CJC Open 3 (2021) S102–S117

Review

Use of Race, Ethnicity, and National Origin in Studies Assessing Cardiovascular Risk in Women With a History of Hypertensive Disorders of Pregnancy

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ABSTRACT

Women with a history of hyperBtensive disorders of pregnancy (HDP) are at particularly high risk for cardiovascular disease (CVD) and CVD-related death, and certain racial and ethnic subpopulations are disproportionately affected by these conditions. We examined the use of race, ethnicity, and national origin in observational studies assessing CVD morbidity and mortality in women with a history of HDP. A total of 124 studies, published between 1976 and 2021, were reviewed. We found that white women were heavily overrepresented, encompassing 53% of all participants with HDP. There was limited and heterogeneous reporting of race and ethnicity information across studies and only 27 studies reported including race and/or ethnicity variables in at least 1 statistical analysis. Only 2 studies mentioned the use of these variables as a strength; several others (k = 18) reported a lack of diversity among participants as a study limitation. Just over half of included articles (k = 68) reported at least 1 sociodemographic

RÉSUMÉ

Les femmes ayant des antécédents de troubles hypertensifs de la grossesse (THG) présentent un risque particulièrement élevé de maladies cardiovasculaires (MCV) et de décès liés à ces dernières, et certaines sous-populations raciales et ethniques sont touchées de manière disproportionnée par ces maladies. Nous avons examiné l'utilisation de la race, de l'ethnicité et de l'origine nationale dans les études observationnelles évaluant la morbidité et la mortalité liées aux MCV chez les femmes ayant des antécédents de THG. Un total de 124 études, publiées entre 1976 et 2021, ont été examinées. Nous avons constaté que les femmes blanches étaient fortement surreprésentées, puisqu'elles constituaient 53 % de l'ensemble des participantes atteintes de THG. Les renseignements relatifs à la race et à l'ethnicité étaient limités et hétérogènes d'une étude à l'autre, et seules 27 études ont indiqué avoir tenu compte de variables relatives à la race ou à l'ethnicité dans au moins une analyse statistique. Seules deux études

Cardiovascular disease (CVD) is the leading cause of hospitalization among Canadian women,[1] and the leading cause of death for women worldwide.[2] Women with a history of hypertensive disorders of pregnancy (HDP), which affect 5%-10% of all pregnancies, are at particularly high risk for CVD and CVD-related death.[3] Substantial heterogeneity exists in the association between HDP and CVD, such that certain racial and ethnic subpopulations (eg, non-Hispanic black and American Indian or Alaska Native women) are disproportionately affected by these conditions.[4,5] Racial differences have been identified in the presentation, incidence, and short- and long-term outcomes associated with preeclampsia (PE),[5] the second leading global cause of maternal mortality.[6,7]

Although this evidence is compelling, as noted by Mays et al,[8] the concepts of race and ethnicity are complex and often

Received for publication June 15, 2021. Accepted August 10, 2021.

Ethics Statement: The research reported has adhered to relevant ethical guidelines.

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See page S111 for disclosure information.

https://doi.org/10.1016/j.cjco.2021.08.002

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variable other than race and ethnicity (eg, marital status and income); however, none investigated how they might have worked synergistically or antagonistically with race and/or ethnicity to influence participants' risk of CVD. These findings highlight significant areas for improvement in cardiovascular obstetrics research, including the need for more robust and standardized methods for collecting, reporting, and using sociodemographic information. Future studies of CVD risk in women with a history of HDP should explicitly examine racial and ethnic differences and use an intersectional approach.

ont mentionné l'utilisation de ces variables comme un point fort; plusieurs autres (k = 18) ont signalé un manque de diversité parmi les participantes comme une limite de l'étude. Un peu plus de la moitié des articles inclus (k = 68) ont fait état d'au moins une variable sociodémographique autre que la race et l'ethnicité (p. ex., l'état matrimonial et le revenu); aucun toutefois n'a étudié la manière dont ces variables auraient pu agir en synergie ou en opposition avec la race ou l'ethnicité pour influencer le risque de MCV des participantes. Ces résultats mettent en évidence des points importants à améliorer dans la recherche sur l'obstétrique cardiovasculaire, notamment la nécessité de méthodes plus fiables et normalisées en matière de collecte, de communication et d'utilisation des données sociodémographiques. Les prochaines études sur le risque de MCV chez les femmes ayant des antécédents de THG devraient examiner explicitement les différences raciales et ethniques et adopter une approche intersectionnelle.

not assessed or reported precisely enough for research needs. This is especially problematic for authors of systematic reviews (SRs) and meta-analyses, which can provide the highest level of evidence for causal association,[9] as inconsistent and incomplete reporting in primary studies can lead to information about race and ethnicity becoming unusable.[10] Although often used interchangeably, race and ethnicity have different meanings and are distinct social constructs.[11-13] There are currently no globally accepted definitions of race and ethnicity.[14] However, in general, race is used to categorize individuals on the basis of perceived physical differences, such as skin colour.[13] In contrast, ethnicity refers to membership of a cultural group and may be tied to an individual's nationality, language, or religion, among other factors.[13] Although these constructs are commonly reported in health research,[11] they are far more subjective than an individual's age or sex,[12] often resulting in their being weakly measured, poorly analyzed, and inadequately reported.[10]

Because the use of race and/or ethnicity can affect the quantification of cardiovascular risk estimates, it is imperative that researchers (1) carefully report on and discuss why race and ethnicity variables are used, (2) discuss how these variables are assessed, and (3) discuss the potential implications of study findings based on their use.[15] Critically, others[5,15,16] note the need to avoid erroneously attributing disparities in health outcomes to specific racial or ethnic groups without attempting to understand or investigate the underlying causes of disparities. To this end, a 2020 report[13] published by the Canadian Institute for Health Information outlined proposed standards for collecting race and indigenous identity data in health care, noting a lack of consensus on data collection standards for these variables. Further, as recently as March 2021, Ontario-based administrative health data provider ICES[17] announced a call for participants to become members of a "People's Panel" with the goal of creating of a race and ethnicity data framework "to ensure the anti-racist use of race, ethnicity and immigration data."[18] Medical journals are also taking note of the need for more careful consideration of the terminology used when describing race and ethnicity. For example, a 2021 *Journal of the American Medical Association*[19] editorial discussed revisions to its submission requirements on race and ethnicity and announced a formal request for input on ways to improve.

