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Review

Sleep Characteristics in Adults of African Descent at Risk for and with Cardiometabolic Conditions: A Systematic Review

Cherlie Magny-Normilus [1,*], Stephanie Griggs [2], Julie Sanders [1], Youri Hwang [3] and Catrina Longhurst [1]

[1] William F. Connell School of Nursing, Boston College, Chestnut Hill, Newton, MA 02467, USA; julie.sanders@bc.edu (J.S.)
[2] Frances Payne Bolton School of Nursing, Case Western Reserve University, Cleveland, OH 44106, USA; sag153@case.edu
[3] Yale School of Nursing, Yale University, Orange, CT 06477, USA; youri.hwang@yale.edu
* Correspondence: cherlie.magny-normilus@bc.edu; Tel.: +1-617-552-8814

Abstract: The purpose of this systematic review is to synthesize available studies on sleep health characteristics in adults of African descent with or at risk for cardiometabolic conditions. PubMed, PsycINFO, CINAHL, and Web of Science were searched for original research studies on subgroups of African descent with at least one cardiometabolic risk factor. Studies published in English with measured sleep characteristics were included. Studies focused on participants with severe psychiatric illness, night shift workers, or with a pharmacologic sleep treatment focus were excluded. The risk for bias was assessed using the NHLBI 2021 Quality Assessment Tool. Two reviewers independently synthesized the results before reaching a consensus. Out of 340 studies screened, 35 studies were included. There were 631,756 participants with an average age of 44.3 combined (SD = 16.5) (53% female and 22% Black). Disparities in sleep health characteristics and cardiometabolic health among African American adults were found. Markers of poor cardiometabolic health were associated with disordered sleep. While the studies in this review captured key factors, the study measurement methods were inconsistent, and African Caribbean Americans were underrepresented. The studies demonstrated the intersectionality of poor sleep characteristics, cardiometabolic risk factors, and racial/ethnic groupings. Clinicians should consider these findings when providing care.

Keywords: sleep characteristics; African descent; African Caribbean; Haitians; cardiometabolic risk; diabetes

Citation: Magny-Normilus, C.; Griggs, S.; Sanders, J.; Hwang, Y.; Longhurst, C. Sleep Characteristics in Adults of African Descent at Risk for and with Cardiometabolic Conditions: A Systematic Review. *Endocrines* **2023**, *4*, 502–520. https://doi.org/10.3390/endocrines4030036

Academic Editors: Maria Mirabelli, Eusebio Chiefari, Antonio Brunetti and Mary Anna Venneri

Received: 20 April 2023
Revised: 11 July 2023
Accepted: 14 July 2023
Published: 19 July 2023

1. Introduction

Cardiometabolic diseases, including endocrine, nutritional, and metabolic diseases (referred to herein as ENM conditions) (e.g., thyroid conditions, diabetes, hyperlipidemia, obesity), affect an estimated 47 million people in the United States) [1,2] and are one of the leading causes of death globally [3]. One-third of the United States population has metabolic syndrome, one in three have prediabetes, and 34.2 million have diabetes (10.5%) [4,5]. Racial cardiometabolic health disparities and cardiometabolic risk factors and outcomes have a higher prevalence at earlier ages in Non-Hispanic Black compared with Non-Hispanic White populations.

ENM conditions disproportionately affect historically underrepresented racial and ethnic groups based on a multitude of multi-ethnic studies from multiple countries, including the United States [6–8]. This is especially true for subgroups of African descent (e.g., Black, African American, African Caribbean American) in America. The African Caribbean American population accounts for over 5% of African Americans [9]. The African Caribbean population has a three-fold higher prevalence of ENM conditions compared to a European population and descents of other African ethnic groups [10,11]. People of African Caribbean descent with ENM conditions are also at greater risk of worse clinical diabetes outcomes than those of European descent [12].

There is an overwhelming gap in our understanding of ethnic disparities in ENM conditions, including prediabetes, as an ethnic background for persons of African descent is rarely delineated. Limited research focused on African subgroups leaves this population vulnerable to unrecognized health disparities. There is sparse research on those of African Caribbean descent, limiting our understanding of the unique biological, clinical, and cultural characteristics of ENM conditions in the African Caribbean American population.

Sleep health is comprised of multiple characteristics, including regularity, satisfaction, alertness, timing, efficiency, and duration [13,14]. Sleep health characteristics are essential to physical and psychological well-being and are a key modifiable factor affecting cardiometabolic disease onset, progression, and severity [15]. For instance, short sleep duration or experimental sleep deprivation led to overweight and obese weight status due to increased energy intake and reduced energy expenditure through reciprocal changes in hormonal appetite regulating responses (higher ghrelin, lower leptin) [15–17]. Obesity is a major contributing factor to incident cardiovascular risk factors, including dyslipidemia, type 2 diabetes, hypertension, and sleep disorders [17].

Adults living with ENM conditions or at risk of ENM conditions often have concurrent cardiometabolic risk factors, including but not limited to hypertension, obesity, and dyslipidemia, which require further management [16]. Experimental data have demonstrated a potential underlying pathway of developing ENM conditions in people with sleep disturbance, such as an increased appetite, altered glucose metabolism through increased nocturnal cortisol and growth hormones, and increased sympathetic nervous system activity [15–19]. The causal direction of the relationship between sleep and ENM conditions is unclear, yet there is compelling evidence that sleep is closely linked to the development and clinical outcomes of ENM conditions [15,20].

Poor sleep health characteristics can also adversely lead to unfavorable ENM-related clinical outcomes in people with or at risk for ENM by ineffective self-management behaviors (e.g., planning meals, physical activity, and regular medical appointments) [21–26]. African Caribbean American adults are at elevated risk for ENM and risk for poor sleep health, characterized by shorter sleep duration [10,12,24–28]. To the best of our knowledge, existing reviews have yet to synthesize the evidence on the potential role of sleep health characteristics for adults of African or African Caribbean descent in preventing and managing ENM disease. To fill this gap in the literature, we conducted a systematic review of sleep health characteristics in adults of African descent. We aimed to evaluate sleep characteristics in adults of African descent with cardiometabolic health risk factors or ENM disease.

2. Materials and Methods

The Preferred Reporting Items for Systematic Reviews and Meta-analyses Statement guidelines were followed for this systematic review [29]. Before implementing the search, we registered our protocol with the PROSPERO registry in the International Prospective Register of Systematic Reviews (Prospero; registration number CRD42021269533).

2.1. Literature Search Strategy

The primary aim of this systematic review was to synthesize available studies on sleep health characteristics (derived from self-report or objective via actigraphy or polysomnography) in adults of African descent with or at risk for cardiometabolic conditions (e.g., type 2 diabetes). A controlled vocabulary and keyword search of the following databases was conducted: PubMed, PsycINFO, CINAHL, and Web of Science. The search was limited to articles published in the English language. All searches covered the periods from the date of establishment of each database to 9 November 2021. The PubMed search terms are provided in Table 1. The search strategies were adjusted for syntax as appropriate for each database. The search was conducted under the guidance of a medical librarian (WA) and two investigators (CMN and SG).

