Review

Addressing Social Determinants of Health in Maternal Cardiovascular Health

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ABSTRACT

Cardiovascular diseases (CVDs) remain the number-one cause of maternal mortality, with over two-thirds of cases being preventable. Social determinants of health (SDOH) encompass the nonmedical social and environmental factors that an individual experiences that have a significant impact on their health. These stressors disproportionately affect socially disadvantaged and minority populations. Pregnancy is a physiologically stressful state that can unmask underlying CVD risk factors and lead to adverse pregnancy outcomes (APOs). Disparities in APOs are particularly pronounced among individuals of color and those from economically disadvantaged backgrounds. This variation underscores healthcare inequity and access, a failure of the healthcare system. Besides short-term negative effects, APOs also are associated strongly with long-term CVDs. APOs therefore must be identified as a cue for early intervention, for the prevention and management of CVD risk factors. This review explores the intricate relationship among maternal morbidity and mortality, SDoH, and cardiovascular health, and the implementation of health policy efforts to reduce the negative impact of SDoH in this patient population. The review emphasizes the importance of comprehensive strategies to improve maternal health outcomes.

Maternal mortality is an indicator of a nation’s healthcare status, and per the World Health Organization, it is defined as the annual number of maternal deaths related to or aggravated by pregnancy, either during pregnancy or within 42 days of childbirth, irrespective of the duration and location of pregnancy.1 Although maternal mortality has shown a global decline over the past decade, the current incidence remains unacceptably high. In the year 2020, approximately 287,000 maternal fatalities occurred during and post-childbirth, with nearly 95% of these occurrences occurring in low-income and lower-middle-income countries.2 In the US, an alarming rise has occurred in the maternal mortality rate, with an increase from 20.1 deaths per 100,000 live births in 2019, to 23.8 deaths per 100,000 live births in 2020, to 32.9 deaths per 100,000 live births in 2021.3 Canada’s maternal mortality rate has remained relatively constant at around 10 deaths per 100,000 live births in recent years.4 Apart from mortality, the health of mothers may be adversely affected by childbirth. The World Health Organization defines maternal morbidity as “any health condition attributed to and/or complicating pregnancy, and childbirth that has a negative impact on the woman’s well-being and/or functioning.”5 “Adverse pregnancy outcome” (APO) is a comprehensive term that encompasses different health-related complications that occur during different phases of pregnancy, including postpartum, which affect the mother, the fetus, or both.6 Notably, a rise has occurred in the incidence of APOs in some higher-income countries. The variation in maternal morbidity and mortality in different regions of the world reflects inequalities in healthcare access and delivery. Most maternal deaths are preventable, and the high incidence of maternal mortality reflects the failure of the healthcare system and society. This failure may stem from suboptimal healthcare quality, lack of access to healthcare, adverse environmental conditions, health inequities, structural racism, and bias causing social disparities and isolation for certain communities.7,8

Cardiovascular disease (CVD) is projected to be a major cause of mortality globally by 2030, currently accounting for > 30% of the deaths in high-income countries and more than half of the noncommunicable causes of death.9,10 Cardiovascular (CV) issues are the main cause of maternal mortality, and a high percentage (around 60%) of these deaths are preventable.11,12 Pregnancy is a physiologically stressful state that leads to multiple vascular, metabolic, hormonal, and physiological changes in the mother that can unmask underlying CVD risk factors, increasing the risk of APOs. The American Heart Association (AHA) recently provided updates for cardiovascular health (CVH) assessment, focusing on CV risk factors and health behaviours—that is, Life’s Essential 8 (manage and control hypertension [HTN], dyslipidaemia, diabetes mellitus [DM], and obesity; promote a healthy diet, increase physical activity; avoid smoking; and get adequate sleep). Accumulation of risk factors relating to these health issues creates a predisposition to premature death, morbidity, and mortality. The AHA statement emphasized the need to address social determinants of health (SDoH) for optimizing and improving CVH.13

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A strong correlation exists between SDoH and CVD, even during pregnancy. Healthcare disparities and adverse effects of SDoH strongly correlate with APOs and long-term suboptimal CVH. This article aims to provide an overview for clinicians on the negative impact of SDoH on APOs and suboptimal maternal CVH, highlight health inequities, and suggest strategies to improve maternal health outcomes.

