

Development and Validation of Cardiology-Specific Quality Indicators for Clinical Pharmacists: A Modified Delphi Study

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Background: Clinical pharmacists play a critical role in cardiology by optimizing pharmacotherapy and improving patient outcomes. However, despite their growing importance, standardized quality indicators to evaluate their impact in clinical practice remain lacking.

Objective: This study aimed to develop and validate a set of cardiology-specific Quality Indicator Drug Therapy Problems (QI-DTPs) defined as medication-related quality indicators focused on identifying, preventing, and resolving drug therapy problems—using a modified Delphi technique in Saudi Arabia.

Methods: Twenty-three candidate QI-DTPs were developed based on a comprehensive review of current cardiology guidelines and evidence-based literature, refined by an expert advisory group. A panel of sixteen experienced clinical pharmacists with cardiology expertise from Saudi Arabia evaluated these indicators using a modified Delphi approach conducted over three iterative rounds. Each indicator was rated on a nine-point Likert scale (1 = strong disagreement to 9 = strong agreement). Indicators achieving $\geq 75\%$ consensus were considered validated.

Results: Sixteen expert clinical pharmacists participated (69% male, 31% female), most of whom had completed a pharmacy residency and had cardiology-related clinical experience. High levels of agreement were achieved across the Delphi rounds, and all 23 proposed QI-DTPs met the predefined $\geq 75\%$ consensus threshold, demonstrating strong agreement regarding their relevance, clarity, and applicability in cardiology practice.

Conclusion: The study successfully identified and validated 23 QI-DTPs, reflecting strong consensus among clinical pharmacists in Saudi Arabia. Implementation of these indicators in clinical practice could enhance the quality of cardiovascular care, reinforce pharmacist-led interventions, and promote medication safety. Future research should assess the direct impact of these quality metrics on patient outcomes.

Keywords: clinical pharmacy, cardiology, Delphi method, drug therapy problems, quality indicator–drug therapy problems, medication optimization, pharmacist led interventions

Introduction

Cardiovascular disease (CVD) continues to be the leading cause of morbidity and mortality worldwide, contributing to a significant burden on healthcare systems and societies.¹ Despite the availability of effective preventive and therapeutic interventions, large gaps persist in the delivery of evidence-based care, particularly in secondary prevention.

Quality improvement initiatives have therefore become a central focus of modern healthcare systems, aiming to ensure that patients consistently receive optimal and timely interventions that reduce risk, improve outcomes, and enhance quality of life. Reliable quality indicators and performance measures are essential, as they not only provide benchmarks for evaluating healthcare delivery but also guide systems toward higher standards of care.¹

Several healthcare systems worldwide have integrated quality indicators into routine practice. For example, NHS England has developed a comprehensive policy to support NHS Health Checks,² while the National Institute for Health and Care Excellence (NICE) provides evidence-based recommendations for secondary prevention and risk reduction in cardiovascular disease.³ NICE has also established structured processes for developing quality standards and indicators to evaluate outcomes that reflect the quality of care.⁴ These initiatives demonstrate how evidence-based strategies can enhance patient outcomes,⁵ with quality indicators being applied across diverse settings to promote high-quality care. Key components include identifying areas requiring improvement, setting priorities for quality enhancement, creating dashboards to monitor local performance, benchmarking against national data, supporting local quality improvement initiatives, and showcasing progress achieved within health systems.¹⁻⁵

Although frameworks exist to define and assess quality in healthcare for secondary prevention and cardiovascular disease risk reduction, none specifically capture the structural and clinical contributions of cardiology pharmacists. The American Heart Association/American College of Cardiology (AHA/ACC) performance measures of cardiovascular disease⁶ and the European Society of Cardiology (ESC) quality indicators for cardiovascular disease⁷ provide comprehensive frameworks encompassing structural, process, and outcome measures. However, these measures were not specifically designed to facilitate or drive structural change within healthcare systems. Furthermore, little is currently known about how effectively local services are organized to achieve quality targets, what barriers must be addressed, or which enablers should be operationalized to improve patient care, strengthen prevention, and reduce premature mortality and loss of quality of life.^{6,7}