Table 1. Characteristics of PubMed Search Strategy.

	MEDLINE PubMed	**CINAHL, PsycINFO, Web of Science**
1	((((“Haiti”[Mesh]) OR (“African Continental Ancestry Group”[Mesh] OR “African Americans”[Mesh])) OR (“Caribbean Region”[Mesh]))	(Haiti or Haitian or African continental ancestry group or African American or African Americans or Caribbean region or African Caribbean American)
2	(((((((sleep habit* [tiab]) OR (sleep disturbance [tiab])) OR (reduced sleep [tiab])) OR (sleep loss [title/abstract])) OR (sleep loss [title/abstract])) OR (sleep loss [tiab])) OR (“Sleep”[Mesh])) OR (“Sleep Wake Disorders”[Mesh])))	(Sleep or sleep-wake disorder or sleep hygiene or sleep habits and patterns or sleep-wake cycle or sleep disturbance or reduced sleep or sleep loss)
3	((“Diabetes Mellitus, Type 2”[Mesh]) OR (diabetes* [tiab])) OR (nutrition* [tiab]) OR (“metabolic* [tiab])) OR (“Endocrine “[Mesh]))	(Type 2 diabetes or diabetes or diabetes mellitus type 2 or diabetes mellitus or NIDDM or non-insulin dependent diabetes or nutrition or metabolic or endocrine)
4	(((((((“Haiti”[Mesh]) OR (“African Continental Ancestry Group”[Mesh])) OR (“African Ameri-cans”[Mesh])) OR (“Caribbean Region”[Mesh])) OR (“African Caribbean Americans”[Mesh]))) OR (((((((((sleep habit* [tiab]) OR (sleep disturbance [tiab])) OR (reduced sleep [tiab])) OR (sleep loss [title/abstract])) OR (sleep loss [title/abstract])) OR (sleep loss [tiab])) OR (“Sleep”[Mesh])) OR (“Sleep Wake Disorders”[Mesh])))))) AND ((((“Diabetes Mellitus, Type 2”[Mesh]) OR (diabe-tes* [tiab])) OR (nutrition* [tiab]) OR (“metabolic* [tiab])) OR (“Endocrine “[Mesh]))))	(Haiti or Haitian or African continental ancestry group or African American or African Americans or Caribbean region or African Caribbean American) and (Sleep or sleep-wake disorder or sleep hygiene or sleep habits and patterns or sleep-wake cycle or sleep disturbance or reduced sleep or sleep loss) and (type 2 diabetes or diabetes or diabetes mellitus type 2 or diabetes mellitus or NIDDM or non-insulin dependent diabetes or nutrition or metabolic or endocrine)

We considered studies with persons of African descent (e.g., Black, African American, and African Caribbean) due to the lack of a uniform term when referring to Black individuals. The primary outcome measures investigated were sleep measures that represent at least one of the following sleep health characteristics: satisfaction or alertness measured via self-report, timing measured via self-report or actigraphy, efficiency and duration measured via actigraphy/polysomnography (PSG) or self-report, and sleep stages (rapid eye movement sleep and non-rapid eye movement sleep [stages 1, 2, and 3], as evaluated with PSG only).

2.2. Eligibility and Exclusion Criteria

Studies that met the following criteria were included in this review: (1) original research of adults identifying as Black, African, African American, African Caribbean, Haitian and who had at least one cardiometabolic risk factor (obesity, diabetes, hypertension, and dyslipidemia) that were published in English; and (2) in which sleep characteristics were measured using self-report questionnaires, wrist actigraphy, or PSG. Studies that focused on populations that met one of the following criteria were excluded: (1) people with severe comorbid psychiatric illness (e.g., bipolar disorder, schizophrenia); (2) night shift workers; and (3) all participants receiving pharmacological treatment for sleep. A sub-analysis was performed when possible if the participants of a study were not exclusively Black, African, African Caribbean, Haitian, or adults.

2.3. Study Selection

A total of 432 references were imported into Covidence (Veritas Health Information), and duplicates were removed. A total of 340 were screened through Covidence. Two reviewers independently screened all titles and abstracts with 87% agreement. Next, the reviewers assessed 53 full texts. A third researcher resolved any disagreements regarding eligibility when consensus was not reached among the first two reviewers. For any studies with the same cohort data, the study with the largest sample size was used to describe study characteristics in the results section. The study selection process is illustrated in Figure 1. We identified 35 studies that met our inclusion criteria. The results are based on the data published in these articles and supplemental materials.