Given recent and increasing calls for improved reporting and analysis of race and ethnicity, coupled with the serious short and long-term consequences that HDP can have on women's cardiovascular health and its increasing global prevalence[20,21]—especially among racial and ethnic subpopulations[21,22]—it is prudent to examine how researchers have used race and ethnicity in studies assessing CVD risk in women with a history of HDP. To address this gap, in this rapid review, we conducted a new analysis examining the use of race, ethnicity, and national origin in prior observational studies assessing CVD morbidity and mortality in women with a history of HDP.

Methods

A rapid review is a type of evidence synthesis produced using streamlined systematic review (SR) methodology to address a predefined research question(s) and the most rigorous methods that a reduced timeframe allows.[23-25] As noted by Polisena et al.,[26] there is no standardized approach to conduct a rapid review, as the methods used should be tailored to meet the specific needs of the study (eg, the expertise of the research team, nature of the evidence base, research question[s], and study aims) as well as those of the end user.[27] Some of the more common methodologic strategies used in rapid reviews include (1) the use of recently published SRs as a starting point in identifying eligible literature,[28] (2) literature screening and inclusion by a single reviewer,[29] (3) limiting the breadth of evidence synthesis to a descriptive summary/categorization of data,[24] (4) narrowing study eligibility criteria (eg, including literature published in English only),[29] and (5) omitting a formal risk of bias assessment or quality appraisal of included studies.[29,30] Critically, in their comparison of rapid and systematic reviews addressing similar research questions , Watt et al.[31] found that the conclusions of reviews conducted using either approach were similar.

Review context

This review adds novel information to previous work[15,32-35] that explored the use of race and ethnicity in epidemiologic and health services research. We build on this

literature by focusing our exploration of these concepts within the context of studies estimating cardiovascular risk in women with a history of HDP.

Eligibility criteria

We used recently published SRs/meta-analyses to populate an initial list of potentially eligible primary studies. Full descriptions of eligibility criteria for both SRs and primary studies are provided in Supplemental Tables S1 and S2, respectively. Briefly, SRs were eligible for inclusion if authors included observational studies (ie, cohort studies, case-control studies, and cross-sectional studies) examining CV morbidity and mortality in women with a history of HDP. Specific CVDs of interest included heart failure, arrhythmias, ischemic heart disease (including coronary heart disease and myocardial infarction), stroke, and death from CV causes. In addition to these CV outcomes, SRs that included studies examining the association between HDP and chronic hypertension (HTN) were also of interest because of its robust association with CVD risk and mortality.[36] Included primary studies obtained from published SRs and the literature search update (see *Literature Search and Screening* section) were screened for inclusion according to the inclusion criteria shown in Supplemental Table S2. Conference abstracts, letters, case reports, opinion pieces, and studies published in languages other than English were excluded. No restrictions were placed on year of publication for primary studies.

Literature search and screening

Two literature searches were designed and carried out by an experienced research librarian (S.V.) on May 20, 2021, in MEDLINE (see Supplemental Tables S3 and S4 for full search details). The first search was carried out to identify recently published SRs. The second literature search was used to identify recently published primary studies. Both searches comprised terms related to pregnancy-induced hypertensive disorders and were informed by previously conducted systematic literature searches.[37,38] The first search was limited to English-language SRs or health technology assessments published from 2020 to present.[39] The second search also incorporated terms relating to coronary artery disease, heart failure, stroke, and myocardial infarction, and was limited to English-language observational studies[40] published from 2019 to present. A gray literature search was not undertaken. All results were exported to Covidence (Melbourne, Australia), and duplicates were eliminated using the platform's duplicate identification feature.

Deduplicated search results were imported into DistillerSR (Ottawa, Canada), which was used to facilitate the screening and data extraction process for our race and ethnicity analysis. SRs and primary studies were managed in separate project folders. First, the titles/abstracts of all records identified through literature searches were screened for inclusion by a single author (A.J.) against the eligibility criteria. The full text of all records identified as potentially eligible based on the results of the title/abstract screen were then assessed for full eligibility. The included study lists of fully eligible SRs were then imported into EndNote (New York, NY) bibliographic software and the platform's duplicate identification feature was used to remove duplicate records. All deduplicated records were then imported into DistillerSR and the full texts screened for inclusion.

Extraction of race and ethnicity data from primary studies

All data were independently extracted by three authors (A.J., V.T., S.D.) into customized extraction forms housed in DistillerSR. Pilot tests were completed on 5 studies by all reviewers, and adjustments were made as required before full data extraction began. Two reviewers (A.J., S.D.) audited extracted data for completeness and accuracy. When necessary, disagreements were resolved by consensus.

