© JUN 2026 | IRE Journals | Volume 9 Issue 12 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I12-1719123

A Hypertension and Diabetes Control Among Cardiology Patients in Saudi Arabia: A Quality-Improvement Study Using a Preventive Care Bundle

MAJID SULEMAN

Abstract- ***Background: Hypertension and diabetes mellitus converge frequently in cardiology clinics and amplify the risk of coronary events, heart failure, kidney disease and premature mortality. In Saudi Arabia, rapid epidemiological transition, regional variation in cardiometabolic risk and uneven follow-up capacity have made simultaneous control of blood pressure and glycaemia a central quality issue rather than a narrow prescribing problem. Aim: This review develops a publishable quality-improvement framework for a preventive care bundle designed for cardiology patients in Saudi Arabia who have hypertension, diabetes or both. Objectives: The objectives were to synthesise 2020-2025 evidence, define measurable care gaps, specify bundle components, propose a clinic-level implementation model and identify indicators that can be used for audit, feedback and scale-up. Methods: A structured narrative review was undertaken using recent international guidelines, Saudi national guidance, national statistics and peer-reviewed studies relevant to cardiometabolic prevention, cardiology care and quality improvement. Evidence was organised around burden, guideline-concordant practice, implementation barriers, bundle design and measurement. Findings: Contemporary evidence supports accurate blood-pressure measurement, individualised glycaemic targets, kidney and lipid risk assessment, intensification of cardioprotective therapy, lifestyle counselling, medication adherence support, remote monitoring and multidisciplinary follow-up. A bundle model can reduce clinical inertia by converting separate guideline recommendations into a repeated workflow. Conclusion: A Saudi cardiology preventive care bundle should be simple, auditable and adaptable across tertiary, regional and rural services.***

I. INTRODUCTION

Hypertension and diabetes mellitus are among the most consequential chronic conditions encountered in cardiology practice because they do not simply coexist; they interact through vascular inflammation, endothelial dysfunction, renal injury, autonomic imbalance and accelerated atherosclerosis. Their combined presence increases the probability of coronary disease, stroke, atrial fibrillation, heart failure and chronic kidney disease, making control of both conditions a defining marker of cardiovascular quality of care [1-7].

Contemporary guidelines no longer treat blood pressure, glucose, lipids, kidney function and lifestyle as isolated domains. They emphasise integrated, risk-based prevention, earlier intensification of cardioprotective medicines, and continuous follow-up to prevent avoidable complications [2-9]. For cardiology clinics, this integrated view is especially relevant because patients frequently present after an acute coronary syndrome, with established coronary disease, with heart failure or with multiple uncontrolled risk factors.

Saudi Arabia provides an important setting for this review. National reports describe a substantial cardiometabolic burden, with diabetes and hypertension forming prominent chronic disease categories and with cardiovascular disease remaining a major contributor to morbidity [10-18].

Recent Saudi studies also show regional differences in cardiovascular disease and risk-factor prevalence, suggesting that clinic models should be standardised enough for reliable care but flexible enough for local variation [11,19-22]. In cardiology patients, the clinical stakes are high: an uncontrolled systolic blood pressure in a patient with diabetes may represent not only a numerical gap but also missed kidney protection, underused lipid lowering, insufficient counselling, fragmented follow-up and therapeutic inertia.

A preventive care bundle offers a practical response. In quality improvement, a bundle is a small set of

evidence-based actions that must be delivered reliably to a clearly defined patient group. The advantage is operational: clinicians do not need to rediscover every guideline recommendation at every visit, because the workflow prompts measurement, risk stratification, treatment optimisation, patient education and follow-up.

This review therefore focuses on a bundle for cardiology patients in Saudi Arabia, rather than a population screening programme. The intended setting is the outpatient cardiology clinic or post-discharge cardiology service, where patients with hypertension and diabetes can be identified, treated, followed and re-audited.

II. AIM AND OBJECTIVES

The aim of the study is to develop an evidence-informed review and quality-improvement framework for improving hypertension and diabetes control among cardiology patients in Saudi Arabia through a preventive care bundle. The first objective is to describe the current burden and care gaps relevant to blood pressure and diabetes control in Saudi cardiology populations.

The second objective is to synthesise 2020-2025 evidence and guideline recommendations that can be converted into a feasible bundle. The third objective is to define bundle elements, responsible roles and measurable indicators suitable for routine clinic audit. The fourth objective is to examine implementation barriers, including clinical inertia, adherence, limited visit time, regional variation and follow-up access.

The fifth objective is to propose a sustainable measurement strategy that can be tested in a Saudi cardiology service and adapted for wider implementation.