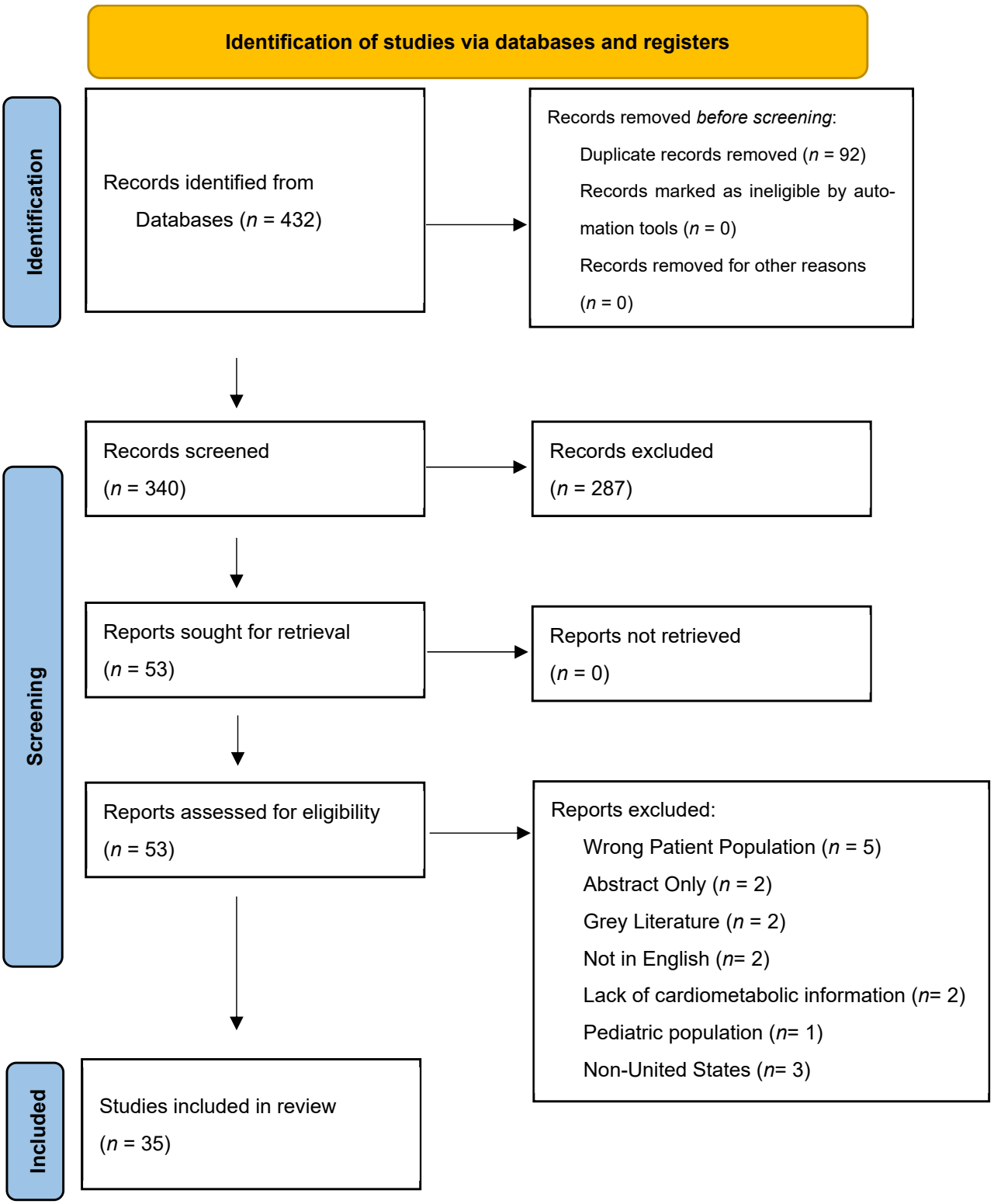

Figure 1. PRISMA diagram illustrates our study search and selection process.

2.4. Data Extraction and Synthesis

Data were extracted and recorded using customized spreadsheets by three reviewers. Recorded data included study characteristics (authors, title, year, country), participants' characteristics (age, race/ethnicity, sex), and sleep measures used (self-report, PSG, or actigraphy). Based on the primary aim of the review, we extracted the sleep characteristics of

each included study. We grouped them into categories adapted from the SATED framework: satisfaction, alertness, timing, efficiency, and duration [14]. We also extracted and recorded data on sleep disorders separately. Numeric results of sleep characteristics were recorded, and a pooled mean was calculated for results with greater than three studies. Results were then narratively described.

2.5. Risk of Bias

Two researchers independently assessed the risk of bias in the included studies using the Study Quality Assessment Tools for Observational Cohort and Cross-Sectional Studies [30]. The Study Quality Assessment Tools for Observational Cohort and Cross-Sectional Studies assess for clear, specific objectives and populations, high participation rate, the timing for exposures and measures, quality of variables, blinding, loss to follow-up, and adjustment of key confounding variables.

3. Results

3.1. Study Characteristics

A total of 31 cross-sectional and 4 cohort studies are included in this review. The studies comprise 631,756 participants with an average age of 44.3 years (SD = 16.5). A little over half (53%) of participants identify as women, and 22% identify as Black. In the total population, 8.8% of participants have type 2 diabetes. There are 470,162 reported cases of other ENM conditions, including hypertension, elevated BMI, obstructive sleep apnea, hypercholesterolemia, dyslipidemia, coronary artery disease or other heart conditions, stroke, heart attack, mild cognitive impairment, elevated cardiometabolic risk, peripheral artery disease. The characteristics of the included studies are presented in Table 2.

Sleep was measured via self-report questionnaires in all studies, actigraphy in five studies [31–35], EEG in one study [36], and PSG in three studies [32,37,38]. For the studies with actigraphy, the procedure was primarily conducted in the participants' homes [32–35], except for one study completed in an inpatient general medicine setting [34]. For studies with PSG/EEG, the procedure was performed in a laboratory setting or at home [32,37,38].

3.2. Quality Appraisal

Each included paper had either a cross-sectional or observational design. None of the selected papers received a poor-quality rating in the quality assessment. Eleven of the papers were rated *good*, and twenty-five of the papers were rated *fair.* Most often, papers were rated *fair* due to the nature of cross-sectional and observational studies, including the lack of exposure measurement prior to measurement of outcomes and the lack of time frame between exposure and outcome. Otherwise, the most common reasons for being rated fair were the lack of sample size justification, power description, variance and effect estimates, and lack of reporting for blinding and participation rates. The findings of the quality assessment are summarized in Table 3.

Table 2. Study Characteristics.

Authors, Year	Study Type	Sleep Measurement	Total N	Age Mean (SD)	Female N (%)	Ethnic Breakdown	% CMC	Total CMC N	Country
Rodriguez et al., 2013 [31]	Cross-sectional/Observational	Sleep subscale of the Choices for Healthy Outcomes in Caring for ESRD Health Experience Questionnaire	168	62 (17)	168 (100)	70% Non-African American 30% African American	92% HTN 49% T2D 35% HF 32% CAD 18% PAD 18% Stroke	410	USA
Bakker et al., 2015 [32]	Cross-sectional/Observational	Polysomnography and actigraphy	2156	68.5 (9.2)	1167 (54)	37.2% White 27.3% African American 23.8% Hispanic 11.8% Chinese	77.3% OSA 40% T2D	2532	USA
Curtis et al., 2017 [33]	Cross-sectional/Observational	Wrist actigraphy	426	56.8 (11.3)	260 (61)	69% European American 31% African American	NR	NR	USA
DePietro et al., 2017 [34]	Cohort study/Observational	Wrist actigraphy, Berlin Sleep Questionnaire	212	63.9 (22.2)	127 (60)	74% African American 26% "other"	61.3% Overweight 58% T2D	252	USA
Wagner et al., 2016 [35]	Cross-sectional/Observational	Self-reported single question (how well did you sleep last night); altigraph for sleep and wake time	77	55.7 (11.8)	77 (100)	51% Black 49% White	100% T2D	77	USA
Yano et al., 2020 [36]	Cross-sectional/Observational	Type 3 home sleep apnea testing device; Seven-day wrist actigraphy with a sleep diary	789	63 (11)	584 (74)	100% Black	25% T2D	197	USA
Mahmood et al., 2009 [37]	Cross-sectional/Observational	PSG—apnea-hypopnea index (AHI)	1008	45 (14.6)	540 (54)	66% African American 18% White 15% Hispanic 3%Asian	53.2% HTN 27% T2D 19.4% HLD 7.8% CAD	1083	USA
Andreozzi et al., 2019 [38]	Cohort study/Observational	PSG—apnea-hypopnea index (AHI)	1717	52.8 (12.7)	573 (33)	62% White 34% Black 4% Other	50% HTN 22% T2D	1234	USA
Assari et al., 2017 [39]	Cohort study/Observational	Likert question on restlessness	1129	41 (11)	727 (64)	69% White 31% Black	NR	NR	USA
Bermudez-Millan et al., 2016 [40]	Cross-sectional/Observational	A single question on sleep quality	77	55.8 (11.7)	77 (100)	51% Black 49% White	100% T2D	77	USA