Among the essential members of the multidisciplinary care team are cardiology clinical pharmacists, who ensure the safe, effective, and individualized use of cardiovascular medications.^{8,9} These pharmacists contribute significantly by identifying drug-related problems, optimizing pharmacotherapy, managing drug interactions, and improving adherence and outcomes.¹⁰ Despite their expanding role, there is no standardized system to measure their clinical impact. This lack of uniform quality assessment hinders benchmarking and improvement efforts in pharmacy services.¹¹ Previous research has introduced general pharmacy performance indicators;^{12,13} however, these do not reflect the complexity of care provided in cardiology settings, where patient cases often involve polypharmacy, high-risk medications, and narrow therapeutic indices. To systematically capture the contributions of cardiology pharmacists, this study introduces Quality Indicators for Drug Therapy Problems (QI-DTPs), which are measurable indicators designed to assess pharmacist interventions that directly impact patient outcomes.¹¹

We aimed to systematically develop and validate a set of cardiology-specific QI-DTPs to quantify the clinical impact of pharmacists, using a modified Delphi approach. In summary, using a modified Delphi approach, the study seeks to achieve expert consensus on clinically relevant, feasible, and actionable indicators. The resulting framework is expected to provide a standardized, evidence-based tool for monitoring pharmacist interventions, facilitating performance benchmarking, guiding quality improvement initiatives, and ultimately improving cardiovascular patient care. By addressing the current gap in profession-specific quality assessment, this study contributes both theoretically, by advancing understanding of pharmacist-led care in cardiology, and practically, by offering tangible tools for healthcare institutions to evaluate and optimize pharmacist impact.

Materials and Methods

Study Design

This prospective consensus study was conducted between February 2024 and January 2025 using a modified Delphi approach to develop and validate consensus-based QI-DTPs for clinical pharmacists in cardiology. The Delphi method is a structured, iterative process that gathers expert opinions anonymously through a series of survey rounds, gradually refining ideas until consensus is achieved.¹⁴ A modified Delphi approach was selected because it integrates evidence-based candidate indicators with expert opinion, reducing time and increasing focus compared to traditional Delphi methods. A total of three Delphi rounds were conducted during the study period. Surveys were administered electronically using Google Forms and distributed via Email to all participants. The expert panel included professionals with relevant experience in cardiology and clinical pharmacy, ensuring that the resulting QI-DTPs were evidence-based, clinically relevant, and feasible for implementation in real-world practice.

Setting and Participants

Participants were recruited through professional networks and direct Email invitations targeting clinical pharmacists with experience in cardiology practice. Invitations were sent to 25 eligible pharmacists, of whom 20 responded. A total of 18 (90%) panelists completed Round 1 of the Delphi survey. During Round 2, 17 (94.4%) participants completed the survey, and 16 (88.9%) panelists completed Round 3, constituting the final expert panel. Eligible participants were licensed clinical pharmacists with a minimum of two years of direct patient care experience in cardiology. Individuals were excluded if they were not involved in cardiology services, held purely administrative or academic roles without clinical responsibilities, or did not complete all Delphi rounds. The expert panel included professionals with advanced qualifications (eg, postgraduate residency, master's degree, or PharmD). A total of sixteen participants completed all Delphi rounds, providing diverse expertise to support robust consensus development.

Development of Candidate QI-DTPs

QI-DTPs were defined as clinically significant medication-related issues that adversely affect patient outcomes and necessitate pharmacist-led interventions to achieve resolution.¹⁵ A comprehensive review of evidence-based cardiovascular guidelines was conducted, focusing on the following key sources: the 2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure,¹⁶ the 2019 ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease,¹⁷ and the 2021 ESC Quality Indicators for Cardiovascular Disease Prevention.⁷ From these guidelines, strong medication recommendations supported by meta-analyses or randomized controlled trials were extracted.

Guideline recommendations were then transformed into actionable QI-DTP statements by the expert advisory panel. Each panelist independently drafted statements that clinical pharmacists could use to initiate, discontinue, increase, or decrease medications. The panel subsequently compared all statements, discussed any discrepancies, and resolved differences through consensus to produce a preliminary list of 23 candidate QI-DTPs.¹⁸ This systematic approach ensured that the final QI-DTPs were therapeutically relevant, evidence-based, and practical for implementation in routine cardiology pharmacy practice.

