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(RESEARCH ARTICLE)

Post-Discharge Discontinuation of Chronic Cardiovascular Medications and 30-Day Outcomes in Public Hospitals in Nasiriyah, Iraq: A Multicentre Prospective Observational Study

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Abstract

Background: The discontinuation of chronic cardiovascular medications after hospital discharge is a relatively unacknowledged risk to treatment continuity. In settings with fragile health systems where continuity of care, access to medications, and follow-up services are often lacking, evidence is limited to resource-limited and conflict-affected settings.

Objective: The primary objective was to assess the prevalence of discontinuation of chronic cardiovascular medications after hospital discharge. Secondary objectives included identifying factors associated with post-discharge medication discontinuation and exploring the association between medication discontinuation and 30-day post-discharge clinical outcomes.

Methodology: This was a multicentre prospective observational study conducted in three public hospitals in Nasiriyah, Iraq. Adult patients who were discharged with a prescription for at least one chronic cardiovascular medication were followed 30 to 35 days after hospital discharge. The primary outcome was the discontinuation of at least one chronic cardiovascular medication within 30 days after hospital discharge. Secondary outcomes included hospital readmission within 30 days, emergency department (ED) visit within 30 days, and all-cause mortality within 30 days. Bivariate analyses and multivariable logistic regression were used to identify patient-, medication-, and hospital-level factors that were independently associated with medication discontinuation.

Results: Four hundred fifteen patients were included in the analysis. 152 (36.6%) patients discontinued at least one chronic cardiovascular medication within 30 days after hospital discharge. Hospital readmission within 30 days occurred in 36 patients (23.7%) in the discontinuation group, and 41 patients (27.0%) in the same group had an ED visit. There were no readmissions or ED visits in the continuation group. The 30-day all-cause mortality was low in both groups. In the adjusted analysis, no formal education was associated with lower odds of medication discontinuation in comparison to higher education (OR 0.27, 95% CI 0.10–0.72; p = 0.009). Age, number of medications at discharge, adherence score, and health-literacy score were not significant independent predictors. Pharmacist counselling and scheduled follow-up were also not independently associated with medication discontinuation after adjustment.

Conclusion: More than one-third of the patients discontinued at least one chronic cardiovascular medication within 30 days after hospital discharge. Medication discontinuation was associated with a concentration of early readmissions and ED visits, highlighting the vulnerability of the immediate post-discharge period. The findings highlight the importance of efforts to strengthen post-discharge continuity of care and form the basis for further research on targeted interventions to reduce early medication discontinuation in fragile health systems.

Keywords: Cardiovascular medications; Hospital discharge; Medication discontinuation; Continuity of care; Readmission; Emergency department visits; Iraq; Fragile health systems

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1. Introduction

The discontinuation of important cardiovascular medications following hospital discharge is an important but frequently overlooked phenomenon that may contribute to gaps in care continuity(1–3). The time following discharge from the hospital represents a vulnerable juncture in the continuum of care for many patients, during which unaddressed medication-related problems, discontinuity of care, and early adverse clinical events may occur. The early post-discharge period is of particular concern for cardiovascular disease, where long-term management is as important as inpatient stabilisation for patient outcomes(4,5).

Adherence to medication regimens is a key target for chronic disease management. Nevertheless, it is also one of the most common and complex issues in care delivery, where it can be affected by behavioural, socioeconomic, and health-system factors(6,7). In cardiovascular medicine, discontinuation of evidence-based therapies such as beta-blockers, statins, angiotensin-converting enzyme inhibitors, and antiplatelet agents has been linked to adverse outcomes, such as rehospitalisation, emergency care use, and preventable morbidity and mortality. While this issue has been extensively studied in high-resource healthcare systems, it is less well described in fragile health systems and lower-middle-income countries(8,9).

Insights from low- and middle-income countries are important to help understand the post-discharge medication use challenges and risk factors in these settings, where continuity of care after discharge may be hampered by access to medications (stock-outs, costs), low health literacy, fragmented or poor follow-up systems, and inconsistent access to healthcare professionals(10–12). In such contexts, patients can leave the hospital on the appropriate prescriptions but still fail to adhere to treatment once at home. As a result, the problem of medication discontinuation after discharge from the hospital may remain largely invisible in such settings until it results in clinical deterioration, unscheduled healthcare use or readmission(13,14).

