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REVIEW

Effectiveness of Quality Use of Medicines (QUM) Programs and Strategies in Saudi Arabia: A Narrative Review

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Background: The high prevalence of chronic diseases, workforce challenges, and growing polypharmacy adversely impact the quality use of medicines (QUM) and health outcomes in Saudi Arabia (SA). The SA Ministry of Health (MOH) has initiated several programs and policies to enhance QUM including a National Medication Safety Program, national clinical guidelines, and technology-based strategies.

Objective: To assess the published literature on the range, quality, and effectiveness of QUM methods in the SA health system.

Methods: Comprehensive search of electronic databases Scopus, Medline, and PubMed for papers reporting evaluation of QUM interventions or programs in SA.

Results: QUM programs involving medication reconciliation, interventions by hospital pharmacists, antibiotics stewardship, technology and staff training are the most commonly used programs reported in SA. Evaluations of several QUM interventions found a significant positive impact on health outcomes, prescribing patterns, chronic disease management, medication safety, and healthcare costs. Medication reconciliation programs reduced discrepancies by up to 20% in some studies. Hospital pharmacist interventions showed high acceptance rates (up to 92%) and improved medication safety. Antibiotic stewardship programs effectively reduced antimicrobial use and costs. Health information technology implementations like electronic health records (EHR), and computerized physician order entry (CPOE) showed mixed results but generally improved medication safety and efficiency. Staff training initiatives enhanced healthcare professionals' knowledge and skills in medication management.

Conclusion: While SA has national QUM policies and programs, and evidence that individual QUM interventions have significant positive local impact, more large-scale, multi-center studies are needed to provide a comprehensive view of QUM practices. More rigorous evaluations of existing programs and expansion of the range of QUM programs to align with international ones could further improve medication safety and patient outcomes in Saudi Arabia.

Keywords: quality use of medicines, QUM, medication safety, rational use of medicines, Saudi Arabia, medication reconciliation, stewardship programs, technology

Introduction

The healthcare system and other sectors in Saudi Arabia (SA) have made significant progress particularly since a national transformation program was launched in 2016.[1] A revision process commenced in 2019 to update and modify the national medicines policy (NMP), aiming at ensuring a secure supply of quality medicines, reshaping prescribing, and procurement habits, and promoting the pharmaceutical industry.[2] One of the key features of the NMP is to create a cohesive structured regulatory framework to manage the provision of effective healthcare including quality use of medicines (QUM). There are different regulatory bodies responsible for developing and evaluating the implementation of medication management and pharmaceutical policies, and one of the aims of the NMP is to follow a well-coordinated approach and avoid duplication of efforts. Saudi Food and Drug Authority (SFDA) has been the main regulator ensuring that safe, and effective pharmaceutical products are marketed, while the Ministry of Health (MOH) is responsible for

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Table 1 Regulatory Institutions in SA and Their Responsibilities to Medication Management and QUM

Regulatory Body	Responsibility
Saudi Food and Drug Authority (SFDA)	Approval, registration, and regulation of medicines to ensure, the safety and efficacy of the medications used in the country[3]
National Drug and Poison Information Center	Provide 24/7 support and advice on medication and poisoning management.[4]
Saudi Health Council	Revision of medicines policies by reviewing and analyzing medicines policies.[5]
Ministry of Health (MOH)	Developing policies and monitor the implementation of policies to ensure safe and effective prescribing, dispensing and administration practices.[6]
Center for Health Technology Assessment	Assessment of new health technology, and establish the national standards and guidelines of the used assessment methods.[7]
Academia, Saudi Commission for Health Specialties	Continuing education, training and professional development of healthcare practitioners in SA.[8]
The Saudi Central Board for Accreditation of Healthcare Institutions (CBAHI)	Development of national standards for healthcare facilities and grant accreditation for the one complying with the standards.[9]

regulating and licensing providers of healthcare. Other regulatory bodies are involved in the training and practice policies of pharmacists and in regulating the pharmaceutical industry. Table 1 describes the responsibilities of seven institutions as defined in the NMP.[2]

SA is also experiencing growing challenges due to the increasing prevalence of chronic diseases including diabetes, cardiovascular diseases, and obesity. Chronic diseases account for 74% of deaths in SA, with associated morbidity and economic burden.[10] Clinical management of chronic diseases impacts QUM with polypharmacy, particularly among older adults, increasing the risk of adverse drug reactions, drug interactions, inappropriate treatment, and medication non-adherence.[11] Poor knowledge among patients about their conditions and the proper use of their medications has been reported by some researchers. For example, a survey of people with diabetes mellitus found that more than half had insufficient knowledge about diabetic retinopathy contributing to sub-optimal self-management.[12]