Selection and Validation of Candidate QI-DTPs via Delphi Consensus

To guide the refinement of candidate QI-DTPs, the following seven selection criteria were applied: (1) the medical condition or disease is prevalent and impactful in cardiology patients (2) the medication involved is a high-alert drug or part of a complex medication regimen (3) the drug therapy intervention is based on high-quality evidence (4) the intervention affects clinically important outcomes (5) the intervention does not negatively impact patient safety (6) there is a direct link between resolving the QI-DTP and improved patient outcomes and (7) the clinical pharmacist is the most suitable healthcare professional to resolve the QI-DTP.

In addition, an overall consensus criterion was used: Resolving this QI-DTP will advance cardiology pharmacy practice to improve the quality of patient care. A purposive sampling method was used to recruit clinical pharmacists specializing in cardiology, each holding advanced qualifications and at least two years of direct, patient-focused cardiology practice. All panelists agreed to complete the three Delphi rounds. Panelists received an orientation prior to Round 1, which explained the study objectives, methodology, QI-DTP definitions, scoring process, and instructions for completing the Google Forms survey. All expert panelists assessed each candidate QI-DTP over three survey rounds. Each candidate QI-DTP was rated on a 9-point Likert scale (1 = strong disagreement; 9 = strong agreement). Consensus was defined as $\geq 75\%$ of panelists rating an item between 7 and 9 in the final round.¹⁹

Three Delphi rounds were conducted during the study period. In Round 1 (February 22–March 22, 2024), the 23 candidate QI-DTPs were presented for initial evaluation based on their clinical relevance, potential impact on patient care, and feasibility in practice. Round 2 (April 2–October 4, 2024) involved reassessment of items not achieving consensus in Round 1, with panelists provided anonymized, summarized feedback. Round 3 (October 15, 2024–January 22, 2025) constituted the final evaluation, establishing consensus for all 23 QI-DTPs. Rounds 1 and 2 were used for iterative feedback and refinement of the QI-DTPs; detailed results of these rounds are summarized in the Results section, with the final consensus established in Round 3 presented in [Table 1](#). Descriptive statistics and percentage

Table 1 Final Validation Ratings for Cardiology-Specific Quality Indicators (Delphi Round 3)

| Item | Cardiology-Specific Quality Indicator | Ratings 1–3 | Ratings 4–6 | Ratings 7–9 | % Consensus |
|------|---|-------------|-------------|-------------|-------------|
| 1. | Recommendation to initiate statin therapy according to the guidelines for secondary and primary prevention. | - | 1 | 15 | 93.8% |
| 2. | Maximum statin dose or addition of non-statin medications to achieve a target LDL level. | - | - | 16 | 100% |
| 3. | Adjust the statin dose according to side effects. | - | - | 16 | 100% |
| 4. | Ensure that all HF patients receive guideline-direct medication therapy if there is no contradiction (ACE inhibitor + β -blocker +AA). | - | - | 16 | 100% |
| 5. | Optimization of HF therapy before discharge when a patient is admitted with ADHF. | - | 1 | 15 | 93.8% |
| 6. | Adjustment or discontinuation of the dose of (ACE inhibitor + β -blocker + AA) according to side effects. | - | 1 | 15 | 93.8% |
| 7. | Maximized guideline-direct medication therapy of (ACE inhibitor + β -blocker) to achieve a target dose. | - | 1 | 15 | 93.8% |
| 8. | Recommend the initiation of antihypertensive therapy to achieve a systolic blood pressure <130/80 for all hypertensive patients. | - | 1 | 15 | 93.8% |
| 9. | Ensure patients receive DAPT for at least 12 months after PCI unless contraindicated, and aspirin alone indefinitely thereafter. | - | 2 | 14 | 87.5% |
| 10. | Initiate DOAC therapy as the initial treatment for AF patients with CHA2DS2VAS=3 or more, unless contraindicated, and use warfarin as an alternative to DOAC with a target INR (2–3). | - | 2 | 14 | 87.5% |
| 11. | Medication reconciliation on admission. | - | 2 | 14 | 87.5% |
| 12. | Pharmaceutical care plan. | - | 1 | 15 | 93.8% |
| 13. | Drug therapy problems resolved per admission. | - | 1 | 15 | 93.8% |
| 14. | Interprofessional patient care round. | - | 2 | 14 | 87.5% |
| 15. | Patient education during the hospital stay | - | - | 16 | 100% |
| 16. | Patient education at discharge. | - | 1 | 15 | 93.8% |
| 17. | Medication reconciliation at discharge. | - | 2 | 14 | 87.5% |
| 18. | Comprehensive direct patient care bundle. | 1 | 1 | 14 | 87.5% |
| 19. | Adverse drug reaction assessment and prevention-related interactions. | - | 2 | 14 | 87.5% |
| 20. | Recognize polypharmacy and de-prescribe unnecessary medication(s). | - | 2 | 14 | 87.5% |
| 21. | Identify medication adherence issues. | - | 1 | 15 | 93.8% |
| 22. | Discuss the risks and benefits of medication to support decision-making. | - | 3 | 13 | 81.3% |
| 23. | Anticoagulation management. | - | - | 16 | 100% |