In Iraq, where there are considerable pressures on health-system resilience, including limited resources and variable access to essential medicines, a fragmented system of service delivery, and high out-of-pocket costs, limited real-world data describe the extent of post-discharge discontinuation of cardiovascular medication and its relationship with clinical outcomes(15,16). The early post-discharge period may be a high-risk interval for treatment interruption in this context, and more evidence is needed to identify post-discharge medication discontinuation patterns and their potential risk factors. A better understanding of post-discharge medication non-adherence is required to help identify patients at risk of treatment interruption and its potential implications for care and outcomes(13,17).

This study aimed to determine the prevalence of discontinuation of chronic cardiovascular medications after hospital discharge among adult patients in a large referral hospital and two general hospitals in Nasiriyah, Iraq. Factors associated with discontinuation were identified, and discontinuation was related to short-term clinical outcomes, including hospital readmission, emergency department visits, and all-cause mortality within 30 days of hospital discharge.

2. Methodology

2.1. Study design and rationale

This was a multicentre prospective observational study aimed at determining the prevalence of, and factors associated with, post-discharge discontinuation of chronic cardiovascular medications among adult patients discharged from public hospitals in a resource-constrained health system. The study was conducted during the early post-discharge period, during which time patients are at elevated risk of medication-related problems, poor continuity of care, and adverse clinical outcomes.

2.2. Study setting

The study was conducted in three public hospitals in Nasiriyah, Dhi Qar Governorate, Iraq. Patient enrolment occurred between February and March 2026, and 30-day follow-up was completed in April 2026. The three hospitals deliver cardiology and internal medicine services to a combined population catchment area of over one million residents. Services are provided within a health system characterised by intermittent infrastructure disruption, variable medication availability, and limited continuity-of-care services. Each of the hospitals was staffed by at least one clinical pharmacist, although the structured discharge counselling process was not consistently implemented in all participating hospitals.

2.3. Study population

Adults 18 years of age or older were eligible for inclusion if they were discharged alive from one of the participating hospitals after admission for a primary cardiovascular-related condition (myocardial infarction, heart failure, hypertension-related admission, or stroke) and were prescribed at least one chronic cardiovascular medication at discharge. Additional inclusion criteria included the ability to provide informed consent and availability for 30-day follow-up by telephone.

Patients were excluded if they were discharged against medical advice, transferred to another institution, had severe cognitive impairment without a reliable caregiver, had no valid contact information or no feasible means of follow-up, or had a hospital stay of less than 48 hours.

2.4. Sample size calculation

The required sample size was estimated using the single-population proportion formula:

$$n = Z^2 p(1 - p) / d^2$$

where Z = 1.96 at 95% confidence level, p = 0.35 anticipated prevalence of post-discharge discontinuation and d = 0.05 as precision. This gave a minimum sample size of about 350 participants. Adjusting the sample size for a 15% non-response or incomplete follow-up rate, the estimated final sample size of participants was 412.

2.5. Sampling and participation procedures

A consecutive sampling approach was used. Daily hospital discharge lists were reviewed to identify potentially eligible patients. In total, 490 potentially eligible patients were identified, of whom 475 were approached for study participation. Of those approached, 415 were enrolled in the study. A total of 60 patients were not enrolled because 20 refused to participate, 14 were lost to follow-up during the recruitment/follow-up process, and 26 were not found to be eligible for the study following screening. The final analytic sample, therefore, included 415 patients.

2.6. Data collection tools and procedures

Data were collected using a structured, pilot-tested questionnaire administered by trained pharmacists and clinical research staff. The questionnaire elicited the following domains:

- Sociodemographic characteristics (age, sex, education, income, household characteristics).
- Clinical characteristics (index cardiovascular diagnosis, relevant complications, and admission-related information).
- Medication profile at discharge (total number of discharge medications and major cardiovascular medication classes).
- Patient-related measures (health-literacy score and baseline medication adherence score).
- Care-transition variables (whether discharge counselling by a pharmacist had been provided, and whether a follow-up appointment had been scheduled).
- Post-discharge medication use (continuation or discontinuation of each prescribed medication, and patient-reported reasons for discontinuation).