III. METHODOLOGY

A structured narrative review methodology was selected because the topic combines clinical evidence, national epidemiology, guideline interpretation and quality-improvement design. Searches were conducted conceptually across PubMed, Embase, Scopus, Google Scholar, official Saudi health sources and international guideline repositories for materials published from January 2020 to December 2025.

Search concepts included hypertension, diabetes, cardiology clinic, cardiovascular disease, Saudi Arabia, quality improvement, preventive care bundle, blood pressure control, glycaemic control, SGLT2 inhibitor, GLP-1 receptor agonist, medication adherence, self-measured blood pressure and multidisciplinary care. Reference chaining was used to identify highly relevant guidelines and Saudi epidemiological papers.

Eligible sources were English-language guidelines, national reports, observational studies, reviews and quality-related studies that addressed hypertension, diabetes, cardiovascular prevention or Saudi cardiometabolic disease.

Studies were prioritised when they included Saudi data, cardiology-relevant populations, clinic-based implementation, risk-factor control or medication optimisation. Sources focused exclusively on paediatric populations, pregnancy, acute critical care, non-cardiometabolic rehabilitation or non-clinical commentary were excluded unless they contributed to understanding Saudi health-system priorities. The evidence was extracted into five domains: epidemiological burden, guideline targets, pharmacological and lifestyle interventions, implementation barriers and quality measures.

The synthesis followed a current-status and future-needs structure. Current status summarised the burden of hypertension and diabetes, control gaps and the implications for cardiology services. Future needs were translated into a proposed care bundle and measurement framework. The review did not attempt pooled effect estimation because the question was not limited to a single intervention or outcome; instead, it sought to define an implementable model aligned with contemporary evidence and Saudi health-system priorities. Quality-improvement recommendations were judged by clinical importance, feasibility, measurability and relevance to cardiology practice.

IV. CURRENT BURDEN IN SAUDI CARDIOLOGY PATIENTS

The coexistence of hypertension and diabetes is a predictable consequence of shared risk factors, including obesity, physical inactivity, high salt intake, dyslipidaemia, ageing and family history. Global evidence indicates that both conditions remain insufficiently detected, treated and controlled despite the availability of effective medicines [23,24].

Saudi data show that cardiometabolic disease is not evenly distributed across regions or age groups; older adults and some regions carry a heavier cardiovascular burden, and diabetes prevalence remains high by international comparison [11,14,15,21,22]. Within cardiology clinics, these figures are magnified because patients are selected by symptoms, established cardiovascular disease or referral after abnormal tests.

The clinical implications are substantial. A cardiology patient with diabetes and hypertension may require blood-pressure lowering, lipid management, antiplatelet review when appropriate, kidney protection, weight management, smoking cessation support and assessment for heart failure or coronary disease.

Diabetes also changes the interpretation of cardiovascular risk: modern guidelines recommend therapies with proven cardiovascular and renal benefit in eligible patients, especially SGLT2 inhibitors and GLP-1 receptor agonists for those with established atherosclerotic disease, heart failure, chronic kidney disease or high cardiovascular risk [5-8]. Therefore, diabetes management in cardiology clinics cannot be limited to HbA1c reporting; it must include vascular protection.
Saudi national health transformation aims to expand access, improve outcomes and shift care towards prevention [16-18].

These goals align closely with a cardiology preventive bundle. A bundle can convert a high-level national aspiration into a visit-level routine: measure accurately, classify risk, treat to target, educate, follow, audit and improve. Without a repeated process, control gaps persist because each visit is absorbed by the presenting cardiac complaint, while chronic risk-factor management is postponed. In practice, many patients move between cardiology, primary care, endocrinology and nephrology, creating opportunities for duplication or omission. The bundle model is designed to reduce this fragmentation.

V. GUIDELINE-BASED CONTROL TARGETS AND CLINICAL LOGIC

Blood-pressure targets require individualisation, but contemporary guidelines generally support more intensive control for high-risk patients when treatment is tolerated [2-4]. The Saudi hypertension guidance places strong emphasis on standardised blood-pressure measurement, cardiovascular risk assessment and appropriate pharmacological treatment [2,17].

International guidance also stresses out-of-office measurement because clinic blood pressure can be distorted by technique, device error, stress, conversation and inadequate rest [1,3,4]. In a cardiology clinic, the first bundle step should therefore be technical reliability: correct cuff size, seated rest, repeated readings, documented posture, and confirmation through home or ambulatory readings when feasible.

For diabetes, a single universal HbA1c target is inappropriate. The 2025 diabetes standards support individualisation according to age, comorbidity, hypoglycaemia risk, life expectancy and patient preference, while also highlighting cardiovascular and kidney protection as major treatment priorities [5,6].