**Adverse Pregnancy Outcomes and Cardiovascular Disease**

The term "APOs" refers to the spectrum of illnesses caused by placental dysfunction and maternal vascular abnormalities, such as endothelial dysfunction, inflammation, and vasospasm. APOs affect 10%-20% of all pregnancies and are related to suboptimal long-term maternal CVH. Per the AHA, 6 of the APOs—hypertensive disorders of pregnancy (HDP), preterm delivery, gestational diabetes (GDM), small-for-gestational-age delivery, placental abruption, and pregnancy loss—are associated with increased CVD risk factors, and subsequently CVD, and chronic illnesses in the long run.

Suboptimal prepregnancy CVH in women is associated with a plethora of APOs, such as preeclampsia (PE), eclampsia, preterm birth, congenital heart defects, and peripartum cardiomyopathy. A study from Canada reported that around half of the serious cardiac events (cardiac arrest, serious arrhythmias, events requiring intensive care, myocardial infarction, stroke, and conditions requiring urgent cardiac intervention) in mothers with prepregnancy CVD were preventable. These events commonly were associated with adverse neonatal and fetal complications. Lack of access to healthcare for prepregnancy diagnosis and treatment of comorbidities, along with limited exposure to appropriate risk-modification interventions, such as those related to nutrition and exercise, culminate in suboptimal maternal CVH. Conditions such as preexisting chronic HTN, diabetes, and inflammatory disorders can increase the risk of PE significantly.

HDP, such as gestational HTN, PE, eclampsia, and HELLP (hemolysis, elevated liver enzyme levels, and low platelet count) syndrome are present in nearly one-third of maternal deaths during delivery hospitalizations. HDP occur in 5%-10% of all pregnancies and are a direct cause of around 6% of maternal deaths. A prospective study from the United Kingdom reported twice the risk of future coronary artery disease, heart failure, and aortic stenosis, as well as 5 times the risk of mitral regurgitation, in mothers with HDP. HDP also are associated with CV changes, such as a 1.5 times higher incidence of left ventricular hypertrophy and atherosclerotic burden than that among their unaffected counterparts. Major risk factors associated with the development of PE include obesity (body mass index > 30 kg/m²), DM, antiphospholipid antibody syndrome, hypercholesterolemia and hypertriglyceridemia, and chronic HTN, which are common risk factors for adverse CVH as well. GDM increases the chances of chronic DM in the future by 10 times, which in turn contributes to suboptimal CVH and to future CVD. APOs such as GDM, pregnancy loss, preterm delivery, and placental abruption are reported to create a > 1.5 times greater risk of developing CVD.

A retrospective study of Canadian mothers reported a 1.6 times higher risk of heart disease or death in mothers after delivery of a preterm and severely small-for-gestational-age infant.

Although APOs may manifest differently, they share a common pathophysiology involving an interplay of inflammation and vascular dysfunction exacerbated by abnormal placental vasculopathy and the physiological changes that occur with pregnancy. Whether APOs are unique nontraditional risk factors, or signs of early dysfunction driven by traditional factors, remains unclear. Irrespective of the interplay, a prudent approach is to recognize traditional CV risk factors as risk factors for APOs, and intervene. Additionally, recognizing APOs as risk factors for future CVD is important, as is aggressively treating and managing APOs, along with using their presence to spur diagnosis and treatment of traditional CV risk factors.

**Social Determinants of Health**

SDoH are an amalgamation of nonmedical factors, such as education, environment, society, occupational status, economics, food security, and a variety of other psychosocial factors that impact a person’s health. The concept of SDoH put forward by the Kaiser Family Foundation explores the notion that race and ethnicity are social constructs influenced by a variety of societal, economic, geographic, and political factors, instead of being biological determinants. SDoH are the conditions a person is born into, and they play a significant role in an individual’s morbidity and life expectancy. These circumstances in which a person grows are in turn shaped by political, social, and economic forces.