Medication errors (MEs) continue to occur in healthcare settings in SA at an unacceptable level. A recent systematic review and meta-analysis estimated the total rate of MEs in SA hospitals to be 44 per 100 prescriptions, which is considered high and raises patient safety concerns.[13] Reviews indicate that MEs occur in diverse healthcare settings, with most errors happening due to factors such as high workload, fatigue, and inadequate staffing.[14] The aging of the population and rapid population growth both contribute to pressure on the health system capacity.[15] In addition to a specific shortage of trained pharmacy professionals, QUM is also impacted by healthcare practitioners not consistently following evidence-based guidelines for medication use.[16]

The Saudi MOH has recognized the need for improved health outcomes and patient safety and has increased its efforts to promote QUM. The MOH launched a National Medication Safety Program in 2013, which aims to improve medication safety in all pharmacy institutions thereby by decreasing medicine-related harms, improving morbidity and mortality, and reducing adverse event-related healthcare costs.[17] The Saudi Center for Evidence-Based Healthcare has developed national clinical guidelines to provide information on pharmacological treatments for specific diseases and conditions.[18] Generic medicines prescribing is still not common in SA, and is relatively low in comparison to other countries.[19] Another MOH measure allows pharmacists to perform generic substitution which could help promote the cost-effective use of medications. The MOH also introduced the use of information systems to support medication management and use processes.[20] Other medication therapy management programs like medication reconciliation and medication review are used in some SA healthcare settings, to help avoid polypharmacy and drug-related problems (DRPs) among patients.[21,22] In addition, the "Choosing Wisely" campaign was launched to support healthcare providers and patients in discussing their options about healthcare services and diagnostic tests with the aim of reducing the risk of harm and service duplication.[23]

However, while there are strong policy and program settings, there is limited literature on the implementation and effectiveness of the QUM policies and program limitations that could affect their implementation in the Saudi healthcare system.[18]

A QUM initiative or program is deemed useful and successful when it results in improved health outcomes and quality care, aids healthcare professionals in decision-making, and acknowledges the community's diversity. A better understanding of these programs, their effectiveness, and their limitations would help to identify whether the SA medication management system incorporates the most effective QUM programs implemented internationally. In this review, we summarize the published studies evaluating QUM strategies in Saudi hospitals to provide insights into the overall effectiveness of the SA's QUM programs, identify any gaps, and consider areas for improvement.

Materials and Methods

A comprehensive search for relevant studies was done using the following electronic databases: Scopus, Medline, and PubMed. The search strategy combined the keywords: "quality use of medicines" OR "QUM" OR "rational use of medicines" OR "appropriate use of medicines" OR "medication safety" OR "medication reconciliation" OR "medication review" OR "stewardship" AND "strategy" OR "initiative" OR "programs" AND "Saudi Arabia". The search was limited to peer-reviewed articles written in English and Arabic. The search results showed 616 articles out of which 93 were included after reading the abstract. The total number of articles eventually included in this review after reading the full texts was 17 articles and they are those reporting measurable outcomes and a clear methodology to evaluate the impact of a program or initiative implemented in an SA healthcare setting to achieve QUM and safe use of medications. A formal systematic review was not undertaken as the intent was to describe the range and scope of evaluation activity rather than a quantitative estimate for a specific topic.

Findings and Discussion

Saudi QUM programs share similarities with QUM programs implemented internationally but exhibit some unique characteristics and areas for improvement. International QUM programs include medication reconciliation,[24–28] hospital pharmacist interventions,[29–36] transition of care programs,[37–40] staff education,[41–43] interprofessional collaboration,[44–47] antibiotics programs[48–50] and the adoption of electronic systems and technologies.[51–61] Consistent with international experience, these initiatives in SA have shown promising results in improving patient safety and medication use. This review of published studies evaluating the impact of programs and initiatives in Saudi healthcare settings on QUM, and it indicates the range includes medication reconciliation, hospital pharmacist interventions, antibiotic stewardship programs, implementing health information technology (IT) systems and staff training.