The 2023 cardiovascular diabetes guideline similarly moves beyond glucose alone by recommending therapies that reduce cardiovascular events in high-risk groups [7]. For Saudi cardiology patients, the bundle should therefore record HbA1c, but it should also ask whether the medication plan is cardioprotective, whether renal function and albuminuria have been assessed, whether weight and lifestyle have been addressed, and whether the patient understands the rationale for the plan.

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DOI: https://doi.org/10.64388/IREV9I12-1719123

The logic of combining hypertension and diabetes control is clinically coherent. Blood-pressure reduction lowers stroke, heart failure and kidney risk; glycaemic optimisation reduces microvascular complications; lipid lowering reduces atherosclerotic events; kidney-protective therapy slows decline; and behavioural interventions influence several risks simultaneously [1-9].

In a busy clinic, however, these actions are often distributed across professions and appointments. The bundle approach makes them visible as a single prevention pathway. It does not replace specialist judgement; rather, it ensures that specialist judgement is supported by reliable prompts, shared documentation and timely escalation.

VI. PREVENTIVE CARE BUNDLE DESIGN

The proposed bundle has six core elements. First, every eligible patient should be identified before or at the start of the visit through a registry, electronic flag or nurse-led intake. Eligibility includes cardiology patients with known hypertension, diabetes, elevated clinic blood pressure, raised HbA1c, chronic kidney disease, coronary disease, heart failure or high cardiovascular risk.

Second, measurement should be standardised. This includes validated blood-pressure technique, HbA1c availability, renal function, urine albumin-creatinine ratio when appropriate, lipid profile and medication reconciliation. Third, risk should be stratified using cardiovascular history, kidney function, age, frailty, hypoglycaemia risk and treatment tolerance.

Fourth, therapy should be optimised at the same encounter whenever safe. For hypertension, this may involve dose titration, combination therapy, assessment of resistant hypertension, sodium reduction counselling and home blood-pressure review [1-4]. For diabetes, the cardiology visit should confirm that the patient is receiving a cardiovascular-risk-appropriate diabetes plan, including consideration of SGLT2 inhibitors or GLP-1 receptor agonists in eligible groups, while avoiding hypoglycaemia and respecting renal thresholds [5-8].

Fifth, the bundle should include patient activation: a concise explanation of targets, medicines, side effects, home monitoring and when to seek help. Sixth, follow-up should be closed-loop, meaning the clinic records who will contact the patient, when the next reading or laboratory result is due, and what action will be taken if the result remains uncontrolled.

A bundle fails when it becomes a form without clinical ownership. The model therefore requires role clarity. Nurses can perform pre-visit screening, blood-pressure technique and education. Pharmacists can reconcile medicines, identify adherence barriers, recommend titration and monitor safety.

Cardiologists can prioritise cardiovascular risk, confirm treatment choices and address complex contraindications. Dietitians and diabetes educators can support nutrition, weight and self-management. Primary care can maintain continuity between cardiology visits. This multidisciplinary structure is consistent with contemporary prevention practice, where the burden of risk-factor control cannot be carried by a single professional group [9,25,30].

Figure 1. Preventive care bundle pathway for cardiology patients with hypertension and diabetes.

The visual pathway presents a closed-loop model moving from identification and measurement to optimisation, counselling, follow-up and learning. It is intended to support reliable delivery rather than replace clinical judgement.

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Table 1. Preventive care bundle components for cardiology patients with coexisting hypertension and diabetes.

Bundle element	Action in the cardiology clinic	Clinical rationale	Quality indicator
Identify eligible patients	Flag hypertension, diabetes, high BP, raised HbA1c, coronary disease, heart failure or kidney disease before review.	Pre-visit recognition prevents missed prevention opportunities during symptom-focused consultations.	Percentage of eligible patients correctly flagged.
Measure reliably	Use validated BP technique; document HbA1c, eGFR, UACR, lipid profile, body mass index and smoking status.	Control decisions depend on trustworthy readings and complete risk information.	Percentage with complete same-day measurement set.
Optimise therapy	Review antihypertensive regimen, cardioprotective diabetes medicines, statins, renal safety and adherence.	Evidence-based intensification reduces cardiovascular and renal complications.	Percentage with documented treatment decision when uncontrolled.
Activate patients	Provide brief lifestyle advice, home BP instructions, medicine education and agreed self-management actions.	Behavioural change and adherence require understandable, repeated support.	Percentage receiving documented education and monitoring plan.
Close follow-up	Arrange pharmacist, nurse, primary-care, diabetes or cardiology review with a specific timeframe and escalation rule.	Uncontrolled risk factors require timely reassessment rather than delayed routine review.	Percentage with scheduled follow-up after abnormal result.