Data extracted from fully eligible primary studies included:

- Study characteristics (author name, publication year, journal name and type, funding, country of conduct, cardiovascular outcomes reported, study design, data source, aims and objectives)
- Race, ethnicity, and geographical origin of participants (geographical origin or participants; if and where race and ethnicity were reported in the study; the terms used to describe race and ethnicity; how race and ethnicity were defined, assessed, and reported; whether and how race and ethnicity were included in analyses; and number of participants by race or ethnic category by HDP diagnosis)
- Other sociodemographic characteristics reported by authors (eg, participant income, marital status, education, employment, religious affiliation)

Study and population characteristics were only extracted if they were relevant to this review. For example, information about irrelevant exposures and comparison groups such as gestational diabetes or women with a history of normotensive pregnancies was not extracted. Further, in the event of a composite exposure (eg, maternal placental syndrome), only information about participants with HDP was extracted. If the geographic location of participants was not stated, the location of the corresponding author was extracted in its place. Supplemental material and previously published methods were not routinely collected or examined for information of interest unless authors explicitly reported that information pertinent to this review was reported elsewhere (eg, supplemental analyses by race or ethnicity or demographic information presented for the study population). Studies were considered to have included participants of a single race or ethnicity if authors made explicit statements such as "black women."

Quality assessment

In accordance with our rapid review protocol, included primary studies were not formally assessed for quality. However, given that we were interested in the reporting and use of race, ethnicity, and national origin in studies of observational design, we noted which studies made use of the **St**rengthening of **R**eporting of **Ob**servational Studies in **E**pidemiology (STROBE)[41] guideline or its extension, the **Re**porting of Studies **C**onducted Using **O**bservational **R**outinely Collected Health **D**ata (RECORD)[42] statement, as appropriate. First

published in 2007, the STROBE guidelines were created to improve the reporting quality of observational studies.[43] The RECORD extension should be used for observational studies that use routinely collected health data.[42] Because the STROBE guidelines were published in 2007, we only looked for the use of these guidelines in primary studies published in 2008 or later.

All included SRs from which most our primary studies were obtained were independently assessed for quality by 2 independent reviewers (V.T., S.D.) using **A** **M**ea**s**urement **T**ool to **A**ssess Systematic **R**eviews" (AMSTAR-2).[44] Discrepancies were adjudicated by a third reviewer (A.J.).

Results

We use the term *women* when reporting all results, as this is the term that was used in all included studies to describe study participants. We recognize that this is a gendered term that may not be generalizable to all study participants and acknowledge that not all currently or previously pregnant persons identify as women.

Study selection and general characteristics

After screening 196 records identified through literature search one, we identified a total of 6 SRs, published in 2020[38,45-48] and 2021[49] (Supplemental Table S5; Figure S1) from which an initial set of 174 potentially eligible primary studies were identified. A total of 524 records were obtained from our second search for recently published primary studies. After excluding records that did not meet our eligibility criteria, a total of 124 primary studies[3,50-172] were included for full review (Supplemental Table S6).

All included primary studies were published between 1976 and 2021, with most studies (72%) published in the last 10 years. Across included studies, we noted a general lack of reporting on the theoretical justification for using (or omitting) race and/or ethnicity in statistical models as well as a lack of justification for, or reflection on, the methods used to classify participants into a particular race and/or ethnicity group. Of the 103 studies published in 2008 or later, only 2[77,171] reported making use of the STROBE[77] or RECORD[171] reporting guidelines. Only one[171] included a copy of their checklist summarizing where each item was addressed in their manuscript.

Most studies used a cohort design (k = 98; 79.0%), 12 were case-control studies (9.7%), and 14 were of cross-sectional design (11.3%). A wide range of HDP diagnoses were reported in included studies, with more than half of participants (or HDP deliveries) having been diagnosed with PE alone or one of 15 author-reported PE subtypes. The authors of about a quarter of included studies (k = 35) reported that HDP diagnoses were obtained using International Classification of Diseases (ICD) codes, and in 19 studies, this information was obtained from participant questionnaires (ie, self-reported obstetric history) (Supplemental Table S7).

Just over half of included studies (k = 64) reported on the risk or odds of HTN in women with a history of HDP. In 45 of those studies, HTN was the only reported outcome of interest. The second most commonly reported cardiovascular outcome was ischemic heart disease (including coronary heart disease and myocardial infarction), which was reported by 30% of included studies. A similar but slightly lower proportion of studies reported on stroke (27%; k = 34) and a further 24 studies reported on CVD as a composite outcome. An additional 23 studies also reported on cardiovascular mortality. Finally, 13% of included studies reported on heart failure, whereas only 4% (k = 5) reported on risk of cardiac arrhythmia in women with a history of HDP.

Geographic location of participants

Figure 1 shows a geographic heat map of the global spread of participants represented in cardiovascular obstetrics (cardio-obstetrics) research as it pertains to women with a history of HDP. Three quarters of participants with a history of HDP (including HDP deliveries) resided in the United States (n = 3,382,939). Of the remaining 1,093,303 participants, most (81%) were from the United Kingdom (n = 363,830; 33.3%), Denmark (n = 193,331; 17.7%), Norway (n = 174,243; 15.9%), and Canada (n = 156,082; 14.3%). The least well represented countries included Turkey (n = 25), India (n = 39), Kenya (n = 63), Chile (n = 71) and Brazil (n = 70). Only one study[138] involved participants residing in Africa, and no studies involved residents of northern Eurasia (eg, Russia, Tajikistan, Uzbekistan).

