Review

Racial and Ethnic Disparities in Primary Prevention of Cardiovascular Disease

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ABSTRACT
Cardiovascular disease (CVD) disproportionately affects ethnic-minority groups globally. Ethnic-minority groups face particularly high CVD burden and mortality, exacerbated by disparities across modifiable risk factors, wider determinants of health, and limited access to preventative interventions. This narrative review summarizes evidence on modifiable risk factors, such as physical activity, hypertension, diet, smoking, alcohol consumption, diabetes, and the polypill for the primary prevention of CVD in ethnic minorities. Across these factors, we find inequities in risk factor prevalence. The evidence underscores that inequalities in accessibility to interventions and treatments impede progress in reducing CVD risk using primary prevention interventions for ethnic-minority people. Although culturally tailored interventions show promise, further research is required across the different risk factors. Social determinants of health and structural inequities also exacerbate CVD risk for ethnic-minority people and warrant greater research efforts.

Racial and ethnic disparities in primary prevention of cardiovascular disease

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RESUMÉ
Les maladies cardiovasculaires (MCV) affectent de manière disproportionnée les groupes de minorités ethniques dans le monde. Ces groupes sont confrontés à une mortalité et des contraintes liées aux MCV particulièrement élevées, exacerbées par les disparités entre les facteurs de risque modifiables, les déterminants de la santé au sens large et un accès limité aux interventions de prévention. Cette revue narrative résume les données probantes concernant les facteurs de risque modifiables, tels que l’activité physique, l’hypertension, l’alimentation, le tabagisme, la consommation d’alcool, le diabète et la multipilule pour la prévention primaire des MCV chez les minorités ethniques. Considérant l’ensemble de ces facteurs, nous constatons des inégalités dans la prévalence des facteurs de risque. Les données disponibles soulignent que les inégalités d’accès aux interventions et aux traitements entravent les progrès réalisés dans la réduction des risques de MCV au moyen d’interventions de prévention primaire chez
Cardiovascular disease (CVD) is a global health concern and is responsible for a third of deaths worldwide. Over the past 100 years, the rates of CVD mortality have been rising, and it has become the leading cause of morbidity and mortality globally.\(^1\) Of particular concern is the staggering 80% of deaths due to CVD occurring in low- and middle-income countries (LMICs).\(^2\)

An epidemiologic transition of death and morbidity caused by infectious and/or communicable and nutrition-deficiency diseases to death and morbidity caused by non-communicable diseases (NCDs)\(^1\) that has happened in developed countries is now occurring in LMICs. Following this transition to NCDs in developed countries, the rate of morbidity and mortality increased until the implementation of public health efforts and preventive medicine led to a declining rate of CVD mortality.\(^3\) This transitional period in LMICs has meant a similar accelerating prevalence and incidence of CVD,\(^4,5\) particularly in ethnic groups,\(^3\) despite recent knowledge and treatments for primary and secondary prevention.\(^6\) An interesting finding is that in developed countries, such as the US and the United Kingdom (UK), where this epidemiologic transition has already occurred, ethnic minorities are still at higher risk of developing CVD than are their White counterparts.\(^7\) Further data on CVD risk and age-standardized disability-adjusted life-years (DALYs) globally are available in Figure 1.\(^7\)

Primary prevention is an essential contributor to reducing the morbidity and mortality associated with CVD. Unfortunately, many CVD deaths occur in patients with atherosclerotic CVD (ASCVD) but without a known CVD diagnosis\(^10\) and are preventable by addressing certain risk factors.\(^11\) Alongside exercise and alcohol consumption, the other 5 important modifiable risk factors in CVD are body mass index, systolic blood pressure (SBP), non-high-density lipoprotein (non-HDL) cholesterol, a history of smoking, and diabetes.\(^11,12\) Primary prevention of cardiovascular disease guidelines from 2019\(^13\) suggested a number of evidence-based primary prevention strategies to prevent ASCVD (Table 1).\(^13\)

Disparities in CVD risk span multiple risk factors, affecting particularly South Asian patients who face higher CVD risk than the White European population.\(^14,15\) These health inequalities demand urgent redress, and primary prevention will be a key enabler to reduce ethnic inequalities in CVD prevalence and incidence. Although prevention guidelines are available for the general population,\(^16\) and specifically for women,\(^17\) no specific primary prevention of CVD recommendations have been made for ethnic-minority populations.

Understanding factors that influence health and healthcare is critical, particularly from the lens of primary prevention. An essential distinction to make is that between risk factors under individual control and those influenced by wider determinants of health. Patient-centred factors, such as diet and exercise, fall within the realm of individual control and are important for CVD health. The wider determinants are those outside the control of individuals, such as a broader set of social, economic, environmental, and political factors. We focus on primary prevention in ethnic minorities and how modifiable risk factors and wider determinants of health influence CVD risk.