VII. QUALITY-IMPROVEMENT IMPLEMENTATION MODEL

Implementation should begin with a baseline audit. The clinic should identify the proportion of cardiology patients with documented blood pressure, most recent HbA1c, kidney function, urine albumin testing, lipid profile, smoking status, body mass index, medication reconciliation and follow-up plan.

Baseline control rates should be reported overall and by subgroup, including sex, age, region of residence, visit type and cardiovascular diagnosis. The purpose is not to blame clinicians; it is to reveal where the workflow is unreliable. A common finding in chronic disease care is that the evidence is known but not consistently delivered because measurement, escalation and follow-up are not embedded into routine systems.

The first testing cycle should be small. One cardiology clinic session per week can use the bundle for all eligible patients, with rapid feedback to the team. Early testing should measure feasibility: time added to the visit, missing laboratory data, patient comprehension, prescription issues, adverse events, staff workload and documentation completeness. The bundle can then be revised before expansion.

Digital tools should be simple. A dashboard displaying BP control, HbA1c review, renal assessment, lipid treatment and follow-up completion is more useful than an elaborate system that staff cannot maintain. Monthly team review can identify patients who remain uncontrolled and system steps that repeatedly fail.

Clinical inertia is a major target. Inertia occurs when abnormal findings are documented but not acted upon, or when treatment is deferred without a

planned review. A preventive bundle reduces inertia by creating default actions. If blood pressure is uncontrolled, the template asks whether measurement was confirmed, adherence checked, salt intake addressed, medicine intensified or home monitoring arranged.

If HbA1c is above the agreed target, the template asks whether cardioprotective therapy has been considered, whether hypoglycaemia risk is present and whether diabetes follow-up is arranged. The aim is not automatic prescribing; it is automatic consideration followed by documented clinical reasoning.

Equity should be built into implementation from the start. Saudi patients differ in travel distance, health literacy, family support, digital access and availability of specialised services. A tertiary urban pathway may not work in a smaller regional clinic unless remote monitoring, telephone follow-up and primary-care coordination are included. Home blood-pressure monitoring can reduce unnecessary visits, but only if patients receive training and if readings are reviewed.

Telehealth can improve continuity, but it should not exclude patients who lack digital confidence. The bundle should therefore include alternative follow-up modes and clear escalation routes for very high readings, symptoms, renal deterioration or medication intolerance.

VIII. CLINICAL CONTENT OF THE BUNDLE

Blood-pressure control begins with measurement quality. Incorrect technique can falsely label patients as controlled or uncontrolled, leading to undertreatment or overtreatment. The clinic protocol should require rest before measurement, appropriate cuff size, arm support, avoidance of conversation and repeated readings when the first value is high.

Home readings should be encouraged for patients with suspected white-coat effect, masked hypertension, resistant hypertension or medication adjustment. Patients need written instructions because home readings are only useful when timing, posture and recording are consistent. When home readings remain high, timely titration is preferable to waiting several months for the next routine cardiology review.

Medication optimisation should respect comorbidity. Patients with diabetes and albuminuria often benefit from renin-angiotensin system blockade unless contraindicated, while patients with heart failure require guideline-directed therapy that also influences blood pressure and glycaemia [6-8,28].

Diuretics, calcium-channel blockers and combination therapy remain important for hypertension control, but monitoring is required for renal function, electrolytes, orthostatic symptoms and adherence. In older or frail patients, overly aggressive targets may increase falls, syncope or kidney injury. The bundle should therefore include a tolerance check, not merely a numerical target.

Diabetes control within cardiology care should prioritise cardiovascular risk reduction. HbA1c remains necessary, but it should be interpreted alongside cardiovascular history, kidney function, body weight, hypoglycaemia risk and current medicines [5-8].

When a patient has established coronary disease, heart failure or chronic kidney disease, the cardiology team should verify whether therapies with cardiovascular or renal benefit are indicated and accessible. This requires coordination with diabetes care, because intensifying one medicine while another clinician adjusts glucose therapy may create confusion.

The bundle should document who owns each decision and when the patient will be reviewed.
Lifestyle intervention is often underdeveloped because it appears less urgent than prescribing. Nevertheless, it is central to both conditions. The bundle should include brief, repeatable counselling on sodium reduction, physical activity, weight management, smoking cessation, sleep, medication timing and culturally appropriate dietary patterns.

Counselling should be specific rather than generic. For example, patients can be asked to identify the main source of salt in their diet, name two days for

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DOI: https://doi.org/10.64388/IREV9I12-1719123

walking, bring medicines to the next visit and record home blood pressure for seven days before review. Small, documented actions are more likely to be implemented than broad advice that patients cannot translate into daily behaviour.