Unequal resource allocation at a local, national, and global level, substandard living conditions, lack of access to healthcare and education, unfavourable work conditions, and inadequate psychosocial support are the major reasons for health inequity among different countries.

**Social Determinants of Health, Cardiovascular Health, and Adverse Pregnancy Outcomes**

The intricate relationship among SDoH, APOs, and maternal CVH is summarized in Figure 1. A study of 1400 US pregnant women reported that > 50% of the women with a high SDoH burden had suboptimal CVH and were at a higher risk of smoking, obesity, and physical inactivity.

Socioeconomic health inequities play a major role in CV mortality and contribute to a huge economic burden. A significant decline has occurred in prepregnancy CVH in the US, from 2011 to 2019. Even though this decline has been across all races and insurance statuses, the decline in prepregnancy CVH has been significantly greater among non-Hispanic Black individuals and Medicaid (government health insurance program to cover individuals from low socioeconomic strata) recipients. This finding highlights the delay and barriers women of diverse backgrounds face to access healthcare during a vulnerable time of their lives. Apart from the global variation, substantial geographic variation in CVH exists within developed countries; for example, in the US, less-favourable patterns are present in the Southern and Western states. These patterns highlight the regional differences in educational status, insurance coverage, such as
Medicaid expansion to cover preconception and the extended postpartum period, and CVD risk factors, such as obesity, HTN, and DM within these regions. Recent data have shed light on the health status of the rural population. In the past decade, a startling increase has occurred in CVD risk factors among the rural population. Women residing in rural areas have a higher incidence of CVDs and CVD risk factors, such as HTN, diabetes, smoking, and obesity. The incidence of prepregnancy HTN, an established risk factor of APOs, strikingly has doubled among rural women, specifically in those aged 20-24 years.

Around 4.7 per 100,000 deliveries in Canada are affected by CVD, which is the most common diagnosis associated with maternal mortality during pregnancy and in the postpartum period. Even in the context of the universal healthcare system in Canada, individuals there belonging to low-level socioeconomic backgrounds are more predisposed to CVD than are those of a higher-level socioeconomic background. Therefore, taking measures to improve health disparities is necessary. The incidence of APOs is disproportionately higher among women of color and socioeconomically disadvantaged populations. Various psychosocial factors (stress from social isolation in minority groups; depression), attitudinal factors (lack of family planning), and economic and structural barriers (no childcare; transportation issues) reportedly are associated with an increased likelihood of inadequate prenatal care among socioeconomically disadvantaged women in Canada. A study of around 412,000 pregnant women in Canada reported an increased risk of GDM, PE, placental abruption, preterm birth, low birth weight, and neonatal complications among Black women in comparison to the risk among White women. Similarly, a study from the US highlighted a high maternal mortality rate that disproportionately affects certain ethnicities, with the mortality rate being 3-4 times higher among Black women in comparison to that among White women. The heightened incidence of comorbidities among specific racial and ethnic groups also may contribute to the overall incidence. For instance, the incidence of metabolic syndrome is on the rise among reproductive-age women, and women who self-identify as being of African American ethnicity are disproportionately more affected. Even though the reported incidence of comorbidities among women of racial and ethnic minority groups is higher, a disproportionately higher postpartum cardiometabolic risk persists, even after accounting for these comorbidities.

Low socioeconomic status also is associated with a high risk of APOs, such as PE, GDM, and preterm birth. Even though the association is independent of racial-ethnic variations, it is still a weaker predictor than racial-ethnic identification, as even after improvement in the low socioeconomic status, the high incidence of APOs among racial and ethnic

Figure 1. Impact of social determinants of health on long-term maternal cardiovascular health.
minority groups persisted. This finding signifies that the underlying complex interplay among SDoH, environmental conditions, discrimination, and genetic predisposition to CVD plays a pivotal role in the health of an individual and the development of APOs. These APOs are further related to long-term adverse maternal CVH.