Table 2. *Cont.*

Authors, Year	Study Type	Sleep Measurement	Total N	Age Mean (SD)	Female N (%)	Ethnic Breakdown	% CMC	Total CMC N	Country
Bidulescu et al., 2010 [41]	Cross-sectional/Observational	PSQI	1515	47.5 (17)	1096 (72)	100% African Americans	56.7% HTN 33.7% High cholesterol 32.5% Obesity 17% T2D	2116	USA
Gaston et al., 2018 [42]	Cross-sectional/Observational	Self-report sleep duration and other self-report questions	80,880	42 (18)	45,729 (57)	70% White 30% Black	70% Overweight 39.3% Obesity 36.3% HTN 9.4% Heart disease 9% T2D 4.3% Stroke	132,637	USA
Im et al., 2019 [43]	Cross-sectional/Observational	Sleep Index for Midlife Women	164	49.9 (5.54)	164 (100)	26.8% White 26.2% Hispanic 24.4% Asian 22.6% African American	59.7% Over-weight/obese 38% T2D	160	USA
Iyegha et al., 2019 [44]	Cross-sectional/Observational	PSQI	155	37.9 (2)	94 (61)	52% Black48% White	39% T2D	60	USA
Kalmach et al., 2016 [45]	Cross-sectional/Observational	Individual questions based on insomnia DSM-5; TST, SOL, WASO using a single question; STOP-BANG	3911	46 (13.3)	2557 (65)	65.4% White 25% Black Asian 4.22% Pacific Islander 1.74% Hispanic/Latino 2.33% Middle Eastern or Indian 1.31% other	25.9% HTN 24.5% HLD 8% T2D 1.4% MCI 1.5% Stroke	2734	USA
Matthews et al., 2018 [46]	Cross-sectional/Observational	Individual questions about sleep duration, SOL, sleep continuity, sleep med use, and subjective feeling	31,724	Categorical	15,369 (48)	79% White 14% Black 7% Native Hawaiian	43% Obesity 27% HTN 9% CVD	27,917	USA
Shankar et al., 2010 [47]	Cross-sectional/Observational	Self-reported single question asking, "During the past 30 days, for about how many days have you felt you did not get enough rest or sleep?"	372,144	Categorical	186,072 (50)	69% White 10% Black 14% Mexican American 7% other	27.3% Obesity 37% Overweight 9% T2D 8.3% CVD	303,298	USA

Table 2. *Cont.*

Authors, Year	Study Type	Sleep Measurement	Total N	Age Mean (SD)	Female N (%)	Ethnic Breakdown	% CMC	Total CMC N	Country
Williams et al., 2018 [48]	Cross-sectional/Observational	ARES questionnaire	1013	62 (14)	699 (69)	100% Black	94% HTN 74% DLD 67% Obesity 60% T2D 31% Heart disease	3303	USA
Duester et al., 2011 [49]	Cross-sectional/Observational	Likert scale	129	31 (8.3) Black, 28.4 (5.6) White	66 (51)	65% Black 35% White	NR	NR	USA
Knutson et al., 2006 [50]	Cross-sectional/Observational	PSQI	204	57.3 (12.5)	119 (58)	79% African American 19% White 2% "other"	100% T2D	204	USA
Ramos et al., 2015 [51]	Cross-sectional/Observational	ARES, ESS, sleep duration with a single question, insomnia symptoms with questions	1013	62 (14)	588 (58)	100% Non-Hispanic blacks	60% T2D 6% HTN 5% Dyslipidemia	1087	USA
Picarsic et al., 2008 [52]	Cross-sectional/Observational	Nap duration, prevalence, nighttime sleep duration, SOL, efficiency (total time in bed, nighttime sleep duration, SOL, efficiency from the PSQI Q1–4)	414	76.8 (4.2)	285 (69)	75% White 18% Black 7% Other Minority/Ethnic group	82.2% CVD 69.3% HTN 22% T2D 9.4% MI 5.6% CHF 4.8% Stroke	799	USA
Gordon and Hsueh, 2021 [53]	Cross-sectional/Observational	Self-reported sleep duration	1,387,569	Categorical	NR	60.3% White 16% Latino 9.8% Black 8.3% Filipino 5.6% Chinese	NR	NR	USA
Shadyab et al., 2015 [54]	Cross-sectional/Observational	Self-reported two questions about nighttime sleep and daytime napping durations	1609	67.3 (9.8)	1609 (100)	56% White 21% Filipina 23% Black	37% T2D	595	USA
Beihl et al., 2009 [55]	Cohort study/Observational	A single question on sleep duration	900	NR	510 (57)	38% non-Hispanic White 34% Hispanic 29% African American	33% T2D 30.6% HTN	575	USA
Gamaldo et al., 2015 [56]	Cross-sectional/Observational	Self-reported sleep duration	1207	47.34 (8.74)	715 (59)	50% Black 50% White	3% CAD 14% T2D	203	USA
Hairston et al., 2010 [57]	Cohort study/Observational	Self-reported sleep duration	1107	41.7 (7.7)	685 (62)	74% Hispanic 26% African American	100% T2D	1107	USA

Table 2. *Cont.*

Authors, Year	Study Type	Sleep Measurement	Total N	Age Mean (SD)	Female N (%)	Ethnic Breakdown	% CMC	Total CMC N	Country
Jackson et al., 2013 [58]	Cross-sectional/Observational	Self-reported sleep duration	130,943	50.6 (0.143)	66,781 (51)	87% White13% Black	78% Overweight 44% Obese 10% T2D	173,005	USA
Maskarinec et al., 2018 [59]	Cohort study/Observational	A single question about sleep duration	151,691	longitudinal	82,594 (54)	26% Japanese American 23% White 22% Latino 16% African American 7% Native Hawaiian 6% other	43.1% Heart attack/Stroke 6% T2D	73,874	USA
Singh et al., 2005 [60]	Cross-sectional/Observational	Self-reported questions about sleep habits, snoring, and sleep duration (24 h) on weekdays and weekends (the 2-week period immediately prior to the study)	3158	41.6 (12.6)	1570 (50)	69% White 25% Black 6% "Other"	25% HTN 6.4% Heart Disease 6% T2D 1.5% Stroke	287	USA
Zizi et al., 2012 [61]	Cross-sectional/Observational	Self-reported sleep duration question	29,818	47.4 (17.8)	16,698 (56)	85% White 15% Black	33.7% Overweight 27% HTN 24.6% Obese 8% T2D 7.8% Heart disease	30,265	USA
Joseph et al., 2017 [62]	Cohort study/Observational	Sleep-disordered breathing burden/Berlin Sleep Questionnaire	3252	53.3 (12.5)	2081 (64)	100% African Americans	17% T2D	560	USA
Ramos et al., 2014 [63]	Cohort study/Observational	Berlin questionnaire to assess OSA risk	176	60.0 (12) 25–92	80 (45)	44% Hispanic 44% Non-Hispanic Black 12% Non-Hispanic White	100% Acute ischemic stroke 84% HTN 38% T2D	391	USA
Rosen et al., 2019 [64]	Cross-sectional/Observational	Self-reported snoring questions	4495	52.1 (12.7)	2884 (64)	100% African American	59.7% HTN 31% Hyperc-holesteremia 16% T2D	4815	USA