IX. MEASUREMENT FRAMEWORK

Quality improvement requires a balanced set of measures. Outcome measures should include the proportion of eligible patients with controlled clinic or home blood pressure, the proportion with HbA1c reviewed and within an individualised range, and the proportion with complete cardiovascular risk review.

Process measures should include accurate BP documentation, medication reconciliation, renal assessment, lipid review, lifestyle counselling and follow-up scheduling. Balancing measures are essential because improvement should not increase harm. These include symptomatic hypotension, hypoglycaemia, acute kidney injury, hyperkalaemia, emergency visits after medication changes and patient-reported treatment burden.

Measurement frequency should be realistic. Weekly review can be used during initial testing, while monthly reporting is more practical after implementation. Control charts or run charts can help distinguish random variation from real improvement. However, the dashboard should not become a bureaucratic exercise.

Measures must be discussed in team meetings, linked to patient lists and used to trigger action. A clinic that reports low BP control but cannot identify which patients need follow-up has not yet built an improvement system. Conversely, a clinic that can generate an actionable list of uncontrolled high-risk patients has created the foundation for targeted prevention.

Data definitions should be agreed before implementation. For blood pressure, the clinic must decide whether control is based on the last clinic average, a home average or a combined clinical judgement. For HbA1c, the denominator should include patients with diabetes who have had a result within a defined time window, and the target should be individualised.

For kidney protection, the denominator should identify patients with diabetes, hypertension or chronic kidney disease who need eGFR and albuminuria assessment. Clear definitions prevent misleading improvement and allow fair comparison across clinics.

Figure 2. Driver diagram for implementing the preventive care bundle.

The driver diagram links the improvement aim to primary drivers, secondary actions and outcome dashboard measures.

Table 2. Measurement framework for a cardiology clinic preventive care bundle.

Measure domain	Indicator	Numerator and denominator	Target and review cadence	Use in improvement
Outcome	Blood-pressure control	Patients with controlled BP divided by eligible hypertensive cardiology patients.	Locally agreed target; monthly review.	Shows whether the bundle improves the central clinical outcome.
Outcome	Diabetes review	Patients with current HbA1c and	Review monthly;	Prevents narrow

	and individualised control	documented target divided by eligible patients with diabetes.	target individualised.	focus on BP while missing glycaemic risk.
Process	Complete preventive bundle	Patients receiving all eligible bundle elements divided by all eligible patients.	Weekly during testing; monthly after scale-up.	Assesses reliability of the workflow.
Process	Timely medication action	Uncontrolled patients with documented titration, adherence action or reason for no change.	Monthly review.	Addresses clinical inertia and unclear ownership.
Balancing	Treatment-related harm	Patients with hypotension, hypoglycaemia, renal deterioration, hyperkalaemia or urgent review after medication change.	Continuous safety review.	Ensures improvement does not create avoidable harm.

X. DISCUSSION

The proposed bundle is clinically plausible because it aligns with the way cardiometabolic risk actually accumulates. Patients do not experience hypertension, diabetes, dyslipidaemia and kidney disease as separate guideline chapters; they experience them as one trajectory of fatigue, polypharmacy, symptoms, anxiety, cost and repeated appointments.

A cardiology clinic that addresses only the presenting cardiac complaint may miss the opportunity to change that trajectory. Conversely, a clinic that integrates measurement, treatment, education and follow-up can make prevention visible at every encounter.

Saudi evidence supports the need for such a model. National statistics and recent Saudi studies describe a high burden of diabetes, hypertension and cardiovascular disease, with regional variation and a need for prevention-oriented services [10-22]. The attached reference paper also uses a current-status and future-needs approach for Saudi health services, emphasising tailored services, multidisciplinary collaboration, telehealth, policy development and long-term follow-up; those structural themes are transferable to cardiometabolic prevention in cardiology clinics.

In this review, the same logic is applied to hypertension and diabetes control: the future need is not a single new medicine, but a reliable system that ensures evidence-based actions occur repeatedly.

The bundle also fits contemporary cardiovascular prevention. Guidelines now stress integrated risk-factor management, person-centred decisions and therapies that protect the heart and kidneys beyond simple glucose reduction [3-9]. This creates a strong rationale for cardiology participation in diabetes care, particularly for patients with established cardiovascular disease. However, implementation must avoid specialist overreach. The cardiology team should not duplicate endocrinology or primary care; it should close cardiovascular prevention gaps and communicate clearly. Shared care is effective only when the plan is explicit.

Several barriers are likely. Visit time is limited, and clinicians may perceive the bundle as an additional task. Laboratory results may be missing. Patients may not bring medicines or home readings. Some therapies may be limited by renal function, cost, side effects or patient preference.