Abbreviations: LDL, low density lipoprotein cholesterol; HF, Heart Failure; ACE inhibitor, Angiotensin-Converting Enzyme inhibitor; AA, Aldosterone Antagonist; ADHF, Acute Decompensated Heart Failure; DAPT, Dual Antiplatelet Therapy; PCI, Percutaneous Coronary Intervention; DOAC, Direct Oral Anticoagulant; AF, Atrial Fibrillation; CHA2DS2VAS=3, Clinical risk score for stroke in atrial fibrillation; INR, International Normalized Ratio.

consensus were used to report the results of each QI-DTP. Any QI-DTP that achieved at least 75% consensus was identified as a priority intervention for clinical pharmacists in cardiology.¹⁹

Data Analysis

Descriptive statistics and percentages were used to report the number of panelists in each rating category (1–3, 4–6, 7–9) for each QI-DTP. On a 9-point Likert scale, consensus was defined as $\geq 75\%$ of panellists rating an item between 7 and 9. Items that did not reach consensus in earlier rounds were re-evaluated in subsequent rounds, with anonymized group feedback including median scores and summarized comments provided to guide reassessment. Candidate QI-DTPs that achieved the predefined consensus threshold were identified as priority interventions for clinical pharmacists in cardiology.

Ethical Considerations

This study was conducted in accordance with ethical standards for research involving human participants. All panelists provided electronic informed consent prior to participation, with the option to select “Yes” to participate or “No” to decline. Participant confidentiality and anonymity were maintained by not collecting personal identifiers, analyzing responses in aggregate, and securely storing data with restricted access. The study protocol was approved by the Research Ethics Committee at King Khalid University (HAPO-06-B-001), with ethical approval number ECM#2024-201.

Results

A total of 16 expert pharmacists participated in the Delphi survey. The panel comprised 16 members with ages ranging from 27 to over 45 years. The majority of participants were between 27 and 35 years 6 (37.5%), followed by 36–40 years 5 (31.2%), 41–45 years 3 (18.7%), and more than 45 years 2 (12.5%). The majority of panel members were male 11 (68.8%), while females accounted for 5 (31.2%). Regarding academic and professional qualifications, most participants had completed a pharmacy residency program 13 (81.3%), followed by master’s degrees 3 (18.8%), post-entry Pharm D 2 (12.5%), Ph.D. 1 (6.3%), and fellowship training 4 (25.0%). Some participants held multiple qualifications. In terms of cardiology-related clinical experience, 9 participants (56.3%) reported 2–5 years, 3 participants (18.8%) had 6–10 years, 2 participants (12.5%) had 11–15 years, and 2 participants (12.5%) had more than 15 years of experience. Regarding board certifications, 6 participants (37.5%) were certified in cardiology pharmacy, 5 (31.2%) in pharmacotherapy, and 5 (31.2%) held other certifications. The panelists were affiliated with a range of institutions: governmental 6 (37.5%), military 4 (25.0%), private 4 (25.0%), and both governmental and private 2 (12.5%). Most pharmacists 15 (93.8%) provided care to both inpatient and outpatient populations, while 1 participant (6.2%) served in an inpatient-only setting (Table 2). The hospitals where these pharmacists practiced ranged in size from fewer than 100 beds to over 400 beds. Their daily roles included medication reconciliation, resolution of drug therapy problems, development of pharmaceutical care plans, patient education, and participation in interdisciplinary clinical rounds. On average, pharmacists reported spending 3–10 hours per day on direct patient care activities.