Interventions for Addressing Social Determinants of Health and Improving Maternal Outcomes

The hurdles mentioned earlier are intricately interconnected within society, thus necessitating a multifaceted approach. Addressing disparities and SDoH requires a targeted approach at international, national, regional, community, and individual levels. The solutions should aim to enhance healthcare delivery and access, reduce CVD risk factors, and improve maternal outcomes. Potential solutions are summarized in Table 1.

Addressing the knowledge gap through research, education, and training

As mentioned, evidence indicates the presence of variation in CVD risk factors, APOs, and suboptimal CVH among people from different minority groups, but little is known about the relationship among these factors. In major CV outcome trials and CV drug trials, a lack of representation of women persists, and a lack of diversity in the women enrolled, with around 80% of trial participants being White, 4% being Black, and 11% being Asian. This issue severely impairs the generalizability of the results of the trials and interventions in historically marginalized populations. Therefore, a need remains to increase inclusivity and diversity in clinical trials. The racial and ethnic minority groups cumulatively constitute at least 50% of the population risk of CVDs. One way to combat this risk is to initiate trials enrolling the underrepresented population. The African-American Heart Failure Trial (A-HeFT) was one such trial, which recruited around 1100 African American patients with heart failure with reduced ejection fraction and reported the benefit of use of isosorbide-dinitrate-hydralazine in this population. Similarly, studies such as the Black Women’s Health Study, the largest cohort of the US Black women population, and the PLATINUM (PLATINUM Clinical Trial to Assess the PRO-MUS Element Stent System for Treatment of De Novo Coronary Artery Lesions) Diversity study, which enrolled a significant number of women and racial and ethnic minority individuals, are needed to explore the risk factors and interventions in the underrepresented population. The construction of a national-level task force to bridge the gap might be deemed effective. The Task Force on Research Specific to Pregnant Women and Lactating Women (PRGLAC) was constructed to identify the knowledge gaps and advise the US Secretary of Health and Human Services on safe and effective therapies for pregnant and lactating women. A similar task force to target health inequities and the disproportionate impact of adverse SDoH on the historically marginalized population can help identify barriers to healthcare and formulate strategies to overcome them.

Novel strategies to improve the construct of clinical trials are especially needed. A few strategies by Ortega et al. include:

| Table 1. Summary of potential interventions to improve maternal health outcomes by addressing adverse effects of SDoH and adverse pregnancy outcomes |
|---------------------------------|---------------------------------|
| **Interventions**               | **Specific strategies**         |
| Addressing the knowledge gap through research, education, and training | - Increase inclusivity and diversity in clinical trials |
| - Commission regional and global task forces directed to identify knowledge gaps in the care of minorities and maternal care |
| - Implement transparent data reporting for allocating resources |
| - Diversify the workforce |
| - Educate the entire healthcare team regarding implicit bias |
| - Educate the workforce on culturally competent care |
| - Accurately documenting and reporting SDoH |
| - Utilizing social service referrals |
| - Advocating for healthcare policy |
| - Enhancing the rural workforce |
| - Providing prenatal, intrapartum, and postpartum care |
| - Tailoring prenatal care to individual requirements and preferences for nonmedical needs, such as social requirements, nutrition, healthcare coverage, and mental health, alongside medical care |
| - Using digital technology for monitoring in-between healthcare visits |
| - Utilizing EMR systems to collect data on SDoH |
| - Using health policy efforts and incentives to improve reporting |
| - Making EMRs more comprehensive and inclusive |
| - Using data-reporting language that is culturally sensitive and respectful |
| Data collection and reporting | - Patient safety bundles |
| - Cultural-sensitivity training |
| - Hospital designation, based on the level of handling complexity and the acuity of care |
| - Increased physician extender workforce (midwives, nurses) |
| - Enhance the rural workforce |
| - Connect rural centres to urban specialists |
| - Using joint decision-making for contraception |
| Value-based care | - Accurately documenting and reporting SDoH |
| - Tailoring prenatal care to individual requirements and preferences for nonmedical needs, such as social requirements, nutrition, healthcare coverage, and mental health, alongside medical care |
| - Utilizing social service referrals |
| - Advocating for healthcare policy |
| - Enhancing the rural workforce |
| - Providing prenatal, intrapartum, and postpartum care |
| - Tailoring prenatal care to individual requirements and preferences for nonmedical needs, such as social requirements, nutrition, healthcare coverage, and mental health, alongside medical care |
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| - Using joint decision-making for contraception |