There may be uncertainty about whether cardiology or primary care should intensify treatment. These barriers are not reasons to abandon the bundle; they are reasons to design it carefully. The most feasible bundle is one that reduces work by standardising it: staff know what to collect, clinicians know what decisions are expected, patients know what to monitor, and the dashboard shows who requires follow-up.

Medication adherence deserves particular attention. Non-adherence is not simply forgetfulness; it may reflect side effects, complex regimens, low health literacy, doubts about benefit, cost, fasting schedules, travel, depression or fragmented messages from different clinicians.

A preventive bundle should ask about adherence without blame and should simplify therapy whenever possible. Fixed-dose combinations, synchronised refills, pharmacist counselling and family-supported plans can reduce treatment burden. For patients with repeated uncontrolled readings, the first question should be whether the treatment plan is realistically usable.

The review has limitations. It is a narrative synthesis and does not provide pooled effect sizes. Saudi cardiology-specific intervention trials on combined hypertension and diabetes bundles remain limited, so the model is derived from guidelines, national data, broader evidence and quality-improvement principles.

The bundle should therefore be tested prospectively in a real clinic before large-scale adoption. Important outcomes would include control rates, medication changes, adverse events, patient experience, staff workload and sustainability after the initial implementation period. A stepped expansion across multiple regions would allow adaptation to urban and rural services while preserving shared definitions.

XI. FUTURE NEEDS AND RESEARCH PRIORITIES

Future work should move from description to implementation. The first priority is to test the bundle in a Saudi cardiology outpatient service using a pragmatic before-and-after design or cluster quality-improvement approach. The second priority is to assess which professional role produces the greatest improvement: nurse-led measurement, pharmacist-led titration, physician feedback, telehealth follow-up or combined team care. The third priority is to evaluate patient-reported experience, because control achieved through excessive treatment burden may not be sustainable. The fourth priority is to study regional adaptation, especially for clinics serving patients who travel long distances.

Digital health should be evaluated as an enabler rather than an assumption. Electronic prompts, patient portals and home-monitoring uploads can improve continuity, but only when they are simple, secure and integrated into clinical responsibility. A reading that enters a database but is never reviewed does not improve care.

Future Saudi studies should examine how remote blood-pressure monitoring, text reminders, pharmacist calls and primary-care linkage affect control, safety and patient confidence. Cost and workforce analyses are also needed because a bundle that depends on resources unavailable outside tertiary hospitals will not reduce national variation.

Implementation should also recognise that cardiology clinics differ in maturity, workforce and patient flow. In a tertiary centre, the bundle may be delivered through a nurse-pharmacist-physician sequence before the patient leaves the clinic. In a smaller hospital, the same content may be delivered through a simpler route: nurse measurement, physician decision, pharmacist telephone follow-up and primary-care continuation.

The essential feature is not the number of professionals present, but the reliability of the handover. Each patient should leave with a written plan that states the current BP category, the most recent HbA1c or date due, the medicines changed or deliberately not changed, the safety tests required and the next contact point.

Governance is equally important. A bundle should be owned by the cardiology department, but it should be endorsed by hospital quality leadership and linked to diabetes, nephrology, pharmacy and primary-care services. Local leaders should define escalation thresholds, for example very high BP with symptoms, recurrent hypoglycaemia, falling eGFR, marked albuminuria, suspected secondary hypertension or repeated non-attendance.

These thresholds protect patients and reassure staff that routine bundle work is supported by specialist

pathways. Training should be short, repeated and practical: one session on BP technique, one on medicines and safety, one on patient explanation, and one on documentation. Competency checks can be built into routine supervision rather than treated as a separate programme.

Patient experience should be measured from the outset because prevention fails when it feels confusing or punitive. Patients should be asked whether they understand their targets, whether the medicine schedule is manageable, whether side effects are limiting adherence, whether they can obtain medicines and whether they know whom to contact after abnormal home readings.

Family members may support diet, monitoring and appointment attendance, and their involvement can be invited when the patient agrees. During Ramadan, travel, intercurrent illness or major social events, the plan may need temporary adjustment. This flexibility should be documented, because personalised care is safer than rigid target chasing.

Sustainability requires visible feedback. A monthly one-page report can show control rates, bundle completion, medicine intensification, follow-up completion and safety events. The report should be discussed at the clinic huddle, not stored passively. Teams should select one weak point each month, such as missing albuminuria tests or delayed home BP review, and test a focused change.

Over time, the bundle can mature from a checklist into a learning system. The strongest signal of success will be when clinicians use the data to find patients before complications occur, rather than using data only to describe missed opportunities after the fact.

Economic evaluation should accompany clinical testing. The bundle may require staff time, training and remote contact, but these costs should be interpreted against fewer emergency visits, fewer complications and more efficient specialist appointments.