### Modifiable Risk Factors

#### Exercise

Physical activity (PA) is cardioprotective and normalizes elevated blood pressure (BP), improves insulin sensitivity, and can improve blood lipid profiles.\(^12,18,19\) The World Health Organization (WHO)\(^20\) recommends exercise levels for health benefit of between 2.5 and 5 hours of moderate intensity, or between 1.25 and 2.5 hours a week of vigorous activity. However, this level of PA is rarely achieved. Globally, insufficient PA ranged from 16.3% (95% confidence interval [CI]: 14.3%, 20.7%) in Oceania to 39.1% (95% CI: 37.8%,

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40.6%) in Latin America and the Caribbean in 2016,\textsuperscript{21} with evidence of stark regional and country-level inequalities in PA.\textsuperscript{22} For example, Saudi Arabia displays differences in activity (3100 steps) compared to Japan (5800 steps), a difference of over 50%.\textsuperscript{22} Likewise, in the US, PA inequalities are found even within a given state, as for example, between walkable cities such as San Francisco, compared to other less walkable cities, such as Fremont.\textsuperscript{22}

A universally accepted finding is that exercise protects against the development of CVD,\textsuperscript{23} even in older age groups,\textsuperscript{24} yet high levels of physical inactivity across ethnic groups is of growing concern, particularly as it is important in CVD prevention.\textsuperscript{18} Across the world, an epidemic of physical inactivity has led to below-recommended PA levels in ethnic minorities in South Asia,\textsuperscript{25,26} the US,\textsuperscript{27} and South America.\textsuperscript{28} The findings in the UK are more inconsistent, with some research indicating increased PA\textsuperscript{29} and other studies showing a decrease in PA for ethnic minorities, compared to White populations.\textsuperscript{30} Sex-based differences have also been identified, with women from the LMICs having consistently lower PA levels than those of their male peers.\textsuperscript{31}

For primary prevention interventions to be considered in ethnic-minority communities, swift action is crucial to first address disparities in PA participation, compared to that of their White counterparts. In small qualitative studies, the findings show that cultural, socio-ecological, and sociocultural reasons are drivers for poor participation levels in PA.\textsuperscript{32-34} Often, barriers include cultural expectations, the lack of a suitable environment for PA, particularly in deprived areas, and poor engagement with health professionals.\textsuperscript{35} The intersectionality of sex, racial identity, and level of deprivation deeply affects the pursuit of PA.\textsuperscript{31}

Guidelines and studies for primary prevention using PA have focused predominantly on populations in the global North. A recent systematic review showed PA to be beneficial for the primary prevention of CVD disease\textsuperscript{36}; however, the studies were predominantly (over two-thirds) from Europe and the US. As a result, whether these findings are generalizable to other populations remains unclear, particularly for ethnic minorities and/or LMICs.\textsuperscript{37} Moreover, a key research gap exists on the effectiveness of PA for primary prevention of CVD in ethnic communities. For example, culturally sensitive interventions, which emphasize patient-desired, staff behaviours and attitudes that culturally diverse patients identify as indicators of cultural respect,\textsuperscript{38} could be assessed against standard, non-culturally sensitive interventions, to determine their effectiveness.

Recommendations

1. Conduct longitudinal studies to explore the long-term impact of culturally sensitive interventions on PA levels and CVD prevention in ethnic communities. This approach is particularly urgent in areas where the data are sparse, such as the Middle East.

2. Compare the effectiveness of standard PA interventions with that of culturally sensitive interventions in ethnic communities to determine which are the optimum interventions in these populations.

3. Studies from LMICs are needed to contribute to the body of evidence regarding the effectiveness of PA for primary prevention of CVD. Further exploration to determine whether findings from the global North are comparable to those in LMICs is needed.

Hypertension

High BP is a major modifiable risk factor and the leading cause of death from CVD. Two thirds of deaths from CVD...
are attributed to hypertension, and it is one of the leading causes of racial and ethnic disparities in health. Increases of 20 mm Hg in systolic BP and 10 mm Hg in diastolic BP, from a baseline reading of 115/75 mm Hg, double the risk of a CVD event. The Blood Pressure Lowering Treatment Trialists’ Collaboration conducted an individual participant-level meta-analysis and revealed that a decrease of 5 mm Hg in systolic BP was associated with a hazard rate (HR) of 0.91 (95% CI 0.89, 0.94) for major cardiovascular events among participants without prior CVD, and an HR of 0.89 (95% CI 0.86, 0.92) for those with a history of CVD.

Although hypertensives are widely prescribed, ethnic health inequalities in hypertension control have previously been documented. Important to note is that this difference was not due to a higher prevalence in ethnic minorities; rather, the evidence is suggestive of it being due to systemic racism. For example, baseline BP is significantly higher in Asian participants, compared to that among those from Australia and New Zealand. A recent, large epidemiologic study conducted in the UK showed that BP control was not as efficacious among ethnic minorities (African and/or African Caribbean people). Moreover, when BP control is improved, a lingering risk remains in people of ethnic minorities that is not present in White people. This residual risk comes when the excess risk associated with hypertension is reduced by treatment and/or control, but not fully reversed. This enduring risk to ethnic-minority groups persists, due to residual sensitivities, this region has high dietary salt intake. A recent, large epidemiologic study conducted in the UK showed that BP control was not as efficacious among ethnic minorities (African and/or African Caribbean people). Moreover, when BP control is improved, a lingering risk remains in people of ethnic minorities that is not present in White people. This residual risk comes when the excess risk associated with hypertension is reduced by treatment and/or control, but not fully reversed. This enduring risk to ethnic-minority groups persists, due to factors under individual control and the wider determinants outlined throughout this review.