Table 2 Demographic Profile of Expert Panel Members Participated in the Delphi Questionnaire

| Panel Members | Category | Number (%) |
|---------------------|----------|------------|
| Age in Years | 27–35 | 6 (37.5) |
| | 36–40 | 5 (31.2) |
| | 41–45 | 3 (18.7) |
| | >45 | 2 (12.5) |
| Gender | Male | 11 (68.8) |
| | Female | 5 (31.2) |

(Continued)

Table 2 (Continued).

| Panel Members | Category | Number (%) |
|--|--------------------------|-------------------|
| Additional Academic/Professional Qualifications | Pharmacy Residency | 13 (81.3) |
| | Master's Degree | 3 (18.8) |
| | Post-entry PharmD | 2 (12.5) |
| | Ph.D | 1 (6.3) |
| | Fellowship | 4 (25) |
| Cardiology related clinical Experience | 2 to 5 Years | 9 (56.3) |
| | 6 to 10 years | 3 (18.8) |
| | 11 to 15 Years | 2 (12.5) |
| | More than 15 years | 2 (12.5) |
| Earned Board Certification | Cardiology Pharmacy | 6 (37.5) |
| | Pharmacotherapy | 5 (31.2) |
| | Others | 5 (31.2) |
| Affiliated Institution | Governmental | 6 (37.5) |
| | Military | 4 (25) |
| | Private | 4 (25) |
| | Governmental and Private | 2 (12.5) |
| Care setting | Inpatient & Outpatient | 15 (93.8) |
| | Inpatient only | 1 (6.2) |

Notes: Participants could hold multiple qualifications; totals exceed 16. Numbers indicate presence of each certification, not exclusivity. "Cardiology Pharmacy" denotes at least one cardiology-focused credential; "Pharmacotherapy" and "Others" include additional relevant certifications.

In the first round of the Delphi process, all sixteen expert pharmacists evaluated the 23 candidate QI-DTPs using a 9-point Likert scale (1–3 = disagreement, 4–6 = moderate/neutral, 7–9 = strong agreement). Several indicators achieved 100% agreement, including initiating statin therapy in accordance with clinical guidelines (Item 1), adjusting statin doses for side effects (Item 3), and ensuring guideline-directed therapy for heart failure patients (Item 4). Other indicators, such as ensuring dual antiplatelet therapy for a minimum of 12 months following percutaneous coronary intervention (Item 9) and providing patient education during hospitalization (Items 15 and 16), received a small number of moderate scores but still surpassed the 75% consensus threshold. The overall agreement level in Round 1 exceeded 90%.

During Round 2, participants reassessed all 23 QI-DTPs after reviewing anonymized, summarized feedback from the first round. Full agreement (scores of 7–9) was retained for multiple indicators, including maximizing statin doses or adding non-statin agents to achieve LDL targets (Item 2), implementation of a comprehensive pharmaceutical care plan (Item 12), and resolution of drug therapy problems during hospital admission (Item 13). A few indicators, such as optimization of therapy in acute heart failure (Item 5) and several patient education elements (Items 15, 16, 20, 21), received some moderate ratings but maintained consensus levels above the 75% threshold. The overall consensus rate in Round 2 was approximately 91%.