Race and ethnicity

Use of the terms *race* and/or *ethnicity*. The terms *race* and *ethnicity* were reported in some form (eg, ethnic, ethnicities, racial) in less than half of included studies (k = 55). In 15 of these studies,[53,64,69,75,93,110,118,122,132,135,141,147,157,160,171] these terms were used interchangeably (eg, *race/ethnicity* or *race-ethnicity*). In six studies,[55,61,115,130,131,134,159] authors used the term *ethnicity* exclusively, and in 12 others,[68,72,73,81,83,86,89,97,129,142,145,154] study authors only used the term *race*. Other related terms used to study populations included *ethnically*,[102] *racially*,[87] and *socioeconomically diverse*,[102] and some participants were described as belonging to specific *ancestory*,[67] or *ethnic* group(s).[79,85,151]

Reporting of race and/or ethnicity information. The authors of 18 included studies (15%) explicitly reported that study participants were of a single race, ethnicity, or national origin. Specifically, 1 study each included only (South) Korean,[140] Northeastern Brazilian,[76] American Indian,[62] Iranian,[149] Norweigan,[152] Dutch,[60] and black[167] women. Two studies each included only white or Caucasian[60,126] and Finnish women,[111,119] and 3 studies each included only Japanese,[114,133,137] and Taiwanese[103,117,158] women. Across the other 106 studies, a modest percentage reported any race- and ethnicity-related information (eg, as related to participant characteristics or in their introduction or discussion sections of their article). As summarized in Figure 2, since the 1970s, the average proportion of studies reporting on these sociodemographic constructs has generally increased over time from 33% of articles published from 1978 to 2001 to 67% of articles published in 2018 to 2021 (103% change).

Of the 106 studies that did not explicitly involve participants of the same race or ethnic group, only 65 authors reported information pertaining to race or ethnicity anywhere in

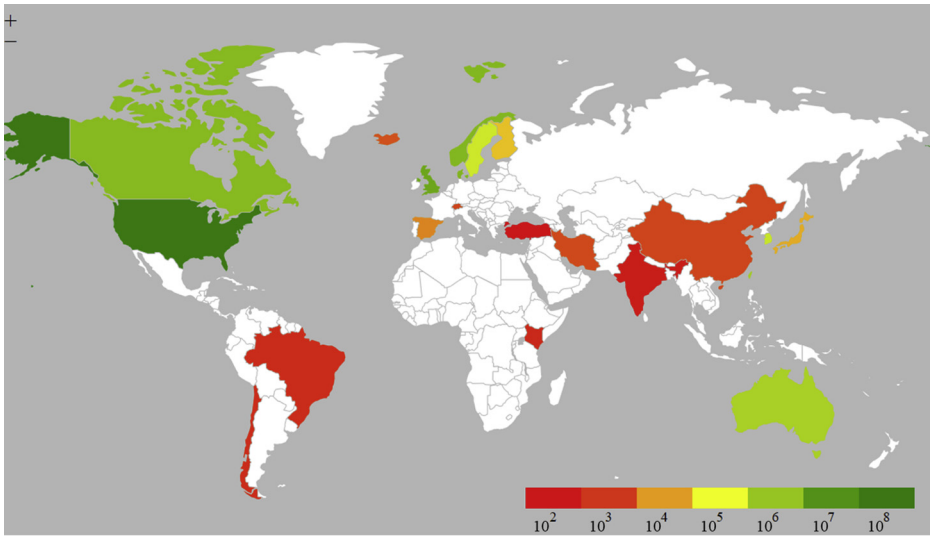

Figure 1. Geographic heat map illustrates the relative number of participants with a diagnosis of hypertensive disorders of pregnancy (HDP) in studies that assessed its association with cardiovascular morbidity and mortality. The number of participants with a history of HDP spanned 5 orders of magnitude; thus, the data are displayed on the $\log_{10}$ scale (eg, 25 is equal to $10^{1.4}$ on the $\log_{10}$ scale) to facilitate the visual comparison of these large disparities. All raw data and corresponding $\log_{10}$ values are provided in Supplemental Table S8.

their published manuscript. Nearly 68% (k = 44) reported on participant race and/or ethnic group in a results table (eg, participant characteristics), and only 30 (46%) also discussed participant race and/or ethnicity in the results text (Table 1). Only 2 studies[86,122] mentioned the use of race and/or ethnicity variables as a strength of their study; however, several more (k = 18) reported that a lack of racial and/or ethnic diversity among study participants was a study limitation. One study completed in Canada[115] discussed the use of immigration status as a proxy for ethnicity, and another study conducted in The Netherlands[67] advised their study population involved a "low prevalence of immigrants."

Nearly one-third of included studies reported that participant race and/or ethnicity was assessed through participant self-report (eg, through questionnaires), whereas just over one quarter (k = 17) were assigned to a racial and/or ethnic category based on the use of existing records (eg, clinical registries). Twenty-nine percent of studies (k = 19) referred to race and/or ethnicity as demographic variables, whereas only 5[51,69,110,101,122] referred to these constructs as sociodemographic variables. The authors of 4 studies[73,89,131,156] reported matching study participants based on race, and another[79] reported limiting at least 1 secondary analysis to white participants with no explanation for this restriction. One 2010 study[135] presented unadjusted CVD death rates by maternal race.

Among studies that included race and/or ethnicity in at least 1 statistical analysis (k = 27), most (59%) reported that these variables were adjusted for in statistical models. Only 2 studies[75,122] reported the inclusion of data on race and/or ethnicity as part of an interaction term. The authors of a recently published study[122] reported excluding participants of other race/ethnicity from analysis because of low numbers. More than half of these studies (approximately 52%) reported significant findings related to race and/or