EMR, electronic medical record; SDoH, social determinants of health.
the training and recruitment of diverse clinical investigators, performance of multicentric studies, and if possible, of those from different countries, to enroll a more diverse population. The informed consent provision process also should be modified to make it more culturally sensitive, as should education of the population involved in research, and importantly, commitment from the industry toward ensuring diversity.62

Apart from clinical trials, an essential approach is to diversify the workforce and deliver more culturally sensitive care, appealing to culturally diverse populations. Evidence indicates that increasing the diversity of the workforce (clinicians, hospital staff, registered nurses, community health workers, etc.) involved in delivering care to the pregnant population is associated with a significant decrease in APOs. Possible reasons could stem from a reduction in implicit bias and improvement in patient-physician solidarity in decision-making when more culturally sensitive care is delivered by a diverse workforce. Thus, educating physicians and clinical staff about implicit bias and structural racism in healthcare is essential during their years of training and practice.7,68

Upstream interventions and data collection on SDoH

Due to the significant impact of SDoH on morbidity and mortality outcomes, in the US, the American College of Obstetricians and Gynecologists (ACOG) and the AHA have issued advisories to improve rural health, reduce racial disparities, promote health equity, and improve maternal outcomes.4,7,65 Per ACOG, important measures are to identify and document the social adversities that are impacting the health of women and provide them with appropriate social service referrals. ACOG emphasizes that healthcare providers recognize race, institutionalized racism, and other forms of discrimination as SDoH, and avoid stereotyping patients based on their presumed cultural beliefs, to improve healthcare delivery. ACOG encourages the use of interpreter services to overcome language barriers and ensure a strong, trusting patient-physician relationship. ACOG also promotes advocacy for changes in health policies to promote a healthy and safe environment.69 The AHA strongly advocates for health policy changes to address healthcare-provider shortages in rural areas, develop new healthcare team models using paramedical professionals, and enhance healthcare infrastructure and connectivity between rural and urban systems.

A dire need exists for healthcare policies to encourage state- and national-level reporting of racial and ethnic data, to aid in the allocation of resources and equitable healthcare access to underserved minority groups. The digitalization of healthcare records brings an opportunity to integrate data about SDoH, race, and ethnicity into electronic medical records, which can be extracted to perform quality assessment, track inequities in delivering healthcare, and formulate an action plan to address the barriers to delivery of equitable healthcare. Also important is acknowledgement that people can identify themselves as belonging to more than one race and ethnicity, and thus, updating electronic medical records to allow for a more comprehensive and inclusive collection of data is essential. Moreover, use of inclusive, culturally sensitive, and respectful language when reporting studies or data is essential. This measure can help healthcare professionals and policymakers understand the impact of structural constructs and avoid implicit bias.

Prenatal screening and diagnosis of congenital diseases is an important component in improving maternal and fetal outcomes. Such work provides an opportunity for early diagnosis of any maternal or fetal conditions involving genetic testing, imaging, blood work, or screening tests, and for delivery of comprehensive counseling and optimal perinatal care. A multicentric study highlighted the adverse association between a decreased rate of prenatal detection of congenital heart diseases and low socioeconomic status, Hispanic ethnicity, rural residence location in the US, and distance from the hospital centre in Canada.1,72 Similarly, a study involving a low-income, Black pregnant population, and healthcare workers involved in their care, from 2 states in the US, highlighted the shortcomings of existing prenatal care in meeting patient care needs.76 Participants suggested that a more holistic approach be used to meet their nonmedical needs, such as social requirements and preferences, along with providing medical care.73 Nutritional assistance programs for those in the prenatal period, pregnant mothers, and children have been used to improve nutritional status and promote health during this crucial time of their lives. Utilization of food vouchers in a high-income country such as the United Kingdom was reported to provide huge potential to improve nutrition among low-income families. Moreover, barriers to these programs were identified as low literacy levels and lack of access to retailers in rural areas, stressing the need to address the adverse effects of SDoH.74