In the final (third) round of the Delphi process, the panel of 16 expert pharmacists evaluated the 23 candidate QI-DTPs. Several indicators, including maximizing statin therapy (Item 2), adjusting medication for side effects (Item 3), ensuring guideline-directed therapy for heart failure patients (Item 4), anticoagulation management (Item 23), and patient education during hospitalization (Item 15), received 100% strong agreement. A few indicators, such as shared decision-

making (Item 22) and comprehensive direct patient care bundles (Item 18), received 1–3 ratings below 7 but maintained consensus above the predefined threshold of 75%. The final consensus rate in Round 3 was 90.6%. By the conclusion of the study, all 23 proposed QI-DTPs had achieved full consensus, reflecting strong expert endorsement of their clinical relevance and utility in cardiology-related pharmaceutical care (Table 1) Figure 1.

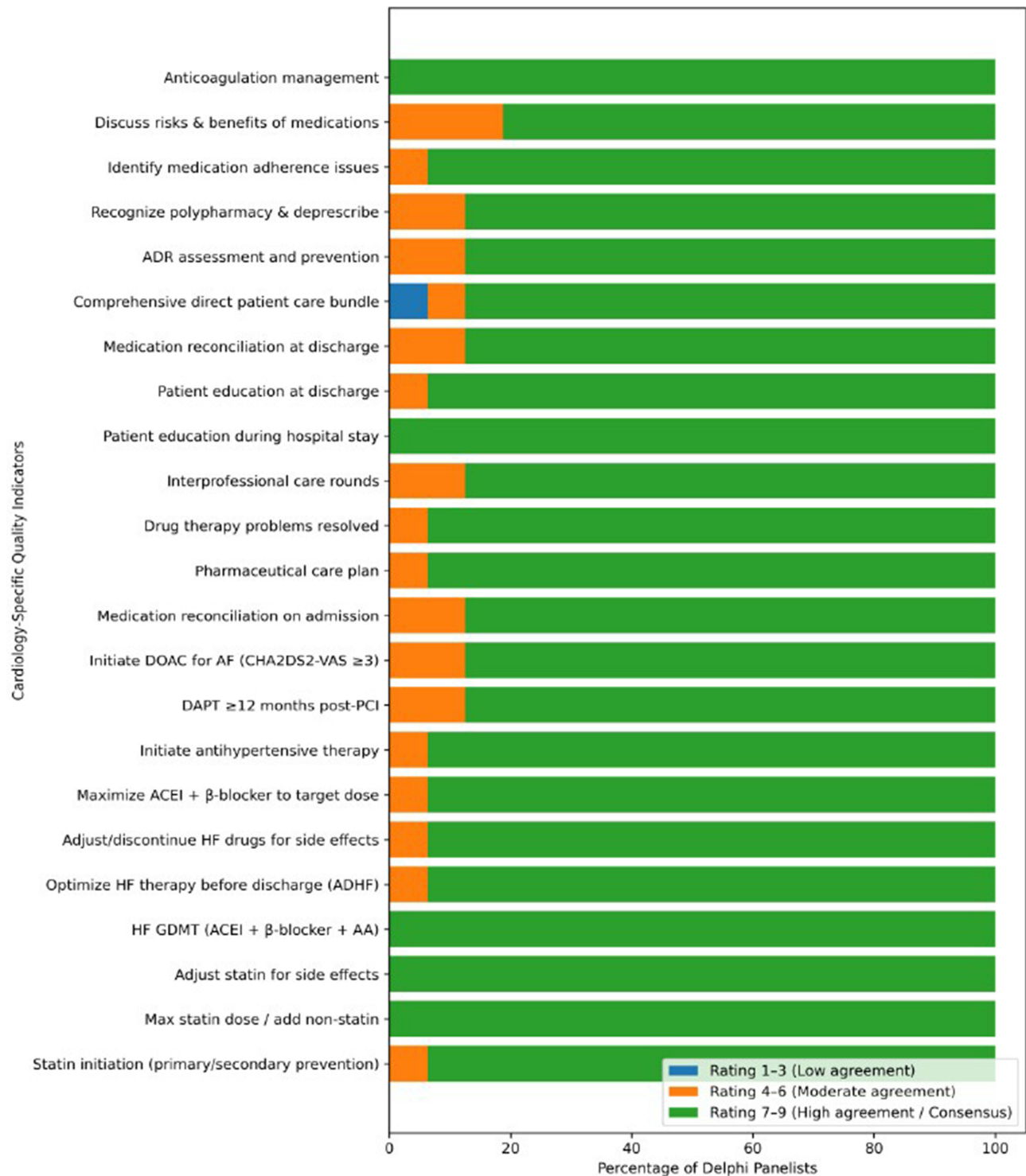


Figure 1 Distribution of Delphi Panel Ratings and Consensus Clustering for Cardiology-Specific Quality Indicators (Round 3). The 100% stacked bar chart illustrates the percentage distribution of low (1–3), moderate (4–6), and high (7–9) agreement ratings assigned by Delphi panelists for each indicator, highlighting clustering of consensus and residual disagreement across indicators.

