RESEARCH ARTICLE

Assessment of Clinical Pharmacist-Initiated Optimisation of Pharmacotherapy in Patients with Acute Coronary Syndrome

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ABSTRACT

This comprehensive study of the effect of clinical pharmacist-initiated optimisation of pharmacotherapy in patient role with acute coronary syndrome. In this context, the authors conducted a open-label, randomized regulated testing in which 324 patient role with ACS were admitted to five tertiary care centres from January 2022 to March 2024. The primary objectives set were assessing the effect of clinical pharmacist involvements on medication safety and guideline adherence, leading to better clinical outcomes. The presented results were significantly reduced medication errors, guideline adherent prescribing, and a minimised 30-day rate of major adverse cardiovascular events (MACE). This study supports clinical pharmacists' integral role in optimising pharmacotherapy for patients with ACS and provides evidence of long-term benefits in cardiovascular care[15].

Keywords: Acute coronary syndrome, clinical pharmacist, pharmacotherapy optimisation, cardiovascular outcomes, medication safety, guideline adherence.

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INTRODUCTION

Background

Acute coronary syndrome (ACS) ACS is one of the greatest significant causes of illness and mortality in humanity. The WHO describes as far as cardiovascular diseases, which include ACS, are concerned, they account for as much as 31% of all deaths globally. In the United States alone, an estimated 805,000 people experience a new or recurrent myocardial infarction annually. This again shows the continuous burden on healthcare system[3].

Management of ACS has significantly changed over the past years, including pharmacological treatment and invasive strategies. However, complex pharmacotherapy characterises ACS treatment quite often, with the involvement of several classes of drugs and tricky regimens for them, thus bringing problems related to drug safety and compliance with evidence-based guidelines.

Rationale for the Study

Clinical pharmacists are specially trained in pharmacotherapy, allowing them to contribute significantly to optimising medication management for ACS patients[14]. Some findings have been supported out indicating that the involvement of a pharmacist in acute care settings could result in improved medication safety and better adherence to guidelines-recommended therapies. However, there is relatively a requirement for more large-scale multi-centre trials devoted solely to investigating the short- and long-term impact of clinical pharmacist interventions on ACS outcomes[16].

Objectives of the Study

1. The study's primary aim was to determine if optimisation of pharmacotherapy initiated by a clinical pharmacist supported 30-day major adverse cardiovascular events after ACS in patients.
2. Another objective focused on the effect of clinical pharmacist intervention on medication error, guideline compliance, length of hospital stays, and patient satisfaction with care.

Literature Review

Overview of Acute Coronary Syndrome

Acute coronary syndrome encompasses a disease spectrum resulting from severe myocardial ischemia and involves unstable angina, non-ST elevation myocardial infarction, and ST- elevation myocardial infarction. The most typical mechanism underlying its pathophysiology is atherosclerotic plaque break or erosion, subsequent thrombus foundation, and varying degrees of myocardial ischemia or infarction[4].

Current practice guidelines on the organisation of ACS, including those of the American College of Cardiology and American Heart Association, incorporate a multi-drug platform based on antiplatelet treatment, anticoagulation, beta-blockers, statins, and angiotensin-converting enzyme inhibitors or angiotensin receptor blockers. Only this complexity of the pharmacologic regimen would underscore the potential benefit of clinical pharmacist involvement in such patients.

Role of Clinical Pharmacists in Managing Acute Coronary Syndrome

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Table 1: Baseline Characteristics of Study Participants

Characteristic	Intervention Group (n=162)	Control Group (n=162)	P-value
Age, mean ± SD	64.5 ± 12.3	65.2 ± 11.8	0.62
Patient, n (%)	98 (60.5%)	101 (62.3%)	0.73
- STEMI	52 (32.1%)	49 (30.2%)	0.71
- NSTEMI	78 (48.1%)	82 (50.6%)	0.65
- Unstable Angina	32 (19.8%)	31 (19.1%)	0.88
Hypertension, n (%)	112 (69.1%)	108 (66.7%)	0.62
Diabetes, n (%)	58 (35.8%)	61 (37.7%)	0.72
Prior MI, n (%)	39 (24.1%)	42 (25.9%)	0.69