However, the evidence indicates that primary prevention of hypertension can be effective in ethnic-minority populations. In the US, an innovative intervention using barbershops frequented mainly by Black male patrons with specialist pharmacists showed substantial BP reduction at 6 and 12 months. However, the reduction from the barbers-alone group was less than that in the trial arm, which included specialist pharmacists. In another trial from the US, Black patients with a BP of at least 140/90 mm Hg who used a 12-month lifestyle coaching intervention found that it was more effective than an enhanced pharmacotherapy protocol at 2 and 4 years post-enrollment. Finally, a third study, also from the US, successfully used health coaching to achieve BP control in South Asian patients.

Clinical trials are needed, either specifically for ethnic minorities, or including and reporting ethnicity data in randomized controlled trials (RCTs; discussed in detail the Increasing Research Participation for Ethnic-Minority Communities section). In a systematic review encompassing 68 RCTs with the aim of synthesizing the lowering of BP in individuals with hypertension, 59 studies were from Europe and America, and 27 included ethnic minorities. However, a point worth noting is that these ethnic minorities were participants who were predominantly Black. Furthermore, most studies were hosted in Europe (23 of 30 trials) and failed to report data on ethnicity. Ethnicity and hypertension reduction remain understudied in ethnic communities from LMICs. Further work is required to ensure that these interventions are sustainable over the longer term in ethnic communities, and further understanding of how cultural differences affect hypertension control in LMICs is needed.

**Recommendations**

1. Investigate how cultural influences affect BP control in LMICs.
2. Conduct RCTs with statistically powered numbers for the recruitment for ethnic minorities, particularly from the Middle East, South America, and Africa.
3. Investigate the sustainability of hypertension-reducing interventions over longer periods of time.

**Diet**

Diet is hugely influential on primary prevention in the development of ASCVD. Until recently, most evidence surrounding the efficacy of dietary modifications was from observational and epidemiologic studies with limited RCT data.

The American College of Cardiology and American Heart Association specifically highlighted the Dietary Approaches to Stop Hypertension (DASH) dietary pattern as a primary prevention strategy. The DASH diet aims to reduce intake of processed food and sodium, typically by 1500 to 2300 mg/d, and it promotes healthier alternatives such as vegetables, nuts, and whole grains. This dietary approach is effective in reducing BP, owing to the essential nutrients, which include potassium, calcium, and magnesium. A previous RCT showed better BP reductions in African Americans with normotensive BP (6.0 mm Hg) vs White populations (3.0 mm Hg), and in hypertensive BP participants (11.4 mm Hg vs 3.5 mm Hg, respectively). Further interventions that require specific tailoring to ethnic-minority communities are also needed, particularly in South East Asia. Aside from a genetic predisposition to salt sensitivity, this region has high dietary salt intake. A successful example of a tailored intervention was reported by Zhang et al., who conducted a cluster randomized trial across 60 communities and in 6 provinces in China using “supportive environment building” for salt reduction, including a number of educational sessions on salt intake reduction. The findings showed a reduction in urinary sodium

### Table 1. Summary of recommendations for a healthy lifestyle from the guideline on primary prevention of cardiovascular disease 2019 from Arnett et al.

<table>
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<th>Risk factor</th>
<th>Recommendation</th>
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<tr>
<td>Diet</td>
<td>Diet should consist of mainly vegetables, fruits, nuts, whole grains, lean vegetable or animal protein, and fish and minimize the intake of trans fats, red meat and processed red meats, refined carbohydrates, and sweetened beverages.</td>
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<tr>
<td>Tobacco</td>
<td>Adults should be screened for tobacco use and should have this data recorded. They should receive behavioural interventions plus pharmacotherapy to maximise quit rates.</td>
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<tr>
<td>Exercise</td>
<td>Adults should engage in at least 150 minutes per week of moderate-intensity physical activity or 75 minutes per week of vigorous-intensity physical activity. Sedentary activity should be minimized.</td>
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<tr>
<td>Obesity</td>
<td>Adults who are overweight or obese should participate in lifestyle programmes to achieve sustained weight loss.</td>
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Summary of guidelines from Arnett et al. of 4 main risk factors for a healthy lifestyle.
level and SBP and DBP by 2.0 mm Hg (0.4 to 3.5; \( P = 0.01 \)) and 1.1 mm Hg (0.1 to 2.0; \( P = 0.03 \)), respectively. Two further large trials, the Strategy of Blood Pressure Intervention in the Elderly Hypertensive Patients (STEP) study64 and the Salt Substitute and Stroke Study (SSaSS)65 from China showed that salt substituted with reduced sodium and increased potassium levels reduced hypertension.