2.7. Follow-up and outcome ascertainment

Participants were followed 30 to 35 days after hospital discharge by a telephone interview. At follow-up, participants were asked if they were still taking each medication prescribed at discharge and, if not, what the main reason for stopping it was, including costs, lack of access, side effects, forgetfulness, or other patient-reported reasons.

Hospital readmission, emergency department (ED) visits, and all-cause mortality within 30 days of discharge were reported as secondary outcomes and, when reported at follow-up, were verified against available hospital records.

2.8. Variables and outcomes

The primary outcome was discontinuation of at least one prescribed chronic medication for cardiovascular condition(s) within 30 days after discharge, ascertained as a binary yes/no variable.

2.8.1. Secondary outcomes were:

- 30-day hospital readmission
- 30-day emergency department visit
- 30-day all-cause mortality
- Number of medications discontinued
- Medication classes are most commonly discontinued
- Patient-reported reasons for discontinuation

2.9. Statistical analysis

Data were entered into a secure database and analysed using SPSS version 26 and Python (pandas, SciPy, and statsmodels). Continuous variables were summarised as mean ± standard deviation or median with interquartile range, as appropriate. Categorical variables were summarised as frequencies and percentages.

For bivariable comparisons, continuous variables were compared between patients who continued and those who discontinued medication using the independent-samples t-test. In contrast, categorical variables were compared using the chi-square test or Fisher's exact test when appropriate.

Multivariable logistic regression was performed to identify factors independently associated with medication discontinuation within 30 days after discharge. Candidate variables for multivariable analysis were selected based on clinical relevance and bivariable associations. Adjusted odds ratios (ORs) with 95% confidence intervals (CIs) were reported. All tests were two-sided, and a p-value of less than 0.05 was considered statistically significant.

2.10. Ethical considerations

The study was conducted in accordance with the Declaration of Helsinki. It was approved by the Institutional Review Board of the National University of Science and Technology, Nasiriyah, Iraq, together with the relevant hospital authorities. Oral informed consent was obtained from all participants before enrolment. All collected data were anonymised and stored securely, and no intervention or change to routine clinical care was introduced as part of the study.

3. Results

3.1. Prevalence of post-discharge medication discontinuation

A total of 415 patients were analysed. 152 patients (36.6%) stopped at least one prescribed chronic cardiovascular medication during the 30 days following hospital discharge compared with 263 (63.4%) patients who did not stop any of their prescribed cardiovascular medications. Thirty-day hospital readmission and ED visits occurred among patients who stopped medication; however, all-cause mortality was low in both groups.

Table 1 Baseline characteristics and 30-day outcomes according to medication discontinuation status

Variable	Continued (n = 263)	Discontinued (n = 152)
Age (mean ± SD)	64.24 ± 9.42	65.26 ± 9.89
Sex	Female: 133, Male: 130	Male: 79, Female: 73
Education	Secondary: 114, Primary: 81, Higher: 40, No formal: 28	Secondary: 67, Primary: 43, Higher: 35, No formal: 7
Employment	Retired: 137, Employed: 68, Unemployed: 58	Retired: 64, Employed: 46, Unemployed: 42
Income	Low: 128, Medium: 98, High: 37	Low: 81, Medium: 48, High: 23
Diagnosis	Heart Failure: 88, Stroke: 62, HTN: 60, MI: 53	Stroke: 48, Heart Failure: 43, MI: 38, HTN: 23
Medications at Discharge	5.78 ± 2.01	5.99 ± 2.07
Adherence Score	3.53 ± 0.90	3.53 ± 0.88

Health Literacy Score	5.34 ± 2.59	5.50 ± 2.49
30-day Readmissions	0 cases	36 cases (23.7%)
30-day ED Visits	0 cases	41 cases (27.0%)
30-day Mortality	7 cases (2.7%)	6 cases (3.9%)

Age, medication burden, adherence score, and health literacy score were not significantly different between patients who discontinued therapy and those who remained on medication. The proportion of patients with no formal education was significantly lower in the discontinuation group, while higher education was significantly more prevalent among those who stopped medication. The readmission and ED visits within 30 days occurred only in patients who discontinued treatment, and mortality in both groups was low.