Value-based care and standardization of quality protocols

Many possible interventions can occur on a healthcare-system level and a regional level

Health system–based interventions. Standardizing the care delivered by all hospitals, especially those catering to underserved minority individuals, by utilizing healthcare bundles, protocols, checklists, multidisciplinary training, resources, and coordinated care can help reduce maternal morbidity and improve CV outcomes.7,75 The adoption of patient safety bundles, safety tool kits has been proven to reduce maternal morbidity rates. These items are aimed at providing best-practice equitable care to all individuals.76,77 Moreover, clinician training to provide more culturally sensitive and individualized care to racial and ethnic minority groups is important, to avoid implicit bias and discrimination while providing care. A need remains for healthcare policies to incentivize the provision of patient-centred care, and accountability when this cannot be done. Also essential is to incentivize hospitals and community-care clinics that provide care in remote locations and to uninsured and underserved populations by reimbursement strategies, tax incentives, and health policy efforts directed toward these that might help improve health outcomes.78

Apart from hospitals and doctors, recruitment and training of more-ancillary workforce members, such as nurses, doulas, and midwives, are also essential. Midwives are an integral part of the multidisciplinary team, and an increase in coverage by adequately skilled midwives could potentially avert 41% of
maternal deaths and 39% of neonatal deaths, especially in low- to middle-income countries and resource-limited areas. Furthermore, training physicians to identify vulnerable populations who experience adversity related to SDoH and may benefit from additional monitoring and integration with financial or social services, is crucial. This approach would help deliver health benefits and reduce morbidity during preconception, pregnancy, and the postpartum period.

**Regional intervention.** An intervention recommended by ACOG is designating different levels (I-IV) for hospitals, based on the complexity of care they can provide. Mothers are dependent on obstetric providers to recognize the acuity and level of care they need, and upgrade accordingly. This approach can help streamline the process of care in resource-limited settings, so that mothers can deliver safely, close to their community, while offering support for situations in which more-advanced resources are necessary.

**Telehealth and digital-based interventions**

Advancements in medical technology hastened by the COVID-19 pandemic can reduce health inequity, encourage physical activity, and improve health practices among hard-to-reach individuals. Telehealth can be provided using mobile devices, virtual platforms on tablets and computers, telehealth kiosks, and over the telephone, and can help connect patients from distant locations with clinicians, and mitigate transportation issues and costs. Along with improving the connectivity of patients to providers, telehealth facilitates connections among healthcare professionals as well. Providers from rural clinic settings can interact with urban specialists, and remote rural clinics can connect with regional health centres, enabling education, consultation, and treatment. Thus, a strong, connected health network can accelerate the escalation of care in complex cases, leading to improved maternal outcomes.

Digital health tools can help patient education and promote healthy lifestyle changes, such as healthy eating habits, increasing physical activity, and smoking and alcohol cessation, leading to improved CVH. Their utilization can contribute to averting acute events and advancement of CVH. These tools can be utilized further to facilitate prenatal and postnatal care in the following possible ways: health promotion, patient education on risk factors, diagnosis and management via virtual sessions with care providers, enhancement of healthcare access, remote monitoring, and follow-up care. Significantly higher rates (70% televisit vs 32% office visits) of follow-up visit completion were reported among postpartum Black women who had HDP or PE.

The Health Information National Trends Survey (2017-2020) studied digital health use among 8573 women who owned smartphones or tablets, and reported that women with chronic illnesses are more willing to adopt digital health tools for the management of their chronic illnesses. However, this study also highlighted the digital gap faced by older individuals, the uninsured, and individuals with low income, among whom the utilization was limited by cost and Internet availability. Moreover, to improve receptivity, the tailoring of digital tools to participants’ language and culture is essential. A cluster randomized control trial (RCT) study among African American churches that included 85 participants (71% female) implemented the FAITH! app to enhance CVH. After 6 months, the intervention group showed significant enhancements in overall CVH, as measured by the AHA Life’s Simple 7 composite scores. Significant advancements in dietary habits and physical activity were noted in the intervention group. Similarly, in an RCT with 205 Latina women, participants in the culturally and linguistically tailored physical activity program reached their physical activity goal more often than the control group. The program was created to be culturally appropriate, relatable, and easily understandable for the users. These findings underscore the importance of delivering culturally relevant lifestyle interventions that can promote CVH care equity.