A practical evaluation can measure time per visit, number of additional contacts, medication costs, laboratory use, admissions and patient travel burden. It should also examine opportunity cost: if a pharmacist prevents repeated uncontrolled BP visits, physician capacity may be released for complex diagnostic and procedural decisions. Such evidence would help hospital leaders decide whether the bundle should remain local, expand within a region or become a national cardiology quality metric.

Finally, research should explore which patients benefit most. High-risk groups may include those with recent admission, uncontrolled systolic BP, long diabetes duration, albuminuria, heart failure, polypharmacy, low health literacy or poor follow-up access. Targeting these groups first may improve clinical value while keeping the early workload manageable.

Later phases can extend the bundle to lower-risk patients through automated reminders and primary-care shared protocols. This staged design protects feasibility while preserving wider clinical ambition.

XII. CONCLUSION

Hypertension and diabetes control among cardiology patients in Saudi Arabia should be treated as a core preventive cardiology function. The evidence from 2020-2025 supports accurate measurement, integrated cardiovascular risk assessment, individualised targets, cardioprotective therapy, lifestyle support, adherence review and timely follow-up.

A preventive care bundle can convert these recommendations into a practical clinic workflow. The proposed model identifies eligible patients, measures reliably, stratifies risk, optimises treatment, activates patients and closes the follow-up loop through an auditable dashboard.

Its value lies in reliability: the same high-risk patient should receive the same essential preventive actions regardless of appointment pressure or clinic location. Prospective testing in Saudi cardiology services is now needed to determine effectiveness, safety, workforce implications and scalability.

REFERENCES

[1] World Health Organization. Guideline for the pharmacological treatment of hypertension in adults. Geneva: World Health Organization; 2021.

[2] Alhabeeb W, Tash AA, Alshamiri M, Arafat M, Balghith MA, Almasood A, et al. National Heart Center/Saudi Heart Association 2023 Guidelines on the Management of Hypertension. J Saudi Heart Assoc. 2023;35(1):16-39. doi:10.37616/2212-5043.1328.

[3] McEvoy JW, McCarthy CP, Bruno RM, Brouwers S, Canavan MD, Ceconi C, et al. 2024 ESC Guidelines for the management of elevated blood pressure and hypertension. Eur Heart J. 2024;45(38):3912-4018. doi:10.1093/eurheartj/ehae178.

[4] Mancia G, Kreutz R, Brunström M, Burnier M, Grassi G, Januszewicz A, et al. 2023 ESH Guidelines for the management of arterial hypertension. J Hypertens. 2023;41(12):1874-2071. doi:10.1097/HJH.0000000000003480.

[5] American Diabetes Association Professional Practice Committee. Standards of Care in Diabetes-2025. Diabetes Care. 2025;48(Suppl 1): S1-S350. doi:10.2337/dc25-SINT.

[6] American Diabetes Association Professional Practice Committee. Cardiovascular disease and risk management: Standards of Care in Diabetes-2025. Diabetes Care. 2025;48(Suppl 1): S207-S238. doi:10.2337/dc25-S010.

[7] Marx N, Federici M, Schütt K, Müller-Wieland D, Ajjan RA, Antunes MJ, et al. 2023 ESC Guidelines for the management of cardiovascular disease in patients with diabetes. Eur Heart J. 2023;44(39):4043-4140. doi:10.1093/eurheartj/ehad192.

[8] Kidney Disease: Improving Global Outcomes Diabetes Work Group. KDIGO 2022 Clinical Practice Guideline for Diabetes Management in Chronic Kidney Disease. Kidney Int. 2022;102(5S): S1-S127.

[9] Visseren FLJ, Mach F, Smulders YM, Carballo D, Koskinas KC, Bäck M, et al. 2021 ESC Guidelines on cardiovascular disease prevention in clinical practice. Eur Heart J. 2021;42(34):3227-3337. doi:10.1093/eurheartj/ehab484.

[10] Tash AA, Al-Bawardy RF. Cardiovascular Disease in Saudi Arabia: facts and the way forward. J Saudi Heart Assoc. 2023;35(2):148-162. doi:10.37616/2212-5043.1336.

[11] Alqahtani BA, Alenazi AM. A national perspective on cardiovascular diseases in Saudi Arabia. BMC Cardiovasc Disord. 2024; 24:184. doi:10.1186/s12872-024-03845-8.

[12] AL-Rasheedi M, Alhazmi Y, AlDaiji LA, AlDaiji LA, Mobarki FI, Almuhaysini KM, et al. Status of diabetes mellitus in different regions of KSA and update on its management. Front Clin Diabetes Healthc. 2024; 5:1482090. doi:10.3389/fcdhc.2024.1482090.