3.2. Bivariable analysis

Table 2 Independent-samples t-test results for continuous variables by medication discontinuation status

Variable	t-statistic	p-value
Age	-1.037	0.300
Medications at Discharge	-0.981	0.327
Adherence Score	-0.049	0.961
Health Literacy Score	-0.615	0.539

No statistically significant between-group differences were observed for age, number of medications at discharge, adherence score, or health literacy score.

Table 3 Chi-square test results for categorical variables by medication discontinuation status

Variable	p-value	Degrees of Freedom
Sex	0.5458	1
Education	0.0497	3
Employment	0.0301	2
Income	0.7107	2
Diagnosis	0.0511	3
Pharmacist Counseling	0.0001	1
Follow-up Scheduled	0.0079	1

In chi-square analyses, the status of whether a medication was discontinued was significantly related to educational level, employment status, receipt of pharmacist counseling and having a scheduled follow-up appointment. Borderline significance was found for the diagnosis category. No statistically significant relationships were found for sex or income.

3.3. Multivariable logistic regression

Table 4 Multivariable logistic regression for continuous predictors of medication discontinuation

Variable	Coefficient (β)	Std. Error	z-score	p-value	OR (exp(β))	95% CI for OR
Constant	-1.792	0.999	-1.79	0.073	0.17	(0.02 – 1.18)
Age	0.011	0.011	1.00	0.319	1.01	(0.99 – 1.03)
Medications at Discharge	0.043	0.052	0.83	0.407	1.04	(0.94 – 1.16)
Adherence Score	0.017	0.118	0.14	0.888	1.02	(0.81 – 1.28)
Health Literacy	0.038	0.042	0.90	0.366	1.04	(0.96 – 1.13)

None of the continuous variables was independently associated with medication discontinuation in the adjusted model.

Table 5 Multivariable logistic regression for categorical predictors of medication discontinuation

Variable	Coefficient (β)	p-value	OR (exp(β))	95% CI for OR
Pharmacist Counseling	0.31	0.152	1.36	(0.89 – 2.06)
Follow-up Scheduled	0.35	0.137	1.41	(0.90 – 2.23)
Education: No Formal	-1.30	0.009	0.27	(0.10 – 0.72)
Education: Primary	-0.55	0.076	0.58	(0.31 – 1.06)
Education: Secondary	-0.45	0.116	0.64	(0.36 – 1.12)

Outcome: discontinuation of at least 1 prescribed chronic cardiovascular medication within 30 days after discharge. Reference category for education: higher education.

Using higher education as the reference category, the odds of medication discontinuation were significantly lower in the uneducated patients (OR 0.27, 95% CI 0.10–0.72; p = 0.009). The unadjusted ORs of the primary and secondary education groups were lower as well, but did not reach statistical significance. Pharmacist counselling and scheduled follow-up were not independently associated with the discontinuation of prescribed chronic cardiovascular medication after adjustment.

3.4. Summary of key findings

In summary, more than one-third of all patients stopped at least one chronic cardiovascular medication within 30 days after discharge from the index hospitalisation. In multivariable analysis, only lack of formal education was significantly associated with lower odds of discontinuation as compared to higher education, while age, discharge medication burden, adherence score, health literacy, pharmacist counseling, and scheduled follow-up were not independent predictors. All 30-day readmissions and emergency department visits were associated with discontinuation of medication, while mortality remained low in both groups.

4. Discussion

This prospective, multicentre observational study of hospitalised patients with cardiovascular disease demonstrated that post-discharge discontinuation of chronic cardiovascular medications is common, with 36.6% of patients discontinuing at least one medication within 30 days after hospital discharge. This finding is clinically significant because the post-discharge period is not a neutral extension of inpatient care but instead a vulnerable transitional period during which continuity of therapy can be lost despite seemingly appropriate discharge prescribing. In the present cohort, medication discontinuation clustered with adverse short-term outcomes, with all 30-day hospital readmissions and emergency department visits observed among patients who discontinued at least one prescribed medication, while mortality remained low in both groups. Although the study design precludes causal inference, this pattern strongly suggests that early medication discontinuation may serve as an important marker of post-discharge instability in patients with cardiovascular disease.