Table 2. *Cont.*

Authors, Year	Study Type	Sleep Measurement	Total N	Age Mean (SD)	Female N (%)	Ethnic Breakdown	% CMC	Total CMC N	Country
Ceide et al., 2015 [65]	Cross-sectional/Observational	ARES score	1035	64 (14)	725 (70)	100% Non-Hispanic Blacks	92% HTN 90% Over-weight/obese 72% DLD 61% T2D	3260	USA

Abbreviations: CMC: cardiometabolic conditions; T2D: type 2 diabetes; HTN: hypertension; OSA: obstructive sleep apnea; CVD: cardiovascular disease; MI: myocardial infarction; DLD: dyslipidemia; CHF: chronic heart failure; MCI: mild cognitive impairment; ESRD: End Stage Renal Disease; ARES: Apnea Risk Evaluation Systems; SOL: sleep onset latency; ESS: Epworth Sleepiness Scale; PSQI: Pittsburg Sleep Quality Index; DSM-5: Diagnostic and Statistical Manual of Mental Disorders; TST: total sleep time; WASO: wake after sleep onset; STOP-BANG: snoring history, tired during the day, observed stop breathing with sleep, high blood pressure, body mass index more than 35 kg/m2, age more than 50 years, neck circumference more than 40 cm, and male sex at birth; AHI: Apnea-hypopnea index; NHANES: National Health and Nutrition Examination Survey; USA: United States of America; UK: United Kingdom.

Table 3. Quality Assessment.

Study	Rodriguez et al., 2013 [31]	Bakker et al., 2015 [32]	Curtis et al., 2017 [33]	DePietro et al., 2017 [34]	Wagner et al., 2016 [35]	Yano et al., 2020 [36]	Mahmood et al., 2009 [37]	Andreozzi, F. et al., 2019 [38]	Assari et al., 2017 [39]	Bermudez-Millan et al., 2016 [40]	Bidulescu et al., 2010 [41]	Gaston et al., 2018 [42]	Im et al., 2019 [43]	Iyegha et al., 2019 [44]	Kalmach et al., 2016 [45]	Matthews et al., 2018 [46]	Shankar et al., 2010 [47]	Williams et al., 2018 [48]	Deuster, P. et al., 2011 [49]	Knutson et al., 2006 [50]	Ramos et al., 2015 [51]	Picarsic et al., 2008 [52]	Gordon and Hsueh, 2021 [53]	Shadyab et al., 2015 [54]	Beihl et al., 2009 [55]	Gamaldo et al., 2015 [56]	Hairston et al., 2010 [57]	Jackson et al., 2013 [58]	Maskarinec et al., 2018 [59]	Singh et al., 2005 [60]	Zizi et al., 2012 [61]	Joseph et al., 2017 [62]	Ramos et al., 2014 [63]	Rosen et al., 2019 [64]	Ceide et al., 2015 [65]
Was the research question or objective in this paper clearly stated?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Was the study population clearly specified and defined?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Was the participation rate of eligible persons at least 50%?	NR	NR	NR	NR	NR	NR	NR	Y	NR	NR	NR	NR	NR	Y	NR	NR	NR	NR	N	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Y	NR	Y	NR	NR	NR	NR
Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	N	Y	Y	Y	Y

Table 3. *Cont.*

Study	Rodriguez et al., 2013 [31]	Bakker et al., 2015 [32]	Curtis et al., 2017 [33]	DePietro et al., 2017 [34]	Wagner et al., 2016 [35]	Yano et al., 2020 [36]	Mahmood et al., 2009 [37]	Andreozzi, F. et al., 2019 [38]	Assari et al., 2017 [39]	Bermudez-Millan et al., 2016 [40]	Bidulescu et al., 2010 [41]	Gaston et al., 2018 [42]	Im et al., 2019 [43]	Iyegha et al., 2019 [44]	Kalmach et al., 2016 [45]	Matthews et al., 2018 [46]	Shankar et al., 2010 [47]	Williams et al., 2018 [48]	Deuster, P. et al., 2011 [49]	Knutson et al., 2006 [50]	Ramos et al., 2015 [51]	Picarsic et al., 2008 [52]	Gordon and Hsueh, 2021 [53]	Shadyab et al., 2015 [54]	Beihl et al., 2009 [55]	Gamaldo et al., 2015 [56]	Hairston et al., 2010 [57]	Jackson et al., 2013 [58]	Maskarinec et al., 2018 [59]	Singh et al., 2005 [60]	Zizi et al., 2012 [61]	Joseph et al., 2017 [62]	Ramos et al., 2014 [63]	Rosen et al., 2019 [64]	Ceide et al., 2015 [65]
Was a sample size justification, power description, or variance and effect estimates provided?	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	Y	N	N	Y	N	N	N	N	N	Y	N	N	N	N	N	N	Y	N	N	N
Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	Y	N	N	N	N	N	N	Y	N	N	N
For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure or exposure measured as continuous variable)?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Was the exposure(s) assessed more than once over time?	N	N	N	N	Y	Y	N	Y	Y	Y	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	Y	N	N	N	Y	N	N	N	N	N	N
Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 3. *Cont.*

Study	Rodriguez et al., 2013 [31]	Bakker et al., 2015 [32]	Curtis et al., 2017 [33]	DePietro et al., 2017 [34]	Wagner et al., 2016 [35]	Yano et al., 2020 [36]	Mahmood et al., 2009 [37]	Andreozzi, F. et al., 2019 [38]	Assari et al., 2017 [39]	Bermudez-Millan et al., 2016 [40]	Bidulescu et al., 2010 [41]	Gaston et al., 2018 [42]	Im et al., 2019 [43]	Iyegha et al., 2019 [44]	Kalmach et al., 2016 [45]	Matthews et al., 2018 [46]	Shankar et al., 2010 [47]	Williams et al., 2018 [48]	Deuster, P. et al., 2011 [49]	Knutson et al., 2006 [50]	Ramos et al., 2015 [51]	Picarsic et al., 2008 [52]	Gordon and Hsueh, 2021 [53]	Shadyab et al., 2015 [54]	Beihl et al., 2009 [55]	Gamaldo et al., 2015 [56]	Hairston et al., 2010 [57]	Jackson et al., 2013 [58]	Maskarinec et al., 2018 [59]	Singh et al., 2005 [60]	Zizi et al., 2012 [61]	Joseph et al., 2017 [62]	Ramos et al., 2014 [63]	Rosen et al., 2019 [64]	Ceide et al., 2015 [65]
Were the outcome assessors blinded to the exposure status of participants?	NR	NR	NR	NR	NR	NR	NR	N	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	N	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Was the loss to follow-up after baseline 20% or less?	NR	NR	NR	NR	NR	NR	NR	NR	Y	Y	NR	NR	NR	Y	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Y	NR	NR	NR	Y	NR	Y	NR	NR	NR	NR
Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Team ranking	Fair	Fair	Fair	Fair	good	good	Fair	good	good	good	Fair	Fair	good	good	Fair	Fair	Fair	Fair	good	Fair	Fair	Fair	Fair	Fair	good	Fair	Fair	Fair	good	Fair	good	good	Fair	Fair	Fair

Key: Y: yes; N: no; CD: cannot determine; NA: not applicable; NR: not reported label as good, fair, or poor.