The wider determinants of health play a pivotal role in diet. Determinants of food choice are complex and are affected by the nutrition environment and economic, cultural, and individual factors.66,67 In common with White populations, who state that they have a lack of time and low motivation to make dietary changes,60,62 South Asian and Black people have further cultural commitments, such as extended family and faith events, that prevent dietary change.70

Additionally, acculturation could be a significant dietary factor impacting primary prevention of CVD in ethnic-minority populations. Acculturation is the adjustment of cultural traditions to adapt to those of the host country, which may affect health, such as dietary habits and PA.71 In a cross-sectional analysis, acculturation was found to be associated with poorer CVD health in multiethnic populations.72 Finally, within lifestyle modification, in particular for diet, a lack of support occurs once the intervention has ended, meaning that participants may regress back to prior habits.73 Sustainable interventions for diet post-study are required to ensure that diet-led primary prevention is sustainable, along with longitudinal studies investigating adherence.

Although limited data are available for LMICs, existing evidence suggests that diet may provide a viable intervention in BP control, particularly as the DASH diet has been shown to be consistently effective in reducing BP for ethnic-minority populations. Acculturation and cultural determinants in diet are important in ethnic-minority communities and must be factored into research in primary prevention for CVD in these populations.

**Recommendations**

1. Explore how the DASH diet tailored for different ethnic communities is effective in reducing hypertension and CVD incidence.
2. Investigate the impact of acculturation on dietary habits of ethnic minorities and CVD incidence.
3. Investigate the sustainability of diet-modifying interventions following the completion of any research studies. Furthermore, the use of longitudinal studies investigating adherence may be required.

**Smoking cessation**

Tobacco use is the largest preventable cause of death and disease globally. The substances from smoking cause inflammation, impair endothelial function, and lower blood levels of HDL cholesterol, which are all associated with CVD risk.74 A clear, established link exists between smoking and CVD, and no level of smoking is safe, including passive smoking, as it has a known association with increased CVD risk.75 Moreover, individuals who smoke, whether normotensive or untreated hypertensive, have higher daily BP readings than those of nonsmokers.76

Significant disparities exist between smoking rates in ethnic groups compared to those among their White counterparts in developed countries, including the US and the UK. In developing countries, the alarming increased level of prevalence of smokers is of major concern.

Smoking-cessation programs have been advocated for many decades. Multiple interventions exist to reduce smoking prevalence, including pharmacotherapies, behavioural support, and e-cigarettes, with some specific interventions tailored to ethnic-minority groups. A systematic review by Liu et al.77 found 23 studies of smoking-prevention interventions adapted to African American and Chinese-origin populations, although no specific interventions for South Asian people were cited. A significant concern within ethnic-minority communities is the uptake of medical interventions due to mistrust in the medical establishment (discussed in the Mistrust in the Medical System section). However, tailored smoking-prevention interventions were received more readily by these communities but did not translate into better smoking-cessation outcomes. A more recent systematic review by Iqbal et al.78 investigated smoking cessation across South Asian countries and found that strategies advocated by the WHO were poorly implemented and led to an increased prevalence of smoking. The 2 systematic reviews are difficult to compare directly, due to the heterogeneity in populations, but smoking cessation continues to be a problem plaguing ethnic-minority groups disproportionately more than it does other ethnic groups, with tailored interventions providing little respite.

Specific smoking-cessation options include e-cigarettes and pharmacotherapies that include the use of nicotine replacement therapy and bupropion, an antidepressant shown to be effective in smoking cessation.79 Smoking cessation is poorly adopted in ethnic-minority communities. An RCT comparing the safety and efficacy of varenicline, bupropion, and nicotine patches in smokers with and without psychiatric disorders (Evaluating Adverse Events in a Global Smoking Cessation Study [EAGLES])80 had a secondary analysis that investigated ethnic differences in smoking cessation. The findings showed Black people who smoked in the US were less likely to quit than White smokers. The limitations included a short duration of follow-up (24 weeks), and the study was not powered to examine ethnic differences in smoking cessation at the outset. Further high-quality trials on smoking cessation in ethnic-minority populations are therefore needed.

**Recommendations**

1. Inclusive clinical trials with longer follow-up periods to examine ethnic differences in smoking cessation are needed. These trials should consider addressing barriers to participation (see “Increasing Research Participation in Ethnic Communities” section).