Medication Reconciliation

Medication reconciliation entails the comprehensive review of patients' medications at different levels of patient care.[62] It involves preparing a complete list of the patient's current medications which should be updated whenever there is an addition or change to medications.[63] Medication reconciliation programs in SA have been evaluated in major hospitals in some studies (Table 2). These programs have demonstrated effectiveness in reducing medication discrepancies and improving patient safety. While studies varied methodologically (retrospective or prospective) and sizes (single-center or multi-center), all studies indicate the value of medication reconciliation for improving patient safety by identifying medication discrepancies and reducing their incidence. Pharmacist involvement in medication reconciliation, standardized processes, multidisciplinary teams, and follow-up after transitions of care appeared to be among the most impactful interventions for reducing medication discrepancies and related problems in the Saudi healthcare settings. In addition, the combination of multiple interventions as part of a comprehensive program seemed to yield the best results.

These results align with international findings that highlight the importance of medication reconciliation in improving patient safety. Recent international studies have examined medication reconciliation conducted at different stages or transitions in care, including admission,[24,25] discharge,[25–27] and outpatient settings.[28] However, Saudi studies appear more limited in scope and number, suggesting implementation is not yet widespread across the healthcare system. The reported SA's programs appear more general compared to more standardized procedures in the international programs,

Table 2 Studies Evaluated Medication Reconciliation Programs in SA Healthcare Settings

Authors	Sample	Settings	Methodology	Findings
Alghamdi et al[22]	Admitted patients	18 major SA hospital	Interventional study	A 20% reduction in discrepancies at discharge and an improvement in compliance with the documentation of the medication reconciliation process have been reported.
Abdulghani et al[64]	286 adult patients	One tertiary hospital	3-month prospective study	The results showed that 48% of patients experienced inaccurate recording of their medication histories at admission (omissions errors 77%, commission 13%, dosing errors 7%, and frequency errors 3%), and most of these discrepancies had moderate to severe harm risk to the patients
Alghanem et al[65]	77 patients	An ambulatory dialysis center	A retrospective observational study for over 6 months	A mean of 11 medications per patient was reduced to 8 after reconciliation, with 55 discrepancies and 216 medication-related problems. This was associated with approximately € 76 per patient per month cost-saving

Table 3 Studies Evaluating Hospital Pharmacist's Interventions on QUM Parameters in SA

Authors	Sample	Settings	Methodology	Findings
Alghamdi et al[67]	182 patients	An academic hospital	A prospective interventional study	The study identified 102 discrepancies (0.7 per patient), mostly omissions (70% at discharge and 42% at admission), and 39% of patients received follow-up calls and reported high satisfaction.
Althomali et al[68]	165 patients	An intensive care unit (ICU)	A retrospective study	The study showed that clinical pharmacists have a critical role in managing patients' therapy, with 404 interventions mainly related to "indication" provided for patients with 92% acceptance rate by physicians.
Alshaiban et al[69]	96 patients	The Prince Faisal bin Khalid Cardiac Center, a tertiary hospital in Abha City.	An observational retrospective cohort study	The study reported an improvement in international normalized ration (INR) control, increasing the percentage of patients achieving target INR from 36% at baseline to 85% by the fifth week. In addition, the need for dose adjustments decreased over time, from 39% initially to 4% by the 5th week, and the risk of hospitalization and bleeding was reduced
Najjar et al[66]	400 geriatric patients	The medical wards of the Department of Medicine at King Abdulaziz Medical City in Riyadh	Prospective study	A significant decrease in the incidence of potentially inappropriate medications (PIMs) from 61% to 29% after the intervention has been reported. First-generation antihistamines, sliding-scale insulin, to evaluate a and benzodiazepines were the most common PIMs.

which cover a broader range of outcomes like medication adherence[26] and clinical outcomes.[25] QUM in SA may benefit from expanding its medication reconciliation initiatives and conducting more comprehensive studies on their effectiveness across various healthcare settings.