3.3. Sleep Characteristics

3.3.1. Satisfaction

Self-report sleep satisfaction was reported in 14 studies [31,33,34,38–50]. A variety of measures were used across studies: the Pittsburgh Sleep Quality Index (PSQI) Global Score (n = 3) [41,44,50], the Berlin Sleep Questionnaire (n = 1) [34], the Sleep Index for Midlife Women (n = 1) [42], and the Caring for End Stage Renal Disease Health Experience Questionnaire sleep scale (n = 1) [31].

Sleep satisfaction across studies measured by PSQI ranged from 6.6 (SD = 3.0) to 7.0 (SD = 3.8) [43,50]. Over half of African Americans were classified as having low sleep satisfaction based on a cut-off score of 5 on the PSQI [41]. Individuals with or at risk for type 2 diabetes reported lower sleep quality [44]. To illustrate, in a study of 155 individuals (52% African American, 48% White), those with prediabetes had significantly poorer sleep satisfaction (PSQI M = 7.2, SD = 0.7) compared with those with standard glucose tolerance (PSQI M = 6.0, SD = 0.4) [44].

Lower sleep satisfaction was significantly associated with poorer type 2 diabetes clinical outcomes (i.e., HbA1c, insulin use) [50]. In a longitudinal study predicting the incidence of type 2 diabetes, restless sleep significantly predicted the development of cardiometabolic conditions, including type 2 diabetes, in Black women, not for Black men [39].

3.3.2. Alertness

There were limited data on alertness comparing racial, ethnic, or cardiometabolic risk differences. Daytime sleepiness is a measure of alertness. Daytime sleepiness was reported in three studies [44,48,51]. Daytime sleepiness was assessed with the Epworth Sleepiness Scale (ESS) in one study [51] and by a single-item question in the other two studies [44,48]. About half of those with type 2 diabetes [51] (53%) had excessive daytime sleepiness (ESS > 10), but the prevalence was not statistically significantly different from those without type 2 diabetes (51%) [51]. There was limited significant data from this sample set on differences in alertness between those with cardiometabolic risk factors and those without, as well as racial or ethnic differences.

3.3.3. Efficiency

Efficiency was assessed in eight studies, with self-report in seven studies and objective measures in three studies [33,34,36,41,44,45,51,52]. Three of these studies used a wrist-worn research actigraph device [32,33,35]. Based on actigraphy data, African Americans had significantly lower sleep efficiency (M = 72.3% SD = 11.5%) than European Americans (M = 82.2%, SD = 8.7%) [33]. Furthermore, lower sleep efficiency was significantly associated with poorer health behaviors related to cardiometabolic risk, including diet, physical activity, and smoking [33]. Consistent with this finding, another study that employed actigraphy also found that lower sleep efficiency was significantly associated with higher glucose and HbA1c in individuals identifying as Black (n = 789) [36] and in the sample where 74% were Black (n = 148) [34].

3.3.4. Duration

Sleep duration was reported in 25 studies and was the most common dimension studied and reported on, of which 4 studies objectively assessed sleep duration using actigraphy and/or PSG [32–34,36]. Self-report sleep duration was measured in 19 studies with a single item [35,41,42,44–47,49–60]. Participants were categorized into short, intermediate, and prolonged sleep groups in nine studies [42,46,51,53,55–59]. The most common definition was $\leq$6 h/night for short sleep and $\geq$9 h/night for extended sleep. Short sleep was defined by studies at or between <5 h/night and $\leq$7 h/night. Long sleep was defined by studies at or between $\geq$6 and $\geq$9 h/night.

Black participants were more likely to have shorter sleep duration when compared with those of other racial/ethnic groups [32,33,42,45,53–55,61]. For example, African Americans had a 40 min shorter average sleep duration compared with European Americans ($p < 0.001$) [32].

Cardiometabolic health risk factors were associated with shorter sleep duration in African Americans [32–34,41,47,56,58,61]. For instance, African Americans with type 2 diabetes had shorter sleep duration than those without ($p = 0.004$) [41].

3.3.5. Sleep Disorders

Sleep disorders were determined by assessing snoring, sleep-disordered breathing, obstructive sleep apnea, and insomnia in 10 studies [32,34–36,45,48,51,62–64]. In four studies, home sleep apnea testing devices such as ARES® were used [36,48,51,65], and two studies used polysomnography [32,37]. Objective sleep measures, including >15 apnea events per hour and percent sleep with less than 90% oxygen saturation, were reported in 6 studies. Markers of poor cardiometabolic health were associated with sleep disorders [32,34,36,37,45,62–64]. To illustrate, Bakker and associates (2015) determined the number of AHI events to be higher in those with abnormal fasting glucose (M 27.0 SD 20.3) compared with those with average fasting glucose (M 20.4 SD 17.4) ($p < 0.01$). In 2017, Joseph and team identified African Americans with optimal modifiable diabetes risk factors were less likely to have a sleep-disordered breathing burden (68% prevalence) than those with poor (98%) or average (91%) modifiable risk factors ($p < 0.001$).

Black participants were more likely to have insomnia disorder when compared with those of other racial/ethnic groups in three studies [42,46,48]. Insomnia symptoms (e.g., difficulty falling asleep, difficulty staying asleep) were prevalent in the African American population. Up to 39% of the Black participants identifying as Black had difficulty falling asleep [41,45,47]; up to 43% had difficulty staying asleep [42,46,48]. A total of 3% (3 days or more per week) to 11% (at least one day per week) of the Black population were on sleep medication [42,46].

4. Discussion

The evidence gathered from this systematic review of 35 research studies provides an international snapshot of the significant global health problem of poor sleep health characteristics, cardiometabolic risk including type 2 diabetes, and the impact on the quality of life for African Americans, Blacks, and African Caribbeans. Multiple studies found disparities in sleep health characteristics and cardiometabolic health among adults of African descent across multiple studies.

This review synthesizes the evidence and supports similarities in sleep health characteristics among African Caribbean adults with cardiometabolic risk compared with other ethnicities in the Caribbean. When African Caribbean sleep characteristics were compared to African American sleep, however, a pattern emerged that Black Americans with cardiometabolic risk, including type 2 diabetes, may be at an elevated risk for poor sleep satisfaction, alertness, efficiency, duration, and sleep disorders compared to African Caribbeans with similar risk factors [66–68]. Due to the minimal concentration of African Caribbean data, future research is required to further our understanding of the physiological, social, and cultural phenomenon.