**Alcohol**

The literature contains discordant findings surrounding alcohol intake and CVD risk. Some studies have shown that a lower risk is associated with moderate alcohol intake, compared to that with abstinence and heavy drinking. However, socioeconomic, behavioural, and lifestyle factors may be causing residual confounding,81 and more recent
evidence, including a genetic epidemiology study, showed an increased CVD risk across all levels of alcohol intake. Furthermore, the WHO recently declared that no level of alcohol consumption is safe as even light-to-moderate alcohol consumption (< 20 g of pure alcohol per day, which is the same as 200 mL of wine) was associated with 23,000 new cancers in a 1-year period.68

Minority ethnic groups in the UK and US have similar racial and/or ethnic disparities, with evidence suggesting that these groups consume less alcohol than their White counterparts, particularly in excessive (binge) drinking. In South East Asian countries, the level of alcohol use is generally lower, and it is much lower in Muslim countries.91 However, pockets of alcohol use may go unreported in Muslim communities and lead to undesirable increased health risks. Where stigma is attached, and where alcohol consumption is illegal, attempts should be made to educate these groups on the importance of self-reporting use, and fostering trust would allow a better understanding of alcohol consumption.

Recommendations

1. Conduct investigation of the reasons behind alcohol consumption among ethnic-minority communities, to understand the cultural, behavioural, and socioeconomic factors influencing alcohol consumption and the potential impact on CVD.
2. In regions where alcohol use is prohibited or stigmatized, conduct studies and campaigns to promote trust (where alcohol consumption is not illegal), so accurate reporting of alcohol consumption can be better recorded.

Diabetes

Another leading cause of morbidity and mortality affecting people, regardless of age or sex, is diabetes.94 Diabetes has a 2- to 4-fold prevalence in ethnic-minority communities, compared to that among White counterparts, particularly for Asian and Black people.96,97 Diabetes and CVD risk are closely linked, with a 2-fold increased risk of CVD for those people with type 2 diabetes mellitus (T2DM).79 Although a recent decrease occurred in the co-occurrence of T2DM and CVD, a residual risk remains. Hypertension is common in people with diabetes, compared to the incidence in those without diabetes. Moreover, diabetes and hypertension are closely interlinked because of similar risk factors, which include vascular inflammation, arterial remodelling, dyslipidemia, and obesity.101

T2DM and dyslipidemia remain a greater risk factor for people with T2DM than they are for those without T2DM.102 In people with T2DM, triglyceride levels are elevated, HDL cholesterol level generally decreased, and the low-density lipoprotein (LDL) cholesterol level may be elevated.105 Statins remain first-line therapy in people with diabetes to reduce LDL cholesterol level, although newer therapies have emerged, such as ezetimibe and injectable proprotein convertase subtilisin/kexin type 9 (PCSK9) inhibitors.104 However, disparities in statin use for ethnic-minority patients have been found. A cross-sectional analysis of adults in the US found lower levels of statin use that could not be explained by disease severity in Black patients who were men (adjusted prevalence ratio (aPR) 0.73 (95% CI 0.59, 0.88), and non-Mexican Hispanic women (0.74; 95% CI 0.53, 0.95). Possible reasons for these disparities were reported to be biases, stereotyping, and mistrust.105 Further research in other regions globally is needed to identify and understand the presence of disparities in prescribing statins in ethnic-minority groups with diabetes.

Obesity has long been recognized as an explanatory factor for T2DM, and it continues to increase in prevalence among South Asian people, caused by poor diet and exacerbated by low intake of fruit and vegetables, and by urbanization.106 Within cardiovascular medicine, some controversy exists because of the obesity paradox, which has shown better survival in patients who are overweight.107 However, in both type 1 and type 2 diabetes, the obesity paradox does not challenge the need to improve weight management in people with these conditions, with excess weight being deleterious to people with diabetes.110 Reducing obesity is vital in primary prevention of CVD in those with diabetes.

Similar to the previously discussed modifiable factors in this review, multiple interventions are centered around lifestyle and pharmacologic approaches that are available to reduce CVD risk in people with diabetes.112 In people with a long duration of diabetes and the highest CVD risk, the findings of a systematic review showed that ethnic-minority patients benefited more than patients who were White when they were prescribed glucagon-like peptide-1 receptor agonists (GLP-1RA) and a sodium-glucose cotransporter-2 inhibitor (SGLT2i).113 However, a systematic review by Kunutsor et al. found a lack of benefit for Black people from using an SGLT2i, although questions were raised regarding underrepresentation, low statistical power, pharmacokinetics, and pharmaco-dynamics.115 Moreover, inconsistencies are present in the rate of prescribing. Data from the US reduced prescribing rates in ethnic-minority patients,115 and statistically significant but small absolute differences in the UK.116 Exploration of why SGLT2is are not being used as much in ethnic-minority populations is needed urgently.

Recommendations

1. Explore reasons for ethnic differences in efficacy of novel therapies and for the underprescribing of these organ-protecting therapies. Furthermore, assessing their impact on CVD incidence also is required.
2. Investigations to determine why lipid-lowering treatment have differential prescribing rates in various ethnic groups are needed.
3. Research investigating the intersectionality of diabetes, hypertension, and dyslipidemia in CVD incidence globally for ethnic-minority patients also is needed.