Hospital Pharmacist Interventions

The impact on MEs and QUM of hospital pharmacist services in SA has been evaluated in some studies (Table 3). The published research suggests that involving hospital pharmacists in all aspects of medication use and patient care could help improve patient safety and achieve QUM. Saudi pharmacists are involved in various aspects of patient care,

including medication reconciliation, clinical interventions, and transition of care services. Significant positive impacts of pharmacist interventions on medication appropriateness, dosing, and clinical outcomes have been demonstrated in all studies, despite using different approaches. The broadest impact on reducing inappropriate prescribing was seen by Najjar et al (2018) in which the combined educational and clinical interventions were used.[66] The results of the studies reviewed are comparable to international studies that consistently demonstrate the value of pharmacist involvement in patient care. For example, such interventions in other countries have been also associated with a high acceptance rate of pharmacists' interventions, resulting in a substantial improvement in medication use among cancer patients undergoing pain management therapy,[29] and patients admitted to general surgical wards.[30] However, international literature describes more specialized pharmacist-led programs, such as comprehensive medication management for specific disease states, while Saudi studies mention fewer such specialized interventions. Adoption of more comprehensive pharmacist care models, such as those targeting patients with multiple chronic conditions or high-risk medications, could enhance Saudi programs.

Antibiotics Stewardship

Some studies have evaluated the implementation and effectiveness of antibiotic stewardship programs (ASPs) in SA hospitals (Table 4). The effectiveness of ASPs in reducing antibiotic use has been demonstrated in these studies in hospital and ICU settings. ASPs in Saudi hospitals have shown promising results in reducing antibiotic use, costs, and healthcare-associated infections, but the impacts on costs and clinical outcomes were more variable. All studies used pre-post designs, but there were key differences in the study setting, duration, and measured outcomes. The multidisciplinary approach that involves leadership was highlighted as important for successful ASP implementation across the studies.

ASPs implemented internationally and in SA share common goals of reducing antimicrobial resistance and improving patient outcomes. However, the literature on ASPs in SA is limited. Internationally, ASPs have been more extensively studied and implemented, with a broader range of interventions and reductions in inappropriate antibiotic prescribing for urinary tract infections,[73] decreased antimicrobial use in nursing homes,[50] and improvements in the appropriateness of antibiotic prescriptions in teaching hospitals.[48] SA may benefit from adopting some of the broader strategies implemented in other countries and conducting more rigorous evaluations of their ASPs to improve antibiotic stewardship practices further.

Information Technology-Based Programs

IT has been part of different initiatives and interventions aimed at improving medication management and achieving QUM in SA. The adoption of electronic health records (EHR), computerized physician order entry (CPOE) and the

Table 4 Studies Evaluating Antibiotic Programs on QUM in SA

Authors	Sample	Settings	Methodology	Findings
Alshareef et al[70]	90 patients	A tertiary center in Saudi Arabia	A retrospective study	Outpatient parenteral antibiotic therapy helped to control the use of antibiotics and reduced therapy complications, hospital readmissions (12 out of the 90 enrolled patients), and costs (18 million SAR saved)
Haseeb A et al[71]	Antibiotic consumption per 100 bed days per month	A critical care unit in a single public emergency hospital in Mecca	A quasi-experimental pre-post study	A reduction of 25% in the use of broad-spectrum antibiotics was shown in the intervention group, while medication costs were found to be increased, which was attributed to the use of more expensive antibiotics like linezolid
Al-Omari A et al[72]	409,403 subjects	Four tertiary private hospitals	A five-year pre-post quasi-experimental study	The study reported reductions in antimicrobial use, cost (decreased by 28%), and healthcare-associated infections (significantly decreased).

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Table 5 Studies Evaluating the Impact of Implementing Different Types of Technologies as Part of SA QUM Programs

Author	Program	Settings	Methodology	Findings
Hamad et al[74]	EHR	A single primary Saudi hospital	A quasi-experimental study	A significant increase in reported medication errors (from 0.029 to 0.040 errors per patient) has been reported after EHR implementation.
AlAzmi et al[75]	CPOE	Pediatric wards and emergency departments at a Saudi hospital	An observational study	The study reported a reduction in DRPs in hospitalized children in a Saudi hospital from 45% pre-implementation to 36% post-implementation. This was attributed to improved communication between pharmacists and physicians and the real-time drug alerts after implementing CPOE
Al Nemari and Waterson et al[76]	Automatic dispensing units	An outpatient pharmacy department in a university hospital	Six sigma approach	In this study, total patient time in pharmacy decreased from 17.09 to 11.81 minutes, and dispensing error rate dropped from 1.00% to 0.24%, and medication wastage costs reduced by 83.9%.
Alshammari et al[77]	Digital prescription program (Wasfaty)	Cost data resources from MOH.	A cost analysis evaluation	Implementing the Wasfaty program was associated with significant reductions in healthcare expenditures and cost savings including reduced medication costs per visit/patient. The overall healthcare expenditure savings for the SA health care system was reported to be $258-275 million USD annually.

introduction of Wasfaty service are examples of technology-based QUM programs implemented in SA with evidence they are effective (Table 5). Different parameters were assessed in the studies including medication errors, cost, and DRPs so an overall conclusion is unclear. While generally showing benefits, they also highlight areas for continued improvement, particularly in pediatric care.