These results align with the literature outside of this search that described poorer sleep characteristics in Black American individuals compared with White American individuals [69–72] and that those with cardiometabolic disease and cardiometabolic risk factors such as type 2 diabetes have poor sleep characteristics [72–74]. The role of socioeconomic disadvantage plays and probably contributes to African decent adults' insomnia disorder. The review by Ruiter et al. has commented on similar factors facing African descendants (e.g., Black, African American, African Caribbean). Obesity was associated with poorer sleep, negatively impacting their health [74]. This review connects the two concepts and

suggests that the intersectionality of African descent in America and cardiometabolic risk may put individuals at heightened risk for poor sleep characteristics.

Previous research has shown that insomnia disorder is associated with various social, physical, and mental health conditions among Blacks [75–77]. While the primary focus of this review aimed to evaluate sleep characteristics in adults of African descent without directly emphasizing the impact of stress, sleep, and cardiometabolic conditions. The differences noted between the sleep duration of those of African descent living in the Caribbean and those in the United States may be due in part to the significant stressors associated with immigrating to and living in the United States [66]. Racialized stress and trauma gained through adjusting to life in the United States significantly influence the day-to-day life of Black immigrants [75]. Racial discrimination has been associated with poor sleep characteristics [75–77]. Poor sleep has been associated with type 2 diabetes severity, cardiovascular disease, obesity, and other chronic diseases [50,78,79]. Cardiometabolic conditions, sleep, and racial/ethnic factors significantly influence health. Many of these societal issues contributing to African-descent adults' adverse health outcomes are modifiable. While detecting and treating African-descent insomnia disorder, clinicians need to be aware of and consider their mental and physical health and social determinants of health.

The lack of knowledge about the negative health impact of lower sleep satisfaction means that African descendants may need help to make informed sleep regime decisions. In this review, we gained some additional insight. In a sample of 1129 participants, Assari et al. noted that restless sleep was a predictor of cardiometabolic conditions, specifically in Black women, not Black men [39]. The study by Fuller-Rowell et al. has commentated that if individuals of African descent individuals perceived their suboptimal sleeping habits to be associated with unfavorable health conditions and they do not believe that they are not as resilient as people perceived them to be about their mental state, they may take measures, and develop good sleep habits [80]. Lower sleep efficiency was also significantly associated with cardiometabolic risk [33]. These findings indicate that lower sleep efficiency is significantly associated with higher glucose levels in individuals who identify as Black [76–79].

Additionally, the intersections of racial identity, sex, and gender identity seem to modify the residual effects of restless sleep over cardiometabolic conditions. Thus, clinicians interested in preventing comorbid sleep problems in individuals of African descent patients should consider a programmatic approach that includes education, frequent detection of poor sleep, building quality treatment modalities, and providing accessible resources. Based on the intersections of racial identity, sex, and gender identity, future research could examine the effect of unhealthy stress behaviors, comorbid sleep problems, and cardiometabolic risk among African descent men and women.

4.1. Clinical Implications

The revealed interconnected web of cardiometabolic disease, race, and sleep is beneficial for clinicians to understand and apply in their practice. Improvements in assessing sleep health behaviors and habits and screening for sleep disorders can be made to improve chronic disease self-care management techniques in at-risk populations. Primary care providers often agree that sleep assessments are essential but may need more training and guidance to address multiple sleep characteristics as well as treat sleep disorders based on work by Klingman and colleagues [81]. Clinicians should consider the intersectionality of poor sleep characteristics, cardiometabolic risk factors, and racial/ethnic groupings when creating care plans and providing care.

4.2. Limitations

The limitations of the 35 studies used in this systematic review related to missing demographic information on gender identity and the specific number of participants in each category. The use of epidemiological techniques for calculating and projecting from retrospective design and less use of prospective data. In several articles, the authors used

national data sources with multiple variables older than five years. A dearth of studies specifically studied African Caribbeans, and most studies that delineated their results by race did not break down further to ethnicity.

Thirty-five of the 35 studies did not specify ethnic background for participants past generalized racial categories. Subsets of African descendants, such as African Caribbeans, have unique cultural, social, and potentially genetic factors that influence health and are therefore essential to study. Only with ethnic delineation is it possible to understand specific population health risks.

The researchers anticipated studies to assess the sleep stage via PSG; however, none of the studies assessed the sleep stage. No two papers had comparable methodologies, so a meta-analysis was not possible. The wide breadth of sleep characteristic measurement methodology provides a general understanding of elevated risk; however, the need for more consistency fails in concretely benchmarking sleep characteristics. Additional research is needed to create fair comparisons between the sleep characteristics of specific populations.

5. Conclusions

Sleep health is vital to cardiometabolic disease and stressors specific to race (e.g., discrimination). Practitioners should also consider assessing sleep behavior and screening for sleep disorders. In this systematic review, the intersectionality between African descent and cardiometabolic disease concerning poor sleep is described. Black Americans with cardiometabolic risk, including type 2 diabetes, may be at an elevated risk for poor sleep satisfaction, alertness, efficiency, duration, and sleep disorders compared to African Caribbeans with similar risk factors. This review contributes to the knowledge gap on sleep characteristics in adults of African descent and calls for further assessment of the racial stress factors associated with living in America that may influence sleep, metabolic factors, and general health. Clinicians should consider African descent and poor cardiometabolic markers as risk factors for disordered sleep and assess sleep as a health measure.

Author Contributions: Conceptualization, C.M.-N.; methodology, C.M.-N. and S.G.; software, J.S. and C.L.; validation, C.M.-N., J.S., Y.H. and C.L.; formal analysis, C.M.-N., S.G., Y.H. and J.S.; investigation, C.M.-N., S.G., J.S. and Y.H.; resources, C.M.-N.; writing—original draft preparation, C.M.-N.; writing—S.G., J.S., Y.H. and C.L.; review and editing, C.M.-N., S.G., J.S., Y.H. and C.L., funding acquisition, C.M.-N. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the National Institute of Nursing Research of the National Institutes of Health under award numbers R00NR019323-03, K99NR019325-02, and R00NR018886.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. IDF Diabetes Atlas | Tenth Edition. Available online: https://diabetesatlas.org/ (accessed on 19 December 2022).
2. American College of Cardiology and Cardiometabolic Disease. Available online: https://www.acc.org/Clinical-Topics/Diabetes-and-Cardiometabolic-Disease (accessed on 5 July 2023).
3. RoglicG. WHO Global Report on Diabetes: A Summary. Available online: https://www.who.int/publications/i/item/9789241565257 (accessed on 25 December 2022).
4. Cheng, X.; Ma, T.; Ouyang, F.; Zhang, G.; Bai, Y. Trends in the Prevalence of Cardiometabolic Multimorbidity in the United States, 1999–2018. *Int. J. Environ. Res. Public Health* **2022**, *19*, 4726. [CrossRef] [PubMed]
5. CDC 2020 National Diabetes Statistics Report. Available online: https://nationaldppcsc.cdc.gov/s/article/CDC-2020-National-Diabetes-Statistics-Report (accessed on 25 December 2022).
6. Thorpe, R.J., Jr.; Fesahazion, R.G.; Parker, L.; Wilder, T.; Rooks, R.N.; Bowie, J.V.; Bell, C.N.; Szanton, S.L.; LaVeist, T.A. Accelerated health declines among African Americans in the USA. *J. Urban. Health* **2016**, *93*, 808–819. [CrossRef] [PubMed]