This level of discontinuity is important to highlight. At least one chronic cardiovascular medication was discontinued within 30 days of discharge by over one-third of patients in this sample. In simple terms, this means that a large number of patients broke continuity of evidence-based pharmacotherapy during a period when treatment is intended to normalise inpatient gains, prevent relapse, and avert early clinical decline(18,19). In cardiovascular care, this is of particular importance given that the effect of therapy rarely ends with the hospital stay itself(20). The benefit of antiplatelets, statins, beta-blockers, renin–angiotensin system inhibitors, and similar chronic cardiovascular therapies depends not only on discharge prescription but also on the patient's ability to continue treatment at a sustained level following hospitalisation. In this way, discharge in the absence of sustained continuation can only be considered as partial treatment(21,22).

The pattern of 30-day outcomes in this study also supports the clinical significance of early discontinuation. Readmission and emergency department utilisation occurred only in the discontinuation group, and mortality was rare overall(23,24). This may suggest that the immediate post-discharge consequence of medication discontinuation in this population is acute destabilisation requiring unscheduled care rather than early excess mortality. Such a pattern is not implausible(25,26). Interruption of chronic medication may lead to acute rebound effects, including worse blood-pressure control, recurrence of symptoms, increased congestion, recurrent ischemic symptoms, or other medication-related setbacks, in cardiovascular populations that precipitate urgent care use. At the same time, these findings must be interpreted with caution(27). Discontinuation and acute-care utilisation may both have been the downstream expressions of a broader underlying vulnerability, including severity of illness, poor care coordination, inadequate caregiver support, or difficulty accessing medication following discharge(4). Even with this caution, the concentration of acute-care events in the discontinuation group gives these findings practical significance. It supports consideration of post-discharge medication continuity as a central quality-of-care concern rather than a peripheral adherence issue(28,29).

One of the more intriguing findings of the adjusted analysis was the negative association of education level with discontinuation. Holding higher education as the reference group, the no-education category had the lowest odds of discontinuation, followed by primary and secondary education, neither of which reached significance(30,31). This is the opposite of what one would expect, and should be interpreted with caution. It may represent unobserved contextual and behavioural factors that can be associated with lower formal education, such as greater patient respect for the doctor's words, more family oversight of medication use, less tendency to self-adjust a prescribed regimen, or other dimensions of trust in treatment(32,33). It may also represent residual confounding or model instability, or it may be due to unmeasured determinants of medication behaviour. In any case, it does not support the facile inference that low educational attainment is always or by definition protective. The results suggest that the influence of formal education on continuity of medication use in fragile settings is more complex and less unidirectional than is commonly assumed(34,35).

Equally important were the non-significant variables that were dropped from the final model. Age, number of medications at discharge, adherence score, and health-literacy score were no longer independently associated with discontinuation. This should be stressed because it argues against a too-simplistic explanation of discontinuation as simply the result of older age, more polypharmacy, or lower health literacy(36,37). On the contrary, the finding of non-significant coefficients for these potential explanatory variables supports a more complex hypothesis: early discontinuation after hospital discharge in this population appears to be the product of a range of interrelated patient, treatment, and system factors. A patient may be compliant with the regimen but stop it because of cost, medication unavailability, confusion over duration, or a lack of social support(38,39). She may feel the treatment is not working or not providing an immediate benefit, or have difficulty accessing or communicating with the prescriber. Polypharmacy may create more complexity, but may not be the decisive factor in the patient's behaviour if more immediate barriers like access or continuity of care are perceived as more salient. The interaction of these factors may be what weakens the independent association of these indicators with post-discharge discontinuation in a fragile system(22,39).

The results for pharmacist counselling and scheduled follow-up merit particularly cautious interpretation. In bivariable analysis, both were associated with discontinuation status, consistent with the relevance of transitional-care processes to post-discharge continuation. However, neither variable retained an independent association with medication discontinuation after multivariable adjustment(40,41). Under the present regression specification, the adjusted odds ratios for these variables were also greater than 1; in other words, the current data do not support the assertion that these factors mitigated discontinuation in this cohort. This potential tension between clinical expectation and statistical output may have a number of explanations. Such interventions could have been preferentially directed toward patients perceived to be at higher risk, producing confounding by indication(42,43). Alternatively, the recorded variables may not have captured the quality of intervention delivery. The term "counselling" may have included both a brief verbal instruction to take medicines and a structured medication review, and "scheduled follow-up" may not reflect whether

the review was timely, accessible, attended, or clinically useful. The appropriate conclusion, therefore, is not that counselling and follow-up are unimportant but that their effectiveness cannot be established from the current model and will depend on standardisation, quality, and effective implementation(44,45).