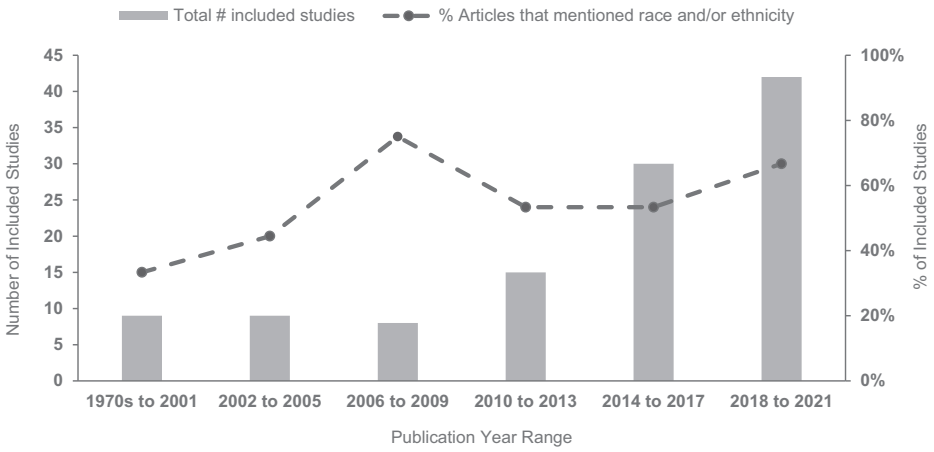

Figure 2. Number of included studies published from 1978 to 2021 in 6 publication-year categories and the corresponding percentage of studies that mentioned race and/or ethnicity in any way.

Table 1. Use of race or ethnicity variables in studies assessing cardiovascular morbidity and mortality in women with a history of hypertensive disorders of pregnancy

Use of race or ethnicity variables	Number of studies (% of total)
Position in article*	
Introduction	6 (9.2%)
Methods	41 (63.1%)
Results (tables)	44 (67.7%)
Results (text)	30 (46.2%)
Discussion	21 (32.3%)
Strengths	2 (3.1%)
Limitations	18 (27.7%)
Stated method of assessment*	
Participant self-report	21 (32.3%)
Existing records	17 (26.2%)
Not stated	9 (13.8%)
Other†	1 (1.5%)
Stated purpose of use or reason for collection*	
Demographic variable	19 (29.2%)
Sociodemographic variable	5 (7.7%)
Confounder or adjustment variable	16 (24.6%)
Not stated	3 (4.6%)
Other‡	2 (3.1%)
Stated method of use in analysis§	
Risk factor	1 (3.7%)
Confounder	8 (29.6%)
Interaction term	2 (7.4%)
Covariate	6 (22.2%)
Control for	2 (7.4%)
Adjust for	16 (59.3%)
Unclear	5 (18.5%)
Reported and discussed results§	
Reported significant findings	14 (51.9%)
Discussed findings	10 (37.0%)
Called for further research	5 (18.5%)
Not stated	6 (22.2%)

*Among studies that reported on race and/or ethnicity of participants and did not involve 1 race or ethnic group exclusively (k = 65).

†One study[85] assessed participant ethnicity based on father's birthplace (no rationale provided).

‡One study each described race or ethnicity variables as "baseline factors"[102] and information of "intrinsic interest."[85]

§Among studies that included race and/or ethnicity in at least 1 inferential analysis (apart from descriptive analyses) (k = 27). Note that some studies may have used more than 1 term; thus, the total is more than 27.

ethnicity, but only 10 discussed them in detail. Five studies[100,101,128,139,164,] called for further research to address knowledge gaps related to the generalizability of findings to more diverse populations.

Reporting of participant race and ethnicity. As shown in Table 2, 61 studies (49%) did not report on participant race and/or ethnicity. Among those that did (k = 45), the highest number of race and/or ethnic groups reported in a single study was 7, which was noted in 2 studies published in 2018[132] and 2020.[171] Two other recently published studies[53,112] reported that participants belonged to 1 of 6 different race and/or ethnic groups, and 7 studies[64,75,85,93,116,135,157] reported that participants belonged to 1 of 5 different race and/or ethnic groups, 5 of which[64,75,93,116,157] were published in 2015 or later. The median/mean number of race and/or ethnic categories reported generally increased over time.

The range of race and ethnicity groups reported on by studies was extensive, with the highest proportion of studies reporting participants of white race (Table 3). Several studies (k = 22) reported that participant race or ethnicity was unknown, missing, unspecified, or other, and several different terms were used to describe the same construct (eg, *Caucasian*, *white*, *non-Hispanic white*, *European descent*). Only 3 studies[64,75,132] reported if participants identified as multiracial, mixed, or multiple race.

Participant race and ethnicity by HDP diagnosis

A total of 2,871,907 women with a history of any HDP (or HDP deliveries) were categorized into a race or ethnic group by study authors. More than 1.5 million participants (53%) were described as white, Caucasian, non-Hispanic white, or European (including Finnish, Norweigan, and Dutch)—2.8 times more participants than the next highest represented race or ethnic group, Hispanic or Latino (n = 544,957) (Figure 3). Nearly 110,000 participants with a history of HDP were classified as other, unknown or unspecified race or ethnicity, representing 4% of the total. Just over 400 participants were described as African and 35 women with HDP in included studies were Iranian.

Other sociodemographic variables

Although the primary focus of this review was on the reporting of race and/or ethnicity, we also noted other sociodemographic variables reported on by authors of included studies (see Supplemental Table S6). Briefly, just over half of included studies (k = 68) reported on at least 1 sociodemographic variable other than race and ethnicity, such as participant marital status, socioeconomic status, religious affiliation, and type of health insurance. Of these, most authors (74%) also explicitly reported having included 1 or more

Table 2. Number of categories of race or ethnicity reported in included studies*

Publication year	Total nNo. of studies	No. of race and/or ethnic categories reported		
		Median categories	Mean categories	Minimum, maximum categories
1970s-2001	1	2	2	N/A
2002-2005	2	4.5	4.5	4, 5
2006-2009	4	1	1.3	1, 2
2010-2013	5	3	2.8	1, 5
2014-2017	12	2.5	2.6	1, 5
2018-2021	21	3	3.5	1, 7
Did not report on race and/or ethnicity	61			
TOTAL	106			

*k = 124 included studies; however, this summary table excludes k = 18 studies in which authors reported that all participants were of the same race or ethnicity.