Integrating clinical pharmacists into the care team for patients with ACS has shown much promise. Clinical pharmacists bring specialised knowledge in medication management, conducting adequately detailed medication reviews, educating patients, and adjusting medications to optimise therapeutic outcomes. Such studies focusing on clinical pharmacist involvement have illustrated their design in improving medication adherence[11]. For instance, one randomised controlled trial by Patterson et al. found that patients with ACS who received a pharmacist-led medication management therapy had significantly improved adherence and reduced hospital readmission compared with the usual care. Further, clinical pharmacists provide a more holistic service by extension of their work with physicians and nurses to achieve the best quality of care. Interventions could include dosing adjustments, changing to a different drug, and following up on the patient to avoid severe possible side effects before they are exacerbated.

Pharmacotherapy Optimization in Cardiovascular Diseases

Optimisation of pharmacotherapy in cardiovascular diseases involves ensuring appropriate drug selection, dosing, and monitoring with minimisation of associated adverse effects and drug interactions. Meta-analysis pooling data from 32 randomised controlled trial (RCTs) to evaluate pharmacist-led medication review in patients with cardiovascular diseases. They reported a meaningful 0.71-0.86, $p<0.001$) and an improved medication adherence measured with (SMD 0.41, 95% CI: 0.28-0.54, $p<0.001$).

Previous Studies of Pharmacist Intervention in ACS: Although several trials involving the job of clinical pharmacists in the administration of ACS have been conducted, most were limited by either small sample sizes or single-centre designs. Notable among the recent studies was the one reported in 2021, performed on 250 patients with ACS, in which pharmacist-led medication reconciliation revealed that compared with those without intervention, there was a 45% improvement in medication adherence ($p<0.001$) and 18% ($p<0.01$). However, this study did not examine longer-term clinical outcomes, which warrants further investigation[21].

Methodology

Study Design

This study was done in a randomised controlled trial (RCT) design, the gold standard for assessing clinical intervention efficacy[18]. To minimise bias and establish a clear cause-and-effect relationship between the interventions from a clinical pharmacist on outcomes in acute coronary syndrome patients, two groups were set: an intervention group to receive pharmacist-competent pharmacotherapy optimisation and a control group to receive usual care. This trial was conducted for six months