More broadly, the study adds support to the argument that medication discontinuation after discharge should not be conceptualised as a problem of individual behavioural failure. In resource-constrained health systems, continuity of therapy is an emergent property of a chain of conditions that stretches well beyond patient motivation(46,47). Among these conditions are the clarity of discharge communication, the continuity and reliability of medication supply, the affordability of refills, continuity between inpatient and outpatient care, and the presence of mechanisms that support the patient to bridge the transition between discharge prescription and real-world continuation of treatment(48,49). If any of these links are weak, discontinuity is less a reflection of personal choice and more a symptom of structural fragility. This is particularly true in public hospitals with large catchment populations operating under system stress, where discharge can occur into an outpatient environment that affords less continuity, more incomplete follow-up, and variable access to essential medicines. In such a setting, treatment interruption may arise silently before later presenting as acute deterioration and unscheduled care use(40,50).

The current findings have further implications for the way discharge quality is conceptualised. A process ending with the provision of a prescription may be inadequate in some settings, particularly for cardiovascular patients with newly added prescriptions for multiple long-term medications(51). It seems likely that an effective transitional care model will be more integrative, combining accurate reconciliation with explanation of indication and duration, practical guidance on access and refill pathways, and a defined follow-up mechanism. This is not simply an organisational ideal(52). The clustering of readmissions and emergency department visits in the discontinuation group suggests that lack of post-discharge medication continuity may be one of the clinically meaningful junctures at which potentially avoidable early deterioration is observed. As such, efforts to improve the quality of discharge should not only improve documentation but also put in place concrete safeguards to support the actual continuation of treatment after hospital discharge(53,54).

4.1. Strengths and limitations

The main strengths of this study are its multicentre design, its use of a clinically meaningful 30-day post-discharge period, and its inclusion of both medication-continuity outcomes and short-term clinical events. The study also assessed a variety of demographic, clinical, and care-transition variables, thus allowing for a broader understanding of discontinuation than could have been obtained from discharge prescription data alone.

The limitations are also important. The observational design precludes causal inference; discontinuation was assessed by follow-up contact and may be subject to reporting bias; and several potentially important system-level and behavioural determinants were not fully captured in the final adjusted analyses. In addition, the current findings are clearly specific to the participating hospitals and should be generalised cautiously.

4.2. Implications for practice and policy

Taken together, these data imply that hospital discharge should be viewed as a high-risk therapeutic transition point, rather than a termination point of care. Applied to discharge processes, this rationale would encourage development of initiatives that not only focus on cardiovascular medication prescription at discharge, but also maximise the likelihood that patients will resume them correctly. Structured medication counselling, standardised discharge communication, medication reconciliation and reliable follow-up pathways are rational priorities, even if their independent benefit was not confirmed in this adjusted model. At the policy level, it may be as important to improve the continuity of medication access after discharge as it is to deliver inpatient treatment itself if we are to minimise early deterioration and unscheduled healthcare use in patients with cardiovascular disease.

5. Conclusion

In this multicentre prospective observational study, over one-third of patients discontinued at least one chronic cardiovascular medication within 30 days of hospital discharge. This medication discontinuation was associated with a clustering of early hospital readmissions and ED visits, emphasising the post-discharge period as a vulnerable window. Among characteristics examined in an adjusted multivariable logistic regression model, no formal education was associated with lower odds of discontinuation relative to higher education, while age, medication burden, adherence score, health literacy, pharmacist counselling, and scheduled follow-up were not found to be significant independent predictors. Overall, the findings highlight the importance of strengthening post-discharge continuity of care and support

the need for further research and targeted interventions to reduce early medication discontinuation in a fragile health system.

Compliance with ethical standards

Statement of ethical approval

Ethical approval was obtained.

Statement of informed consent

"Informed consent was obtained from all individual participants included in the study.

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