Table 3. Race and ethnicity categories reported on by authors of included studies*

Asian	Black	Hispanic or Latino	Indigenous	Middle Eastern	White	Unknown or missing	Other terms
Korean (k = 1)	Black (k = 13)†	Hispanic (k = 16)	American Indian (k = 1)	Iranian (k = 1)	White or white origin (k = 16)	Unknown (k = 4)	Father's birthplace: North Africa (k = 1)
Japanese (k = 4)	African American (k = 7)	Hispanic/Latino‡ (k = 2)	Aboriginality (k = 1)	Turkish origin (k = 1)		Declined (k = 1)	
Taiwanese (k = 2)	Non-Hispanic black (k = 5)	Northeastern	Native American (k = 3)	Moroccan origin (k = 1)	Caucasian or Caucasian origin (k = 10)	Missing (k = 1)	Father's birthplace: Europe or elsewhere (k = 1)
Asian (k = 9)§			American Indian/Alaskan				
Asian or Pacific Islander (k = 5)	Black/African American (k = 1)	Brazilian(k = 1)	(k = 1)	Father's birthplace: Other West Asia (k = 1)	Non-Hispanic white (k = 8)		Non-white (k = 1)
		Latina (k = 1)			Finnish (k = 2)		Non-black (k = 1)
	Afro-Caribbean (k = 1)			Father's birthplace: Israel (k = 1)	Norwegian ethnicity (k = 1)		Non-Nordic (k = 1)
	African (k = 1)						Non-Hispanic (k = 2)
					Norwegian (k = 1)		Other (k = 16)¶
					European (k = 2)		Other or unspecified (k = 1)
					Europe (k = 1)		
					White European (k = 1)		Other/multiple (k = 1)
					White Northern European (k = 1)		Multi-racial/other (k = 1)
					European continental ancestry (k = 1)		Other/mixed (k = 1)
					Nordic (k = 1)		

* Categorized using the Canadian Institute for Health Information's Proposed Standards for Race-Based and Indigenous Identity Data Collection and Health Reporting in Canada[13] as a guide.
† One study[116] included persons classified as black Caribbean, black African, and black other into a single *Black* category.
‡ One study[141] reported Hispanic/Latin, which was also included in this category.
§ One study[116] included persons of South Asian descent (Indian, Pakistani, Bangladeshi) and persons classified as other Asian into a single *Asian* category.
¶ One study[116] included participants classified as Chinese, mixed, and other into a single *Other* category.

of those factors as an adjustment variable or covariate in at least 1 statistical model. These types of sociodemographic varibles varied widely across studies, both in terms of how they were defined, breadth of variables reported, and in terms of the combination of variables that were incorporated into statistical models.

The most commonly reported sociodemographic variables reported by authors were participant education and marital status. Measures of socioeconomic status and social class varied most widely, ranging from factors such as annual family income,[135] employment information (ie, job title or category),[63,125,168] to composite variables that derived an overall score for each participant using previously established methods (eg, the Index of Relative Socio-Economic Advantage and Disvantage[54] and Nam-Powers socioeconomic scores[159,160]). These scores combined information about a variety of factors such as car ownership, neighbourhood-level social class and overcrowding, and highest level of education and occupation, among other factors.[55,153] Two studies published in 1997[94] and 2005[85] used husband's occupation as a measure of participant social class but provided no rationale for doing so (eg, participants may not have been employed outside the home, and the tools used to assess social class did not account for this kind of work).

Only 25 (20%) studies reported on participant sociodemographic information in addition to race and/or ethnicitiy; however, none investigated how the additional sociodemographic variables they collected (eg, education, marital status, income, rural vs urban setting, insurance payer) may have had synergistic or antagonistic effects with race and/or ethnicity to influence participants' risk of CVD.

Discussion

In this review, we examined the use of race, ethnicity, and national origin in observational studies assessing CVD morbidity and mortality in women with a history of HDP. Overall, we found limited and heterogeneous reporting of race and ethnicity information across included studies. Despite evidence of substantial racial and ethnic differences in the prevalence estimates for HDP, which range from less than 3% for Chinese and Vietnamese women to 8.9% for Indigenous American women and nearly 10% for non-Hispanic black women,[173] we found that white participants were heavily overrepresented in the literature. Continents such as Africa, where the burden of HDP is high,[22] exceeding 20% of all pregnancies in Botswana alone,[174] were also poorly represented. Despite the burden of HDP being higher across several racial and ethnic minority groups, almost no studies examined race and/or ethnicity differences in the association between HDP and CVD outcomes.

Findings in light of previous research

The methodologic issues related to the reporting and use of race and/or ethnicity identified in this review align with those reported in several published studies.[32-35,175,176] The overrepresentation of white populations in health research has been frequently observed,[34,35,176,177,178] and others[179] have noted it as a major limitation of studies examining cardiovascular risk in women with a history of HPD. Like others,[35] we found limited reporting of race and ethnicity information