Discussion

This study successfully brought together 16 experienced cardiology clinical pharmacists, representing diverse practice settings and professional backgrounds, to determine a consensus-based set of 23 QI-DTPs. By employing a structured, multi-round Delphi method, a wide spectrum of expert perspectives was captured while minimizing individual biases.¹⁹ Ultimately, all 23 proposed indicators achieved the pre-established 75% threshold of strong agreement (scores of 7–9), suggesting robust support for these measures as priorities in cardiology pharmacy.

Before this study, no unified set of cardiology-focused QI-DTPs existed to direct and quantify the unique contributions of clinical pharmacists. Although the literature documents favorable outcomes stemming from pharmacist-led interventions such as optimal use of statins, evidence-based heart failure therapy, and structured patient education there was no standardized approach to identifying and prioritizing drug therapy problems within this specialty. By identifying and validating these 23 QI-DTPs, our research provides a cohesive framework for improving medication-related outcomes in cardiology, fostering consistent clinical practice, and supporting quality benchmarks in pharmacy services.

A notable strength of this investigation lies in the composition of the expert panel. Pharmacists were deliberately selected based on their advanced qualifications (eg, postgraduate residencies, master's degrees, or PharmDs) and their direct patient care experience in cardiology. Such homogeneity of expertise enhanced the focus on cardiology-specific interventions, while geographic and institutional variation introduced broader perspectives, thereby increasing the applicability of the final indicators. The 100% response rate across all three survey rounds further minimized the risk of non-response bias.

Most of the proposed QI-DTPs align closely with well-established guidelines from the American Heart Association and the European Society of Cardiology. Several heart failure indicators included the combination of ACE inhibitors, β -blockers, and aldosterone antagonists (AA), consistent with guideline-directed therapy. This highlights the importance of evidence-based pharmacotherapy in optimizing outcomes for patients with heart failure.^{20,21} The unanimity observed for items such as statin therapy optimization, guideline-directed heart failure management, and structured anticoagulation strategies underscores the extensive clinical consensus that exists for these interventions in the published literature.^{16,22} Recent evidence supports these alignments: a pharmacist-led guideline-directed medical therapy initiative improved initiation and optimization of heart failure therapies, consistent with current AHA/ESC GDMT recommendations,²³ while a pharmacist-led medication titration program in cardiac patients demonstrated that pharmacists can meaningfully increase adherence to guideline-recommended therapy and reduce adverse cardiovascular outcomes.²⁴ Indicators focusing on patient education, medication reconciliation, and proactive identification of polypharmacy issues also resonate with broader calls for a patient-centered approach to cardiovascular pharmacotherapy.

The unanimous strong agreement for items such as maximizing statin therapy (Item 2), ensuring guideline-directed therapy for heart failure (Item 4), and structured anticoagulation management (Item 23) mirrors recent implementation and outcome studies showing that focused pharmacist-led initiatives materially improve delivery of these guideline-recommended interventions.^{25–27} Specifically, pharmacist- and team-based programs increase appropriate statin initiation/intensification and LDL-C goal attainment,²⁵ dedicated heart-failure stewardship and pharmacist-led GDMT models substantially increase prescribing and uptitration of foundational HF therapies during hospitalization and in outpatient optimisation clinics,²⁶ and contemporary anticoagulation stewardship programs led by clinical pharmacists reduce anticoagulant-related medication errors and improve adherence to evidence-based anticoagulation guidelines.²⁷ High agreement for indicators related to in-hospital patient education and discharge-focused processes (Item 15) is also supported by systematic reviews and implementation reports: pharmacy-led transitions-of-care and post-discharge pharmacist interventions (medication reconciliation, counselling, and timely follow-up) have consistently been associated with lower 30-day readmission rates and improved medication safety.²⁸ While many indicators achieved full consensus, it is important to acknowledge a potential ceiling effect, where almost all items were rated very highly. This may reflect both the strength of the underlying evidence and the relative homogeneity of the expert panel. Recognizing this effect helps contextualize the consensus results and suggests that future studies with more diverse panels could further validate the applicability of these QI-DTPs across different practice settings. Together, these findings provide empirical backing for the expert panel's endorsements and strengthen the case for adopting the 23 QI-DTPs as meaningful, evidence-aligned benchmarks for cardiology pharmacy practice.