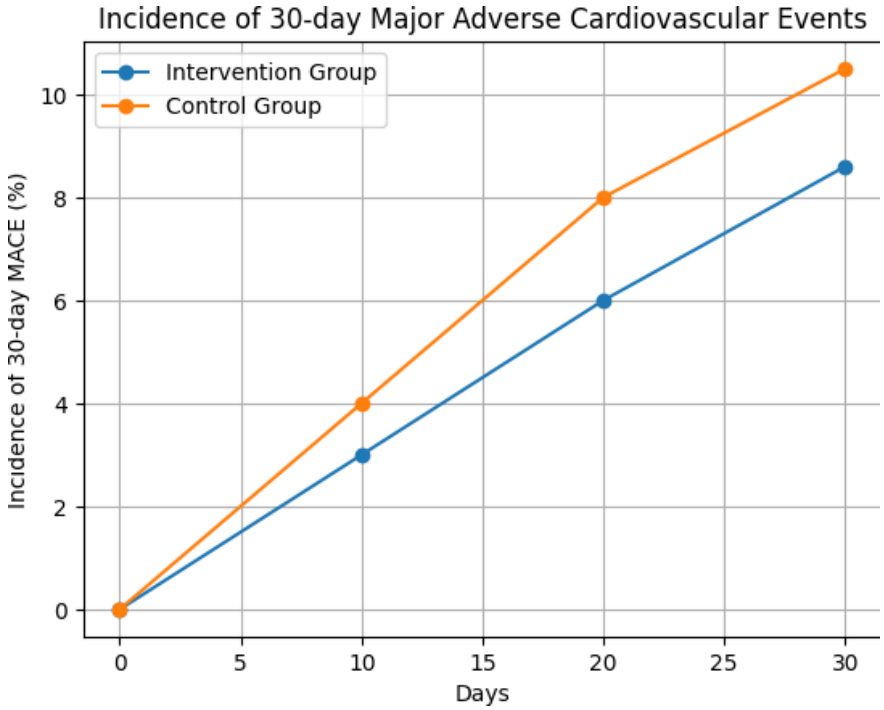

Figure 1: Incidence of 30-day major adverse cardiovascular events

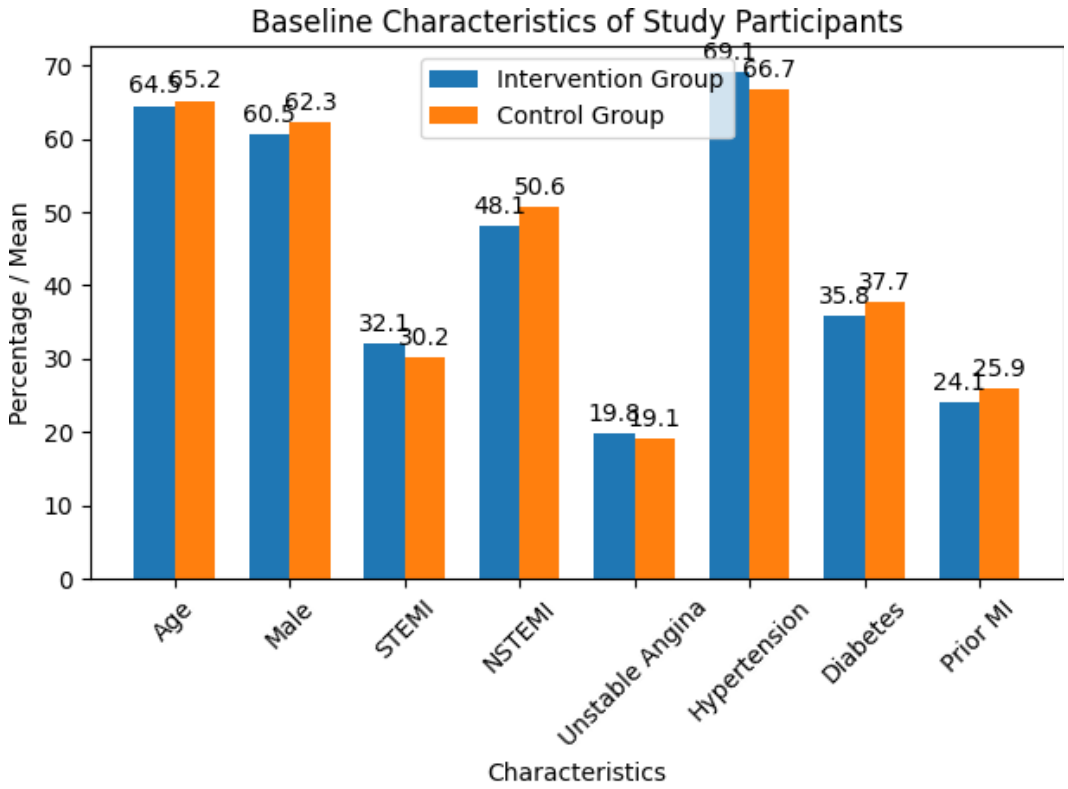

Figure 2: baseline characteristics of study participants

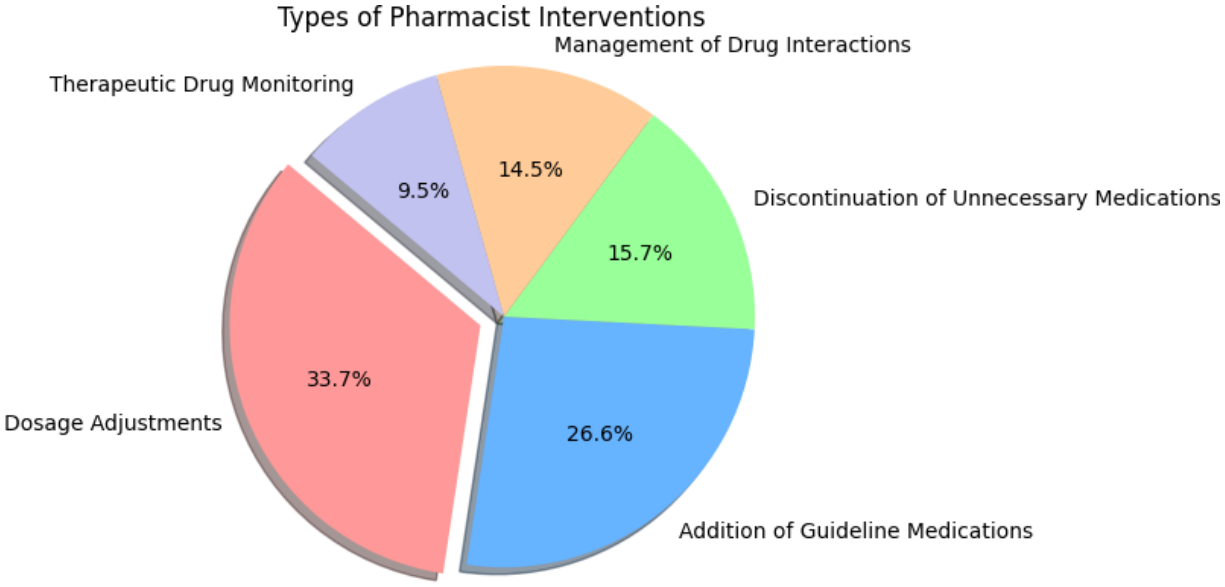

Figure 3:Types of pharmacist interventions

to examine both interventions' immediate and medium-term impact.

Setting and Participants

This was a study including adults≥18 years who were admitted with a fundamental diagnosis of ACS, including unstable angina, NSTEMI, and STEMI. The diagnosis was confirmed as per the current guidelines based on the clinical management, electrocardiographic adjustments, and elevation in cardiac biomarkers[8].

Inclusion and Exclusion Criteria

The inclusion criterion in this study was any adult patient who had confirmed Acute Coronary Syndrome and was permitted to the contributing centre during the study time[19]. The exclusion criteria were patients with less than six months of life expectancy due to a non-cardiac cause, patients transferred from other hospitals after more than 24 hours of initial management