Apart from improving patient care and outcomes, digital health tools can improve data collection and research recruitment, enabling participants from remote places and diverse racial-ethnic backgrounds to participate in clinical trials. For example, the MyHeart Counts Cardiovascular Health Study and the Health eHeart Study were able to recruit 48,986 patients, and more than 140,000 patients more than app-based platforms in their studies, respectively. Digital-based platforms have been shown to enhance the recruitment of underrepresented populations. The potential of digital health tools in recruiting participants for maternal outcomes trials and traditional clinical trials has not been investigated fully. However, these studies offer a glimpse into the opportunities that digital health tools may present.

**Community-based interventions**

The AHA promotes community- and individual-based interventions to educate, prevent, and manage risk factors of suboptimal CVH and improve the health status of the rural population while overcoming adverse SDoH. Patient navigation systems are a patient-centred intervention through which trained personnel identify the individual barriers, such as cultural, financial, logistical, and educational hurdles to accessing healthcare, and then help overcome these barriers and integrate the fragmented healthcare system to facilitate timely and appropriate access to healthcare. They provide individuals with health education and social support, mitigate access barriers, such as help in arranging transport, assist with healthcare, insurance paperwork, schedule appointments, and improve health literacy and self-efficacy in the long run. Such interventions are targeted to promote healthcare among diverse, historically marginalized racial and ethnic groups, and populations of low socioeconomic status. The postpartum navigation system has proven to be a success among racial and ethnic minority groups, by improving retention in postpartum care, vaccination, psychosocial screening, and acceptance of contraception. Thus, a need exists to promote more patient-centred interventions, such as navigation systems for all spheres of life, to overcome adverse SDoH, promote health-seeking behaviour, and improve healthcare utilization.

Existing infrastructure and community resources can be leveraged to reach a broader swath of the community, including racial and ethnic minority groups, particularly in rural areas. These resources should be available in places that are easily accessible and can help deliver care efficiently, such as churches, schools, and marketplaces. Therapeutic lifestyle
change (TLC) is one such community-based intervention that is beneficial in the treatment and management of chronic illnesses, such as HTN. The Faith-Based Approaches in the Treatment of Hypertension (FAITH) study was an RCT involving 373 Black, church-going participants (76% women), with a mean age of 63 years to evaluate the effectiveness of TLC in a community-based setting. At the 32 involved churches, congregants were given either sessions about TLC, along with motivational interviewing (intervention group), or a single TLC lecture supplemented by lectures on various health topics. The TLC and motivational interviewing were done by lay health advisors and were more effective in controlling HTN at 6 months than was health education alone. The likely reason for the success of faith-based organizations (FBOs) and churches is the trust of the community in the institution. FBOs are an integral part of the healthcare system in African countries and help deliver primary-, secondary-, and tertiary-level care to resource-limited settings. They also deliver maternal and child health services, such as obstetric services, training of healthcare workers, health promotion, sexual education, and immunization services. They are associated with improvement in healthcare outcomes and health-seeking behaviours. Similarly, the Healthy Beginnings initiative evaluated a church-based intervention vs standard health-facility referral for increasing human immunodeficiency virus (HIV) screening in pregnant women in Nigeria. The initiative included health education and onsite testing during baby showers. Results showed a significantly higher HIV testing rate in the intervention group (92%), compared to that in the control group (55%). These findings highlight the importance of culturally adapted community-based programs in resource-limited settings. Maternal and child health services provided by FBOs have led to a reduction in maternal morbidity and mortality. Services also improve community involvement in healthcare, increase the uptake of maternal healthcare services, and increase satisfaction as reported by users of care. Even though the FBO-based approach has the potential to strengthen the healthcare system, more research into its effectiveness is needed. However, this strategy does set a precedent for use of more community-based approaches for better maternal outcomes in patients with adversity related to SDoH.