Polypill

In 2004, the WHO recognized the poor adherence to therapies for chronic diseases and proposed the use of a single pill. This “polypill” incorporated multiple cardioprotective drugs to reduce cardiovascular risk factors.118 Although polypills are not widely used,119 a growing movement is underway to utilize these for primary prevention, with...
evidence indicating that they are effective in the primary prevention of CVD.

Evidence indicates that polypill therapies are effective in improving health outcomes in ethnic-minority communities. Polypill-based therapies reduced inequities in Māori vs non-Māori people in New Zealand. In the US, in an RCT, those assigned polypill (components included atorvastatin [at a dose of 10 mg], amlodipine [2.5 mg], losartan [25 mg], and hydrochlorothiazide [12.5 mg]) showed a reduction from baseline to 12 months in their systolic BP (baseline: 140 mm Hg; at 12 months, difference, -7 mm Hg; 95% CI, -12 to -2 mm Hg; P = 0.003) and their LDL cholesterol (baseline: mean 113 mg/dL; at 12 months, difference, -11 mg/dL; 95% CI, -18 to -5; P < 0.001), compared to usual care in people with low socioeconomic status (SES) and in ethnic-minority patients. In the cohort, which recruited 96% Black people, they found that SBP decreased by 9 mm Hg, and the mean LDL cholesterol level decreased by 15 mg/dL in the polypill group, compared to 2 mm Hg and 4 mg/dL respectively, in the usual-care group. Another RCT study conducted across 9 Asian countries of a polypill vs a placebo recruited participants without a history of CVD and followed-up with them for an average of just under 5 years. The findings showed that in a population at intermediate risk of CVD, the relative risk of CVD events was 31% lower (1.7% absolute risk difference). Further research is required to determine the benefits of polypills in primary prevention in LMICs and ethnic-minority communities. A balanced approach is required, which should consider that some patients may benefit more than others from fixed-dose combinations, such as younger and treatment-naïve patients, and patients with diabetes.

Recommendations

1. Explore how polypill can be used to reduce inequities in LMICs and between ethnic-minority groups in primary prevention of CVD.
2. Determine cost-effective studies of polypill use to reduce the burden of CVD in LMICs.

Wider Determinants of Ethnic Inequalities in Primary Prevention

Social determinants of health are known to exacerbate health inequalities between and within countries. How CVD risk among different ethnic groups is influenced and modified by population-level factors, including social and commercial determinants, structural racism, and other factors beyond individuals’ control is not well known.

Social determinants of health

The term “social determinants of health” (SDoH) refers to economic, social, political, environmental, and commercial factors, and the conditions in which people are born, live, learn, work, play, worship, and age. These determinants play a significant role in the development of CVD risk and health outcomes, including morbidity and mortality. The health inequalities highlighted by the COVID-19 pandemic shone a light on the role of the SDoH and adverse health outcomes in ethnic minorities. Ethnic minorities had the highest mortality rates in the pandemic, owing to disparities in employment, housing, education, and healthcare access.

Evidence is growing that health outcomes in marginalized groups are not predetermined by genetic factors linked to their race, but instead are biological responses influenced by discrimination. The responses include chronic stress, which can activate the sympathetic nervous system and hypothalamic-pituitary-adrenal (HPA) axis, leading to higher levels of inflammation and increased BP and heart rate.

Socioeconomic status

SES is associated with many risk factors for CVD incidence and outcomes. In high-income countries, a strong association has been found between individual-level socioeconomic factors (education, income, and occupation) and CVD outcomes, with the data suggesting that lower SES serves as a source of chronic stress and promotes a proinflammatory state and atherogenesis. The evidence in LMICs is less well known. However, a prospective study investigating SES and risk of CVD in 20 LMICs (the Prospective Urban Rural Epidemiology [PURE] study) showed an association between SES and the incidence and mortality from CVD, mainly driven by poor healthcare access and quality of care, even though the cohort had good overall risk factor profiles. Access to quality education and quality healthcare are affected by socioeconomic factors. For example, expanded insurance coverage for those with lower SES was associated with improved access to care and a lower incidence of CVD mortality.

Housing and built environments

Recent studies have found that certain attributes of built environments are associated with CVD risks and outcomes. For instance, residential density, and lack of traffic safety and recreational facilities are associated with incident coronary heart disease. Research has shown that higher metropolitan-level Black segregation and most neighbourhood-level segregation are associated with greater CVD risk. Furthermore, a proliferation of fast-food outlets in ethnic areas is contributing to an “obesogenic environment” that has contributed to an increased prevalence of risk factors for CVD, such as diabetes and hypertension. Conversely, residential areas with green spaces have been found to be protective for cardiovascular health, possibly due to promoting PA, improving mental health, decreasing stress, and mitigating pollution. Moreover, a systematic review reported that, across 18 different countries, green-space exposure was beneficial to CVD health. A point of note is that the data were mainly from developed countries, and when ethnicity was recorded, several studies underadjusted for ethnicity. Further research is required to understand how obesogenic environments impact CVD development, particularly as these environments centre around poorer areas where ethnic communities may reside.