On the other hand, international more diverse technologies have been studied like clinical decision support systems,[51,53] mobile applications for emergency situations,[56,57,78] telehealth services for medication management,[59,60] and bar-code medication administration technologies.[79] There would appear to be opportunities and potential benefits for QUM in SA from the trialing of these other decision support tools and mobile applications for medication management. In addition, more studies are required to identify the limitations of the systems and the optimal error prevention strategies using these technologies.

Staff Training

Well-informed and trained professionals play an essential role in improving the QUM. Staff training and continuous education is the key factor in ensuring that healthcare professionals have the requisite knowledge and the skills to practice effectively and safely. The published research showed QUM knowledge among SA's healthcare practitioners including pharmacists and physicians could be improved through QUM training programs (Table 6).

However, the literature on staff training programs in SA appears limited compared to the staff training programs implemented internationally which tend to be more varied and extensively evaluated. For instance, international studies have demonstrated the effectiveness of training physicians in electronic prescribing systems,[41] providing pharmacists with training in motivational interviewing to improve patient adherence,[42] and implementing standardized training for pharmacists and pharmacy technicians in gathering admission medication history.[43] This suggests that SA could benefit from expanding and systematizing its training initiatives and conducting more comprehensive evaluations to further improve healthcare professionals' skills and knowledge in medication management.

Table 6 Studies Evaluating Impact of Training and Educational Programs on QUM in SA

Author	Training Program	Sample	Settings	Methodology	Findings
Rasheed et al[80]	1-day educational session on diabetes care knowledge and attitudes	40 pharmacists	Community pharmacies	A questionnaire	Improvements were seen in the understanding of pharmacists about the diabetes medication, dosing of insulin, and monitoring of the disease course with a significant increase in knowledge scores (11.02 to 14.05 out of 17) and attitude scores (49.79 to 52.91 out of 60).
Haseeb A et al[81]	A pharmacist-led educational intervention to reduce the use of high-risk abbreviations in an acute care setting	Preintervention: 660 Postintervention: 498 handwritten physician orders, 482 patients' medication administration records (MRAs) and 388 patients' pharmacy dispensing sheets	A public emergency hospital in Mecca	Pre-post design	The study reported significant reduction from 61% to 29.5% in the incidence of high-risk abbreviation use.
Almidani E et al[82]	An educational and monitoring program on medication reconciliation compliance	Pediatric physicians	A Pediatrics Department	A pre-post design over 2 months evaluated an	Reported a significant increase (from 0–15% to 96%) in compliance of medication reconciliation at the time of admission for the pediatric patient population

Limitations

This review included only 17 articles that reported measurable outcomes with most of the studies conducted in single Saudi healthcare settings, which could limit the generalizability of the data to the entire system. As the review included only published studies, other QUM programs may have been overlooked.

Other Areas for Improvement

As noted above, there is a range of areas for potential improvement in QUM measures in SA and specifically there is a need for larger, multi-center studies to provide a more comprehensive view of QUM practices and their implementation, and conducting more rigorous evaluations of existing programs, including cost-effectiveness analyses and long-term outcome studies.

Conclusion

While not extensive, the published research and reports on the implementation of QUM programs in SA indicate a range of QUM strategies were associated with improvements in terms of improving the prescribing quality, enhancing the management of chronic diseases, and most importantly enhancing medication safety. Key initiatives such as medication reconciliation, hospital pharmacist interventions, antibiotic stewardship programs, information technology-based systems, and staff training have all contributed to improvements in patient care. While there is a well-articulated national QUM framework in the Saudi NMP, it is not clear from current published research the extent to which QUM measures

have been systematically implemented across the SA healthcare system. The published research suggests there would be significant benefits to patients, quality of care, and health care costs in systematic implementation. Areas where SA's QUM programs could be enhanced to align more closely with international best practices including implementing more specialized pharmacist-led programs, expanding the range of technology-based interventions, developing more comprehensive staff training programs, and increasing focus on patient education and engagement. In addition, there is a need for more extensive research and monitoring of the effectiveness of programs at a national level.

Disclosure

The author(s) report no conflicts of interest in this work.

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