It should be emphasized that the current study primarily establishes content validity of the 23 QI-DTPs through structured expert consensus using the modified Delphi method. This approach confirms that the indicators are relevant, appropriate, and evidence-informed for cardiology pharmacy practice. Other forms of validity such as construct validity, feasibility, reliability, and impact on patient outcomes have not been evaluated in this study to date. The modified Delphi approach used in this study fostered iterative refinement of the QI-DTPs while maintaining participant anonymity, a feature that likely reduced the potential influence of dominant personalities.¹⁹ Iterative rounds of controlled feedback are a recognized strength of the Delphi technique, as they allow participants to reassess their judgments in light of group responses, thereby improving clarity and convergence of selected indicators.²⁹ Additionally, the anonymity inherent in this approach helps minimize bias from dominant individuals or peer pressure, ensuring that the final consensus reflects a balanced distribution of professional opinions.³⁰ Combined with a high response rate and structured feedback, this methodology strengthened the internal validity of the data. Furthermore, by grounding the indicator development process in a review of authoritative clinical guidelines, the study ensured that each proposed QI-DTP was evidence-based and practice-relevant.

Potential next steps for implementation include integrating the 23 QI-DTPs into electronic documentation systems, training pharmacists to consistently record and report these indicators, and piloting dashboards for real-time performance tracking. Such strategies could facilitate systematic performance monitoring, enable continuous quality improvement, and support evidence-based practice in cardiology pharmacy.

Limitations

This study has several limitations. Although consensus was achieved among the 16 expert clinical pharmacists on the panel, the findings may have limited generalizability to all cardiology pharmacists across diverse healthcare settings. The expert panel was primarily drawn from Saudi institutions, which may share similar training and practice cultures. This could further limit the generalizability of the findings to other healthcare systems. Future studies with more internationally diverse panels are recommended to enhance applicability. Selection bias may have occurred, as participants were purposively recruited through professional networks. While the Delphi process maintained anonymity, ratings relied on individual judgment and may have been influenced by personal experience. The study employed three survey rounds, which may have constrained the exploration of additional QI-DTPs. Furthermore, although widely used, the predetermined 75% consensus threshold may not fully capture subtle differences in opinion. Finally, the context-specific nature of the results may necessitate adaptation when applied to other regions or practice settings.

Recommendations

It is recommended that clinical pharmacists adopt the 23 validated QI-DTPs to standardize cardiac care and improve patient outcomes. These indicators can be utilized by healthcare organizations and pharmacy training programs for education, quality assurance, and performance benchmarking. Future research should focus on evaluating their clinical applicability across diverse settings, while professional associations may consider incorporating them into practice guidelines for cardiology pharmacy.

Conclusion

This study developed and validated, through expert consensus, a robust framework of 23 cardiology-specific QI-DTPs to support and standardize clinical pharmacy practice in cardiology. These indicators reflect key medication-related processes such as patient education, statin optimization, and heart failure pharmacotherapy that are central to pharmacist-led care. While clinical and health-system outcomes were not evaluated in this study, the QI-DTPs provide a content-valid, evidence-informed foundation for performance monitoring and quality improvement. Future implementation and outcome-based research is warranted to assess feasibility, effectiveness, and impact on patient- and system-level outcomes.

Data Sharing Statement

The original contributions presented in the study are included in the article, further inquiries can be directed to the corresponding author.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare no conflict of interest.

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