in Libya are often characterized by shorter waiting times, more personalized care, and stronger patient-provider relationships, all of which can positively influence adherence behaviors. In contrast, public sector patients frequently encounter overcrowded clinics, inconsistent medication availability, and reduced opportunities for individualized counseling, which may contribute to poorer adherence. These findings are consistent with international evidence indicating that health system factors exert a substantial influence on medication-taking behaviors [32-34]. In terms of determinants, older age and longer duration of therapy emerged as significant predictors of adherence, which is in line with previous studies demonstrating that patients with more prolonged experience in managing chronic illness develop structured routines that facilitate medication-taking [35-37]. Educational attainment played a role, with higher education levels being associated with improved adherence. This may reflect greater health literacy, a better understanding of the risks of non-adherence, and greater capacity to navigate healthcare systems effectively. Conversely, employment status and self-perceived health did not significantly affect adherence in this cohort, suggesting that structural and educational factors may outweigh socioeconomic and psychological variables in this context [38-40].

One of the most important aspects highlighted by this study is the potential role of clinical pharmacy in addressing adherence challenges. Clinical pharmacists are increasingly recognized as essential members of multidisciplinary teams, with a capacity to provide direct interventions that improve patient outcomes. Through medication therapy management, pharmacists can systematically review treatment regimens, identify drug-related problems, and

tailor therapeutic plans to individual patient needs [41-45]. Medication reconciliation at transitions of care is another critical pharmacist-led activity, ensuring continuity of therapy and reducing errors that may undermine adherence [5, 28, 43]. Patient education and counseling represent further domains where clinical pharmacy can exert meaningful influence. Evidence indicates that structured pharmacist-led counseling sessions improve patient understanding of treatment regimens, alleviate concerns regarding side effects, and reinforce the importance of adherence [37, 39, 41]. By fostering stronger patient engagement and addressing misconceptions, pharmacists can bridge gaps in communication often observed in busy clinical settings, particularly within public facilities. Also, collaborative practice agreements between pharmacists and physicians, already in use in some countries, could be adopted in Libya to empower pharmacists to adjust dosages, monitor progress, and proactively address barriers to adherence [37, 39, 41]. The implications of these findings for healthcare policy in Libya are profound. Incorporating clinical pharmacists into outpatient clinics-both public and private-could represent a cost-effective strategy to mitigate non-adherence and improve outcomes for patients with chronic conditions [32, 39, 41]. National policies that expand the scope of practice for pharmacists, strengthen training in adherence-focused interventions, and integrate pharmacy services into chronic disease programs may help bridge the gap observed between healthcare sectors. Moreover, addressing systemic challenges such as medication stockouts, limited consultation times, and inequities in resource allocation will be essential in ensuring sustainable improvement in adherence across the country [34, 38, 45]. While this study offers important insights, certain limitations must be acknowledged. The cross-sectional design precludes causal inferences, and reliance on self-reported adherence may introduce social desirability and recall biases. Expanding future research to include objective measures, such as pill counts or electronic monitoring, would strengthen the accuracy of adherence estimates [35, 37]. Furthermore, longitudinal studies are warranted to evaluate the long-term effectiveness of pharmacist-led interventions in enhancing adherence and to assess their impact on clinical outcomes such as disease control, hospitalization rates, and healthcare costs [39, 40].

Conclusion: Medication adherence among chronic disease patients is influenced by age, illness duration, employment status, and self-perceived health. Significant disparities exist between the public and private sectors. Clinical pharmacy interventions are vital to improve adherence, enhance patient outcomes, and reduce healthcare disparities. Tailored, pharmacist-led strategies should be implemented to optimize chronic disease management.

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