Appropriate fourth-trimester and long-term maternal care

The “fourth trimester of pregnancy” is defined as the first 12 weeks after delivery (and beyond). This time is a critical period for clinicians to intervene to optimize women’s CVH and transition them into long-term care. Pregnancy-related deaths can occur up to a year after childbirth, with cardiomyopathy being the primary cause beyond 42 days. With the current knowledge that APOs have long-term implications on maternal CVH, the fourth trimester is an opportunity to identify undiagnosed prepregnancy conditions, manage the complications from APOs, assess and attempt to educate about any increased future risks of CVD, and begin to manage these risk factors to prevent future CVD and adverse outcomes. Unfortunately, the disparity in postpartum care has been well reported. A study conducted in the US reported that being a mother on Medicaid insurance, a mother identifying as Hispanic/Latino, or a mother aged < 20 years had a strong association with nonattendance at postpartum visits. Nearly half of the individuals from ethnic and racial minority groups reported an unmet need for postpartum care assistance for postpartum depression, in comparison to 9% of White individuals. A study including mothers on Medicaid insurance in the US also reported that Black mothers had fewer postnatal visits and were less likely to receive any contraception or effective contraception.

Breastfeeding is also an important aspect of the postpartum period that requires extra care. Breastfeeding has been associated with cardiometabolic benefits, reduction in long-term CV risk, and improved long-term maternal outcomes. Unfortunately, patients with APOs and adverse impacts relating to SDoH face more barriers to breastfeeding initiation and success. Per the national data from the 2017-2018 Canadian Community Health Survey, a decreased duration of breastfeeding was documented among individuals belonging to households with food insecurity, highlighting the adverse impact of SDoH on breastfeeding. Thus, healthcare policies should promote education and overcome barriers to enhance breastfeeding among communities with low socioeconomic status, especially those with APOs.

Optimal maternal health is important before the next pregnancy; therefore, all mothers, especially those with APOs, must receive adequate counselling about the risks of a future pregnancy, counselling, and careful management of preexisting CV conditions. A joint decision between the patient and the physician should be made based on underlying CV risk factors, comorbidities, and the patient’s choice for preferred contraception.

Therefore, healthcare systems should focus on all phases of pregnancy: preconception, intrapartum, and postpartum. Per the recommendations by ACOG and the AHA in the US, and similar recommendations by the Public Health Agency of Canada and the Society of Obstetricians and Gynaecologists of Canada, women with certain APOs, such as gestational HTN, GDM, and preterm delivery, should be referred to a primary care physician or a cardiologist for long-term monitoring and prevention of CVD. Hence, ensuring reliable continuity of care during the transition from obstetrics to primary and CV care is essential. The use of transition clinics (eg, the Maternal Health Clinic in Ontario, Canada) and medical technology for remote monitoring and follow-up have proven to be beneficial.

Given the importance of extended postpartum care, adequate resources should be provided to women to ensure that they have access to care (in-person or virtual if needed). Monetary support during maternal leave may be a viable option to help new mothers focus on themselves and their infant’s well-being by having time for follow-up care, breastfeeding, and recovery. Health systems should promote continuity of care for high-risk patients to ensure that APOs are addressed adequately to mitigate future CVD risks.

Conclusion

SDoH can significantly impact maternal outcomes and CVH. Women of color and individuals with low socioeconomic status are disproportionately affected by APOs, CV risk factors, and CVDs, due to health inequity, limited
healthcare access, psychological stress, and social adversities. APOs share risk factors with CVDs and are associated with suboptimal maternal CV outcomes in the long run. Thus, APOs provide clinicians with an early opportunity for aggressive risk prevention and early intervention, making postpartum care a vital part of maternal health. Reduction of healthcare disparities and adverse effects of SDoH warrants a multilevel approach at a global, national, regional, community, and individual level, which is essential to improve CVH and maternal outcomes. Our review highlights the intricate relationship among maternal outcomes, SDoH, and CVH.

Ethics Statement
The research reported 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 article. The drafting of this article did not require any direct handling of a patient database.

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Disclosures
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