Commercial determinants of health (CDoH)

The term “commercial determinants of health” (CDoH) refers to the systems, practices, and pathways through which commercial actors drive health and health inequity. The organizations are generally global corporations that produce commodities that impact health, such as tobacco, alcohol, and
ultraprocessed foods. These determinants can create conditions that influence health through various mechanisms. For example, advertising to promote unhealthy products or products that contain harmful ingredients can influence an individual’s behaviours and choice, through pricing, availability, or can influence policy and regulation through lobbying (eg, alcohol). Further work is required to understand how the CDoH impact CVD incidence in ethnic-minority communities.

Structural racism and discrimination

The term “structural racism” refers to laws, policies, and practices that influence health outcomes and create disparities in health outcomes. Evidence indicates that structural racism is associated with the incidence of CVD. Black populations in the US living in areas with higher levels of Black segregation have a 12% higher risk of CVD disease, independent of their SES and other risk factors. The effects of structural racism are pernicious and have been shown to lead to higher incidence of Covid-19 deaths in minority communities in the US and UK. Structural racism influences individuals psychologically and is significantly associated with cardiovascular health outcomes, both through chronic activation of biological stress responses and systemic inflammation and by increasing the frequency of behaviours that negatively impact cardiovascular health, such as smoking, isolation, and overeating.

Mistrust in the medical system

Medical mistrust can present as a barrier to a strong patient-clinician relationship and can negatively influence patient behaviours. Medical mistrust is correlated with race and ethnicity, and perceived discrimination. These correlations are complex and can be attributed to historical factors.

The unethical medical experiments conducted on African Americans represent a troubling chapter in the history of medicine. One of the most notorious examples was the Tuskegee Syphilis Study, conducted between 1932 and 1972. In the study, African American men with syphilis were left untreated deliberately, even after the discovery of penicillin. Sadly, the Tuskegee study was not the only violation of medical ethics. Numerous studies and examples led to needless suffering and exacerbated the low level of engagement and participation in clinical trials for ethnic minorities. However, although these historical and painful experiences provide a context for the origin of mistrust, an important point to highlight is that bias and racism are still present in the medical system today. A recent example is a review by the National Health Service (NHS) Race and Health Observatory in the UK, which found that neonatal assessments, including the Apgar score, are “not fit for purpose” for ethnic-minority babies. Until 2023, the National Institute for Clinical Excellence (NICE) recommended adjusting for ethnicity when calculating estimated glomerular filtration rate (eGFR) in people from Black ethnic groups. This perpetuated health inequalities by overestimating kidney function in these groups, as this overestimation was not evidence-based, and instead was based on inaccurate historical tropes that Black people have more muscle than their White contemporaries. Recognizing ethnic-minority difference in healthcare has prompted some positive changes,
Table 2. Author research recommendations based on the findings presented in the paper

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Research recommendation</th>
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<tbody>
<tr>
<td>Exercise</td>
<td>• Conduct longitudinal studies to explore the long-term impact of culturally sensitive interventions on physical activity levels and CVD prevention in ethnic communities, particularly in areas where the data are sparse, such as the Middle East.</td>
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<td></td>
<td>• Compare the effectiveness of standard PA interventions with culturally sensitive interventions in ethnic communities to determine which provide better results in this population.</td>
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<td></td>
<td>• Studies from LMICs are needed to contribute to the body of evidence regarding the effectiveness of PA for primary prevention of CVD. Further exploration to determine whether findings from the Global North are comparable to those from LMICs are needed.</td>
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<tr>
<td>Hypertension</td>
<td>• Investigate how cultural influences affect BP control in LMICs.</td>
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<td></td>
<td>• Conduct RCTs with statistically powered numbers for the recruitment for ethnic minorities, particularly from the Middle East, South America, and Africa.</td>
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<td></td>
<td>• Investigate the sustainability of hypertension-reducing interventions over longer periods of time.</td>
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<tr>
<td>Diet</td>
<td>• Explore how the DASH diet that is tailored for different ethnic communities is effective in reducing hypertension and CVD incidence.</td>
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<tr>
<td></td>
<td>• Investigate the impact of acculturation on dietary habits of ethnic minorities and CVD incidence.</td>
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<tr>
<td></td>
<td>• Investigate the sustainability of diet-modifying interventions following the completion of any research studies to ensure these are sustainable. Furthermore, the use of longitudinal studies investigating adherence may be required.</td>
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<tr>
<td>Smoking</td>
<td>• Inclusive clinical trials with longer follow-up periods to examine ethnic differences in smoking cessation. These trials should consider addressing the factors “increasing research participation in ethnic communities” section.</td>
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<tr>
<td>Alcohol</td>
<td>• Investigation of the reasons behind alcohol consumption among ethnic-minority communities. The aim is to understand the cultural, behavioural, and socioeconomic factors influencing alcohol consumption and the potential impact on CVD.</td>
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<td>• In regions where alcohol use is prohibited or stigmatized, conduct studies and campaigns to promote trust (where alcohol consumption is not illegal), so accurate reporting of alcohol consumption can be more recorded.</td>
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<tr>
<td>Diabetes</td>
<td>• Explore the reasons why for ethnic differences in GLP-1RA and SGLT2i efficacy and under-prescribing. Furthermore, assessment of their impact on CVD incidence also is required.</td>
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<td></td>
<td>• Investigate why lipid-lowering treatments have differential prescribing rates in ethnic groups is needed.</td>
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<td></td>
<td>• Research investigating the intersectionality of diabetes, hypertension, and dyslipidemia in CVD incidence globally for ethnic minorities is also needed.</td>
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<tr>
<td>Polypill</td>
<td>• Explore how polypills can be used to reduce inequities in LMICs and between ethnic-minority groups in primary prevention of CVD.</td>
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<tr>
<td>Wider determinants</td>
<td>• Investigate how obesogenic environments impact CVD development, particularly as these environments have a higher prevalence in poorer areas, where ethnic communities may reside.</td>
</tr>
<tr>
<td>Research participation</td>
<td>• Using the 4 components of the health research inclusivity model may increase research participation. Further work is needed to investigate if any of these components has led to a change in research participation.</td>
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<tr>
<td></td>
<td>• Investigate how cultural-competency training for researchers, partnership working with communities, a personalized approach, and addressing mistrust of health institutions with ethnic communities improves research participation.</td>
</tr>
</tbody>
</table>