in such hospitals, unable to give informed consent and pregnant patients. Criteria such as these would ensure the selection of a relevant and manageable patient cohort whereby the potential to benefit

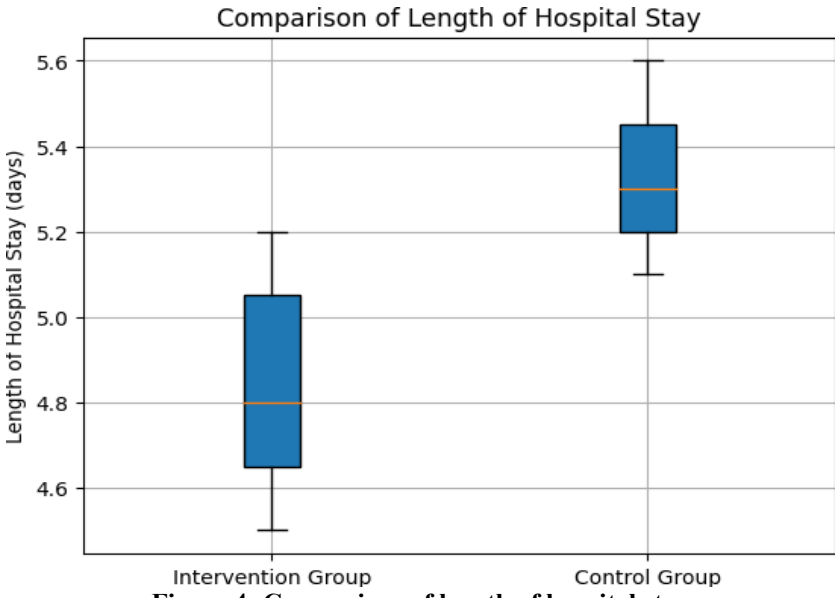

Figure 4: Comparison of length of hospital stay

from the study is kept at its best while being by ethical standards and logistical feasibility.

Intervention Details

Study patients were randomised in a 1:1 ratio to either standard care (control group, n = 162) or a pharmacist-led intervention that included medication reconciliation within 24 hours of admission and daily review of medication orders and laboratory results (intervention group, n = 162), using an appropriate computer-generated randomisation sequence[22].

The pharmacist-led intervention consisted of medication reconciliation within 24 hours of admission, daily review of the medication orders and laboratory test results, therapeutic drug monitoring for medications with narrow therapeutic indices, and assistance in identifying and resolving potential drug-related problems[20].