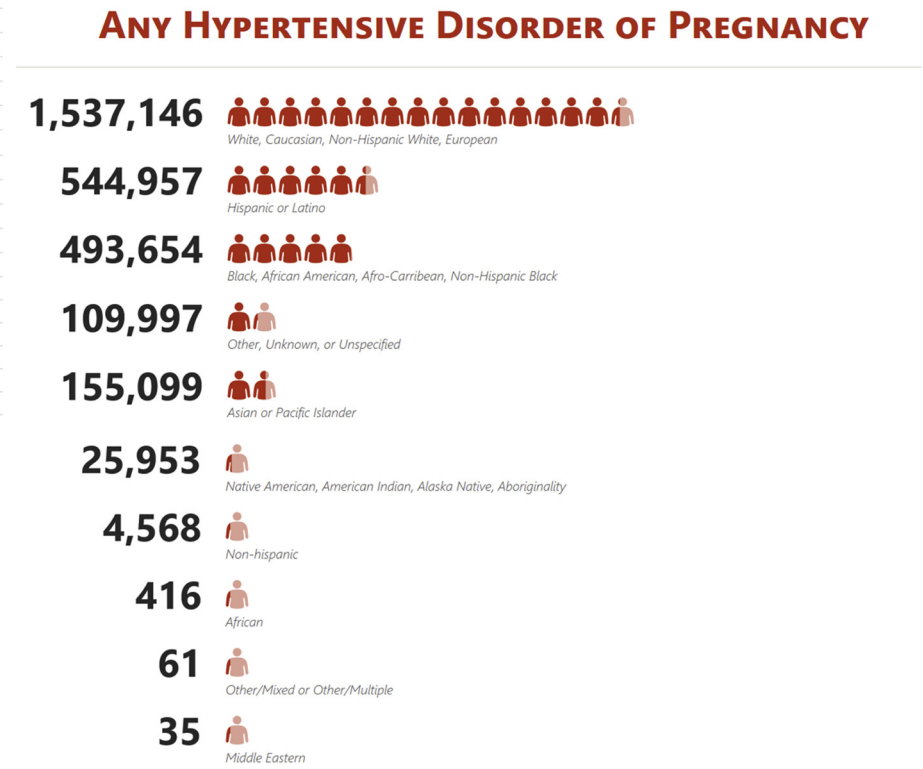

Figure 3. People graph illustrating the total number of women with a history of any hypertensive disorder of pregnancy in included studies by reported race or ethnicity group.

across included studies, and, when authors did report this information, several different terms were used to describe the same construct (eg, *Caucasian*, *white*, *non-Hispanic white*, *European descent*). Further, we identified only 1 study[148] whose authors reported classifying participants into a specific ethnic group based on an existing framework or prespecified criteria.

In their 2020 review, Bokor-Billmann et al.[35] noted that a substantive portion of studies in general medicine, surgery, and oncology published between 2007 and 2018 reported non convenience race or ethnic groupings. Similarly, we found that across included studies, thousands of women with HDP were assigned to a category referred to as *other* to represent their race. In addition, we noted that only 3 studies[64,75,132] included in this review reported any category that captured individuals who identify as multiracial. This finding is concerning given that individuals who identifiy as multiracial may experience inequalities in health that are different from those who identify with a single racial group.[180] In the year 2000, the US Census started distinguishing Asian and Pacific Islander as 2 separate racial categories.[181] However, the authors of 5 studies,[53,64,132,142,171] all of which were published in 2016 or later, still reported individuals as belonging to a combined Asian/Pacific Islander race. This finding points to the limitations of using registry and administrative data in epidemiologic studies, as researchers using these types of data cannot control how they are collected and may not be able to adapt their reporting of variables if data collection methods change over time.

Previous reviews[15,32,35,] have noted a gap in the reporting of criteria used to categorize individuals into race and/or ethnic groups in medical research. This finding is likely driven by a lack of consensus in the definition of race and ethnicity and a paucity of standardized classification systems and reporting standards.[35] It may not be feasible to classify all individuals into specific race or ethnic categories and, in some cases, categories may need to be combined to gain statistical power or to preserve the anonymity of participants.[12] However, no matter which approach is taken, it is imperative that researchers examining associations between HDP and CVD carefully delineate and define the categories they intend to use and consider the possible heterogeneity that doing so may create, as it could have important implications for the interpretation and meaning of results.[11]

Although previous literature supports the use of race and/or ethnicity obtained through self-report as the gold standard method of assessment,[11,182] we observed that only about one-third of authors used self-report as a means to obtain these data. One study[85] used father's birthplace as a proxy for participant ethnicity, and an additional 25% reported using existing records (eg, registry and other administrative data) to obtain information about demographic variables with no explicit mention about the potential for misclassification and its potential impact on study findings. An individual's ethnic identity can change depending on the context (so-called *situational ethnicity*[8]) both in terms of how they define themselves and how they may be perceived by society,[11,12] which underscores the need for participants to self-declare this information.

Similar to the findings of Ahdieh and Hahn,[32] we found that most studies statistically controlled for race and/or ethnicity in multivariable models by including them as potential confounders in the association between HDP and CVD. However, in etiologic studies, such as most of those included in this review, race and ethnicity can play an important role in helping researchers understand the effect of HDP on CVD through their interaction with race.[183] We identified only 2 studies[75,122] that reported on the use of interaction terms to investigate the statistical significance (and magnitude) of the effect of race and HDP exposure on CVD outcomes. One study[75] only reported the results of statistically significant interactions, whereas the other[122] reported on the results of all interactions tested, regardless of statistical significance.

Although significant interaction terms may signal important race and/or ethnic differences in the risk of CVD in women with a history of HDP, a lack of significance should not be interpreted as direct counter evidence of a difference between race and/or ethnic groups.[184] Tests for interaction are dependent on the type of measurement scale (ie, multiplicative or additive), and researchers can reach different conclusions depending on the scale used.[185] Further, studies may not be adequately powered to identify significant interactions even if they are present.

If more than just a few studies had made use of reporting guidelines (eg, STROBE) to structure and report on their methodology and findings, we would likely have gained more robust insight into the rationale behind the use of race, ethnicity, and national origin in studies published on this topic. Important questions remain about whether (1) race and ethnicity variables were generally incorporated into models based on a priori conceptual frameworks or (2) decisions about covariate selection were primarily made using statistical approaches and (3) whether researchers chose not to investigate statistical interaction because of a lack of power or whether several more studies tested these types of interactions and simply did not report them because of nonsignificant findings.[186] Further, a lack of explanation or justification for the methods used by some authors (eg, the use of husband's occupation as a proxy for participant social status, the use of father's birthplace as a proxy for participant ethnicity, and limiting secondary analyses to white participants) could be perceived as gender and racial bias, as they appear to place a higher value on men's status in society as well as individuals of white race. However, without more insight into the rationale for these methods, it is difficult to draw any firm conclusions.