BP, blood pressure; CDoH, commercial determinants of health; CVD, cardiovascular disease; DASH, Dietary Approaches to Stop Hypertension; GLP-1RA, glucagon-like peptide-1 receptor agonists; LMIC, low- or middle-income country; PA, physical activity; RCT, randomised controlled trial; SGLT2i, sodium-glucose transport protein 2 inhibitor.

However, including evidence-based advice to lower the body mass index threshold for some treatments for ethnic minorities.

These wider issues need to be addressed by the medical and research community to ensure equitable access to clinical trials and treatments. Furthermore, for SDoH, multilevel and multidisciplinary approaches involving public health measures, changes to health systems, and the dismantling of structural racism must be addressed for the disparities in CVD to improve for ethnic minorities.

Increasing Research Participation for Ethnic-Minority Communities

The challenges for ethnic minorities include the appropriate recording of ethnicity, and widening of the level of participation within health research. The impact of ethnicity-based health inequalities has been difficult to analyze, due to historically poor recording and reporting of ethnicity, compared to that for patients who are White. A particularly troublesome challenge is to determine health inequalities in countries where the law precludes the collection of ethnicity data, such as France. However, multiple recommendations include the standardization of ethnicity data and better reporting practices, influenced by mandatory reporting by some academic journals.

Beyond coding, and due to multiple factors (discussed previously), voluntary participation in health research has suffered. This lack of active participation has led to some harms. A striking example is lack of efficacy in a regularly used antiplatelet treatment (clopidogrel) because of the ineffective metabolism of the active constituent in Asians and Pacific Islanders, owing to genetic polymorphisms. Several strategies have been proposed to improve research engagement for ethnic-minority communities, as shown in the health research inclusivity model (Fig. 2), and maximizing the opportunities to use self-identification of race and/or ethnicity of participants. Other suggestions include cultural-competency training for researchers, working in partnership with communities, taking a personalized approach by ensuring that participants are seen as individuals, and addressing mistrust of health institutions within these communities.
Recommendations

1. Using the 4 components of the health research inclusivity model may increase research participation. Further work is needed to investigate whether any of these components has changed the level of research participation.

2. Investigate how cultural-competency training for researchers, partnership in working with communities, a personalized approach, and addressing mistrust of health institutions within ethnic communities improves the level of research participation.

Limitations and Further Research

Although primary prevention research may well have recruited and/or analyzed ethnic-minority health data, historically poor reporting could be a driver of the lack of specific primary prevention research in this community.

CVD remains a leading cause of adverse outcomes in ethnic-minority communities, and tailored, evidence-based clinical guidelines may help reduce the incidence of morbidity and mortality within this group. Accounting for differences in leisure time, level of economic development, and rural vs developed economies will be helpful in addressing inequalities in primary prevention of CVD in ethnic-minority communities. Additional studies investigating the effect of interventions for ethnic minorities that improve the social determinants of health, in turn preventing CVD, are required urgently. Further recommendations can be found at the end of each modifiable risk factor section and are summarized in Table 2.

Conclusion

The path to reducing CVD inequalities in ethnic-minority communities involves not only evidence-based interventions but also a wider acknowledgement of broader societal factors that contribute to them. Tailored intervention shows some potential, but further research is required, particularly in understudied regions and ethnic groups. Collaboration among healthcare systems, policymakers, and researchers are key to using primary prevention to reduce both CVD disparities in ethnic-minority populations and the disproportionate CVD burden globally.

Ethics Statement

The research has adhered to the relevant ethical guidelines.

Patient Consent

The authors confirm that patient consent is not applicable to this article, as it is a review synthesizing previous research.

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