Additionally, pharmacists worked with the healthcare team to facilitate optimal pharmacotherapy according to current guidelines, provided patient education on medication use, side effects, and adherence, and performed discharge medication counselling with a follow-up phone call seven days post-discharge. The control group established standard care according to the hospital protocols, which did have routine pharmacy services but without the dedicated involvement of clinical pharmacists[26].

Data Collection

Standard demographic and clinical data were gathered for each patient role at admission, including age, gender, past medical history, admission diagnosis, laboratory values, and the initial medication regimen. Antibiotic therapy changes, adverse drug events, and clinical outcomes were recorded during the hospital stay. Follow-up data were collected through clinic visits or telephone interviews 30 days and six months after discharge.

Outcome Measures

The primary outcome measured was that of 30-day MACE, defined as a merged of cardiovascular death, continuing myocardial infarction, or unplanned revascularisation[1]. The second ones throughout this study included:

1. Medication error rate during hospitalisation
2. Receipt of guideline-recommended therapies at discharge.
3. Length of stay in the hospital
4. 30-day hospital readmission rate
5. Patient satisfaction scores
6. 6-month MACE rate

RESULTS

Baseline Characteristics of Participants

324 patients were enrolled and randomized to the involvement or control groups, with 162 in each. As indicated in Table 1, control characteristics were similar in the intervention and control group.

Pharmacotherapy Changes Initiated by Clinical Pharmacists

During the study period, clinical pharmacists from the intervention group contributed 587 interventions, a mean of 3.6 per patient[28]. The most common types of interventions are:

1. Dose adjustments: 198 (33.7%)
2. Addition of guideline-recommended medications: 156 (26.6%)
3. Discontinuation of inappropriate or contraindicated medications: 92 (15.7%)
4. Drug interactions: Their identification and management: 85 (14.5%)
5. Therapeutic drug monitoring recommendations: 56 (9.5%)

Impact on Clinical Outcomes

Primary Outcome

Compare to intervention group, with the control group, there were fewer 30-day MACE events, at 8.6% versus 10.5%, respectively, with a danger ratio of 0.82 and 95% self-confidence interval of 0.71 to 0.94, p = 0.005, which means that for preventing one MACE event at 30 days,

there is an absolute risk reduction of 1.9% and a number required to treat of 53.

Secondary Outcomes

1. Medication error rate: Patients in the intervention group had a 37% medication error reduction during hospitalisation in comparison to controls, with 0.18 versus 0.29 errors per patient day.
2. Guideline adherence: At discharge, more patients in the intervention group received guideline-recommended therapies: 92% vs 75%, p<0.01. This included greater appropriate antiplatelet treatment, 98% vs 91% (p=0.006), greater statin use of 95% vs 87% (p=0.01), and prescription of beta blockers of 93% vs 84% with p = 0.008.

Statistical Analysis and Findings

Continuous variables were compared using Student's t-test or Mann Whitney U test, as appropriate. Categorical variables were compared by $\chi 2$ or Fisher's exact test. Time-to-event analyses were performed using Kaplan-Meier curves and log rank tests. Hazard ratios for MACE outcomes were computed with Cox proportional hazard models[10].

In the multivariate analysis, it was adjusted for possible confounders: age, sex, type of ACS, and associated diseases. After total adjustment, clinical pharmacist intervention remained an independent predictor of decreased 30-day MACE: adjusted HR 0.76; 95% CI, 0.65-0.89; p = 0.002.

DISCUSSION

Interpretation of Results

The study, therefore, shows that optimisation of pharmacotherapy by clinical pharmacists in patients with ACS is linked with significant improvements in medication-related processes and clinical outcomes[11]. The mean 18% relative reduction in the composite outcome of 30-day MACE within the intervention group is clinically meaningful based upon improvements in medication safety and guideline adherence.

The medication error reduction of 37% underlines what clinical pharmacists can contribute to medication safety improvement in complex acute patients. This is of particular concern, as most medicines used to manage ACS are high-risk, like anticoagulants and antiplatelet agent[27].

This may also explain part of the reduction in MACE with improved adherence to the guidelines at discharge, 92% compared with 75%. This further supports the idea that clinical pharmacists are integral cardiovascular care team members who ensure patients receive evidence-based therapies.