Harnesing the power to perform cardio-obstetrics analyses through an intersectional lens

If the goal is to attain a more comprehensive understanding of disparities in women's cardiovascular health, future work[187-189] must move beyond the collection and use of a single or small group of sociodemographic characteristics focused solely on the individual (eg, race and/or ethnicity, age, sex, education) and move toward approaches that account for a more robust range of important social factors.[187-189] Given that peoples' life circumstances are "often determined at higher levels of social organization,"[190] the use of more comprehensive statistical approaches that continue to focus on the use of a single race and/or ethnicity variable as a covariate, mediator, stratification variable, and effect modifier will fail to go far enough.[190] To this end, it has been suggested that researchers apply an intersectional approach to health research—one that uses a multidimensional lens with the goal of gaining a better understanding of the interactive, indirect, and cumulative effects of multiple determinants of health (eg, interpersonal, sociocultural, and community factors) on disease outcomes.[4,5,191,192]

An intersectional approach to cardio-obstetrics research counters the notion that women are a homogeneous group of individuals—even if categorized as belonging to the same race or ethnic group.[193] This paradigm emphasizes the need to consider a wider set of social variables in health research and is especially important for women, as there is evidence that both structural and interpersonal discrimination are more prevalent in individuals identifying with this gender compared with men.[194] For example, being a woman and being black each bring their own set of unique social experiences that can collectively affect risk for CVD[193] and HDP[195] but in a way that is more than simply the sum of being a woman and being black. Indeed, the use of more sophisticated statistical methods undertaken with the aim of investigating the synergistic effects of individual- and population-level sociodemographic measures (eg, socioeconomic status, immigration status, education, geography, gender identity, and discrimination)[10,190] can only be considered if researchers have access to robust data on diverse populations.

Strengths and limitations

We completed a rapid and comprehensive review of the use of race, ethnicity, and national origin in observational studies assessing CVD morbidity and mortality in women with a history of HDP. This work not only builds on existing literature addressing the use of race and ethnicity in medical research but provides new knowledge about the use of these variables within the context of cardiovascular risk in women with a history of HDP. This study, however, is not without limitations. Because this was a rapid review, we streamlined components of the SR process; however, several different measures were taken to balance methodologic rigour and timeliness. Our literature base was mainly built from the included studies of recently published SRs, all of which had major methodologic shortcomings. However, we identified and included 6 SRs, all of which used comprehensive inclusion criteria, and completed a search update to look for more recently published primary studies of potential relevance. As such, although we cannot be certain that all the available literature on this topic was captured, we are satisfied that we have likely captured the most relevant primary studies published on this topic. Further, although data extraction was not completed in duplicate, we pilot tested extraction forms and completed data audits to ensure their accuracy and found very little error or omission. If the country of conduct was not reported, we extracted the geographic location of the corresponding author in its place. We recognize that this may not have been an accurate proxy for participant location; however, this was rarely required, and in each instance, we were able to use additional information (eg, funding and data sources) to

help triangulate the information. Finally, we only included English-language literature, which may limit the generalizability of our results; however, none of the included SRs that placed no restriction on language of publication included foreign-language studies.

Conclusions and a Call to Action

Based on our findings, race and ethinicity are not uniformly documented in studies of women with HDP, and, when documentation exists, it is inconsistently applied. Further, despite a high burden of HDP among Hispanic and black women in certain geographic regions (eg, Botswana), existing data disproportionally represents white women in North American and/or northern European settings. These findings highlight significant areas for improvement in HDP research, especially with regard to the need to study more diverse populations, as well as the use of more robust and standardized methods for collecting, reporting, and use of sociodemographic information.

Both short- and long-term changes can be made to facilitate a better understanding of the reasons behind cardiovascular health disparities in women with a history of HDP that are linked to race and ethnicity. At a minimum, cardiovascular researchers should be transparent about the reasons information about race and ethnicity are collected and report the rationale behind their categorization,[15] which should be built on classification frameworks that are internationally comparable. Furthermore, it is essential that they carefully reflect on the appropriateness of using a standalone race and/or ethnicitiy variable in statistical models and ensure that the interpretation of data obtained from the use of these variables is appropriate.

Ultimately, if disparities in CVD outcomes for women with a history of HDP are to be eliminated, we must seek better ways to identify and study them. This will require the development of (1) international consensus standards for the use and reporting of race and ethnicity in clinical research; (2) standardized data collection tools; (3) the development of large-scale geographically and demographically diverse women's health registries that allow for the collection of a comprehensive set of sociodemographic information about participants, and repeated and long-term follow up; and (4) race- and ethnicity-focused analyses that are designed and carried out using an intersectional approach.

Funding Sources

No funding was received for this study.

Disclosures

A.J. is supported by a Doctoral Research Award from the Canadian Institutes of Health Research. V.T. is supported by the University of Ottawa Cardiac Research Endowed Fellowship. T.C. is supported by a Clinician Scientist I Salary Support Award from the Heart and Stroke Foundation of Ontario, and by the Chair Award from the University of Ottawa Heart Institute's Canadian Women's Heart Health Centre. J.E. receives research funding from the Canadian Institutes of Health Research, the Canadian Cardiovascular Society, and Brain Canada and is a Heart and Stroke Foundation of Canada National New Investigator.

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Supplementary Material

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