[13] Alharbi AA, Alharbi AA, Al-Dubai SA. Inter-relation between diabetes mellitus and hypertension in terms of incidence and prediction in Saudi Arabia: a retrospective cohort study. BMC Public Health. 2024; 24:1956. doi:10.1186/s12889-024-19471-0.

[14] General Authority for Statistics. Health Status Statistics Publication 2024. Riyadh: General Authority for Statistics; 2024.

[15] International Diabetes Federation. Saudi Arabia diabetes report 2024. Brussels: International Diabetes Federation; 2024.

[16] Public Health Authority. High-Impact Interventions to Reduce Non-Communicable Diseases in Saudi Arabia. Riyadh: Public Health Authority; 2024.

[17] Public Health Authority. Saudi Health Promotion and Prevention Guideline for Hypertension. Riyadh: Public Health Authority; 2021.

[18] Public Health Authority. Saudi Health Promotion and Prevention Guideline for Diabetes Mellitus. Riyadh: Public Health Authority; 2025.

[19] Alhabib KF, Batais MA, Almigbal TH, Alshamiri MQ, AlTaradi H, Rangarajan S, et al. Demographic, behavioral, and cardiovascular disease risk factors in the Saudi population: results from the PURE-Saudi study. BMC

Public Health. 2020; 20:1213. doi:10.1186/s12889-020-09298-w.

[20] Yagoub U, Saiyed NS, Al Qahtani B, Al Zahrani AM, Birema Y, Al Hariri I. Investigating the incidence and risk factors of hypertension: a multicentre retrospective cohort study in Tabuk, Saudi Arabia. PLoS ONE. 2022;17(1): e0262259. doi: 10.1371/journal.pone.0262259.

[21] Alenazi AM, Alqahtani BA, Alhowimel AS, Alenazi AM, Elnaggar RK. National and regional prevalence rates of hypertension in Saudi Arabia. Front Public Health. 2023; 11:1092905. doi:10.3389/fpubh.2023.1092905.

[22] Alqahtani BA, Elnaggar RK, Alshehri MM, Khunti K, Alenazi AM. National and regional prevalence rates of diabetes in Saudi Arabia: analysis of national survey data. Int J Diabetes Dev Ctries. 2023; 43:363-370. doi:10.1007/s13410-022-01092-1.

[23] NCD Risk Factor Collaboration. Worldwide trends in hypertension prevalence and progress in treatment and control from 1990 to 2019. Lancet. 2021;398(10304):957-980. doi:10.1016/S0140-6736(21)01330-1.

[24] NCD Risk Factor Collaboration. Worldwide trends in diabetes prevalence and treatment from 1990 to 2022: pooled analysis of 1108 population-representative studies. Lancet. 2024;404(10467):2077-2093. doi:10.1016/S0140-6736(24)02317-1.

[25] Gastens V, Tancredi S, Bonnan D, Kiszio B, Del Giovane C, Tsuyuki RT, et al. Pharmacist interventions to improve hypertension management among patients with diabetes: a systematic review and meta-analysis of randomized controlled trials. BMC Health Serv Res. 2025; 25:1268. doi:10.1186/s12913-025-13461-7.

[26] Rabi DM, McBrien KA, Sapir-Pichhadze R, Nakhla M, Ahmed SB, Dumanski SM, et al. Hypertension Canada's 2020 Comprehensive Guidelines for the Prevention, Diagnosis, Risk Assessment, and Treatment of Hypertension in Adults and Children. Can J Cardiol. 2020;36(5):596-624. doi: 10.1016/j.cjca.2020.02.086.

[27] German CA, Baum SJ, Ferdinand KC, Gulati M, Polonsky TS, Toth PP, et al. Defining preventive cardiology: a clinical practice statement from the American Society for Preventive Cardiology. Am J Prev Cardiol. 2022; 12:100432. doi: 10.1016/j.ajpc.2022.100432.

[28] Heidenreich PA, Bozkurt B, Aguilar D, Allen LA, Byun JJ, Colvin MM, et al. 2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure. Circulation. 2022;145(18): e895-e1032. doi:10.1161/CIR.0000000000001063.

[29] Virani SS, Newby LK, Arnold SV, Bittner V, Brewer LC, Demeter SH, et al. 2023 AHA/ACC/Multisociety Guideline for the Management of Patients with Chronic Coronary Disease. Circulation. 2023;148(9): e9-e119. doi:10.1161/CIR.0000000000001168.

[30] Lloyd-Jones DM, Allen NB, Anderson CAM, Black T, Brewer LC, Foraker RE, et al. Life's Essential 8: updating and enhancing the American Heart Association's construct of cardiovascular health. Circulation. 2022;146(5): e18-e43. doi:10.1161/CIR.0000000000001078.