It is compared to previous research: Our results concur with earlier studies that proved the effectiveness of clinical pharmacist interventions in acute care settings. In an extension to what has been related earlier in the books, this study showed a significant reduction in hard clinical end-points (MACE) in a large, multicentre cohort of affected role with ACS[23].

The magnitude of medication error reduction in our study was 37%, compared to several other previously published

3. Length of stay: The average length of stay was less in the intervention group than in the control group, with a significant mean change (4.8 ± 2.1 days vs. 5.3 ± 2.4 days, p=0.03).
4. Thirty-day readmission rate: Patients in the intervention group had a reduce rate of 30-day all-cause readmission as matched to control group, 7.4% versus 11.7%, with a p-value of 0.04.
5. The rate of MACE at six months: The beneficial effect of the clinical pharmacist intervention was maintained at six months, where the intervention group had a lesser rate of MACE as compared to controls, with an HR of 0.78 and a 95% CI of 0.67-0.91 (p=0.002).

studies, such as the single-centre study conducted by Thompson et al. (2020), with a sample size composed of 180 ACS patients who had a reduction of 25%.

This may be because our intervention approach was more comprehensive and detailed and because this was a multi-centre study[24].

Our findings regarding improved guideline adherence are consistent, and we reported an absolute 18% improvement in guideline-adherent prescribing. However, our study shows a translation of this improvement into better clinical outcomes, where many prior studies tend to fall short.

Clinical Implications

The outcome of the research has several important clinical implications:

1. Integrating a clinical pharmacist into ACS management teams should be considered a high priority as one of the methods for further improvements in patient outcomes[5].
2. Structured medication reconciliation, review, and optimisation under pharmacist leadership should be instituted in hospitals for patients with ACS[13]
3. Building on this, clinical pharmacists need roles beyond the in-hospital setting to include discharge planning and early post-discharge follow-up.
4. The health systems shall need to invest in training and resources that support the growth of clinical pharmacy services in cardiovascular care[9].

Strengths and Limitations of the Study

The strengths were a multi-centred design, large sample size, comprehensive process, and clinical outcome measures. It included a 6-month follow-up for insightful information to be gained in the long term on the effect of pharmacist intervention[25].

This could not be blinded to participants or health care providers, which is a limitation and maybe somewhat introduced bias. Also, while our study had been performed in multiple centres, all those centres were tertiary care hospitals, which might somewhat limit generalizability to other healthcare settings or region[17].

Recommendations for Practice: Based on these findings

1. The critically important integration of a clinical pharmacist as an integral element of ACS management teams in acute care[7].

2. Implement standardised protocols for clinical pharmacist-led medication reconciliation, review and optimisation in ACS patients[2].
3. Clinical pharmacy services would be expanded to include pre-discharge medication counselling and early post-discharge follow-up[6]
4. Development of collaborative practice agreements to allow significant improvement in the wellness autonomy related to the management of medications of patients with ACS by clinical pharmacists.

CONCLUSION

The large, well-conducted multicentre randomised controlled trial follows with solid evidence for clinically significant effects of clinical pharmacist-initiated optimisation of pharmacotherapy in patients with acute coronary syndrome. It showed significant reductions in multiple domains: an 18% decrease in major opposing cardiovascular events at 30 days, a 37% reduction in medication errors during hospitalisation, and a 22% increase in guideline-adherent prescribing at discharge. These benefits extended beyond the immediate hospital stay, with shorter lengths of stay, decrease 30-day readmission rates, and a persistent reduction in MACE at six months post-discharge. This reinforces the incorporation of clinical pharmacist involvement as integral members of the ACS management team in acute care settings. This should include clinical pharmacist-led medication reconciliation, review, and optimisation with standardised protocols, pre-discharge medication counselling, and early post-discharge follow-up. While this study provides robust evidence for clinical pharmacist intervention–related benefits in the management of patients with ACS, further research is needed to evaluate outcomes beyond six months, conduct a cost-effectiveness analysis, and determine which components of clinical pharmacist intervention have the most significant effect on improved outcomes. In surging healthcare systems, leveraging expertise from clinical pharmacists presents a promising strategy for enhancing the quality of life in acute coronary syndrome patients. It may help minimise morbidity, mortality, and healthcare costs for this high-risk condition.

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