7. Geronimus, A.T.; Hicken, M.; Keene, D.; Bound, J. "Weathering" and age patterns of allostatic load scores among Blacks and Whites in the United States. *Am. J. Public. Health* **2006**, *96*, 826–833. [CrossRef] [PubMed]
8. Levine, M.E.; Crimmins, E.M. Evidence of accelerated aging among African Americans and its implications for mortality. *Soc. Sci. Med.* **2014**, *118*, 27–32. [CrossRef]
9. Khosla, L. HbA_{1c} Performance in African Descent Populations in the United States with Normal Glucose Tolerance, Prediabetes, or Diabetes: A Scoping Review. *Prev. Chronic. Dis.* **2021**, *18*, 200365. [CrossRef]
10. Pham, T.M.; Carpenter, J.R.; Morris, T.P.; Sharma, M.; Petersen, I. Ethnic Differences in the Prevalence of Type 2 Diabetes Diagnoses in the UK: Cross-Sectional Analysis of the Health Improvement Network Primary Care Database. *Clin. Epidemiol.* **2019**, *11*, 1081–1088. [CrossRef]
11. Spanakis, E.K.; Golden, S.H. Race/Ethnic Difference in Diabetes and Diabetic Complications. *Curr. Diabetes Rep.* **2013**, *13*, 814–823. Available online: https://link.springer.com/article/10.1007/s11892-013-0421-9 (accessed on 25 December 2022). [CrossRef]
12. Bennett, N.R.; Francis, D.K.; Ferguson, T.S.; Hennis, A.J.M.; Wilks, R.J.; Harris, E.N.; MacLeish, M.M.Y.; Sullivan, L.W.; U.S. Caribbean Alliance for Health Disparities Research Group (USCAHDR). Disparities in diabetes mellitus among Caribbean populations: A scoping review. *Int. J. Equity Health* **2015**, *14*, 23. [CrossRef]
13. Allen, S.F.; Akram, U.; Ellis, J.G. Examination of sleep health dimensions and their associations with perceived stress and health in a UK sample. *J. Public. Health Oxf. Engl.* **2020**, *42*, e34–e41. [CrossRef]
14. Buysse, D.J. Sleep health: Can we define it? Does it matter? *Sleep* **2014**, *37*, 9–17. [CrossRef]
15. Cappuccio, F.P.; Miller, M.A. Sleep and Cardio-Metabolic Disease. *Curr. Cardiol. Rep.* **2017**, *19*, 110. [CrossRef] [PubMed]
16. Farmaki, A.-E.; Garfield, V.; Eastwood, S.V.; Farmer, R.E.; Mathur, R.; Giannakopoulou, O.; Patalay, P.; Kuchenbaecker, K.; Sattar, N.; Hughes, A.; et al. Type 2 diabetes risks and determinants in second-generation migrants and mixed ethnicity people of South Asian and African Caribbean descent in the UK. *Diabetologia* **2022**, *65*, 113–127. [CrossRef] [PubMed]
17. Mathur, R.; Farmer, R.E.; Eastwood, S.V.; Chaturvedi, N.; Douglas, I.; Smeeth, L. Ethnic disparities in initiation and intensification of diabetes treatment in adults with type 2 diabetes in the UK, 1990–2017: A cohort study. *PLoS Med.* **2020**, *17*, e1003106. [CrossRef] [PubMed]
18. Beccuti, G.; Pannain, S. Sleep and obesity. *Curr. Opin. Clin. Nutr. Metab. Care* **2011**, *14*, 402. [CrossRef]
19. Powell-Wiley, T.M.; Poirier, P.; Burke, L.E.; Després, J.-P.; Gordon-Larsen, P.; Lavie, C.J.; Lear, S.A.; Ndumele, C.E.; Neeland, I.J.; Sanders, P.; et al. Obesity and Cardiovascular Disease: A Scientific Statement from the American Heart Association. *Circulation* **2021**, *143*, e984–e1010. [CrossRef]
20. Sasson, C.; Eckel, R.; Alger, H.; Bozkurt, B.; Carson, A.; Daviglus, M.; Deedwania, P.; Kirley, K.; Lamendola, C.; Nguyen, M.; et al. American Heart Association Diabetes and Cardiometabolic Health Summit: Summary and Recommendations. *J. Am. Heart Assoc.* **2018**, *7*, e009271. [CrossRef]
21. Antza, C.; Kostopoulos, G.; Mostafa, S.; Nirantharakumar, K.; Tahrani, A. The links between sleep duration, obesity and type 2 diabetes mellitus. *J. Endocrinol.* **2021**, *252*, 125–141. [CrossRef]
22. Chasens, E.R.; Korytkowski, M.; Sereika, S.M.; Burke, L.E. Effect of Poor Sleep Quality and Excessive Daytime Sleepiness on Factors Associated with Diabetes Self-Management. *Diabetes Educ.* **2013**, *39*, 74–82. [CrossRef]
23. Griggs, S.; Morris, N. Fatigue among Adults with Type 1 Diabetes Mellitus and Implications for Self-Management: An Integrative Review. *Diabetes Educ.* **2018**, *44*, 325–339. Available online: https://journals.sagepub.com/doi/10.1177/0145721718782148 (accessed on 19 December 2022). [CrossRef]
24. Wachid, N.; Gayatri, D.; Pujasari, H. Correlation between sleep quality with diabetes self-care management on diabetes mellitus type 2 patients. *AIP Conf. Proc.* **2019**, *2092*, 040018. [CrossRef]
25. Arora, T.; Taheri, S. Sleep Optimization and Diabetes Control: A Review of the Literature. *Diabetes Ther.* **2015**, *6*, 425–468. [CrossRef] [PubMed]
26. Schipper, S.B.J.; Van Veen, M.M.; Elders, P.J.M.; van Straten, A.; Van Der Werf, Y.D.; Knutson, K.L.; Rutters, F. Sleep disorders in people with type 2 diabetes and associated health outcomes: A review of the literature. *Diabetologia* **2021**, *64*, 2367–2377. [CrossRef] [PubMed]
27. Goff, L.M.; Ladwa, M.; Hakim, O.; Bello, O. Ethnic distinctions in the pathophysiology of type 2 diabetes: A focus on black African Caribbean populations. *Proc. Nutr. Soc.* **2020**, *79*, 184–193. [CrossRef] [PubMed]
28. Grandner, M.A.; Seixas, A.; Shetty, S.; Shenoy, S. Sleep Duration and Diabetes Risk: Population Trends and Potential Mechanisms. *Curr. Diab. Rep.* **2016**, *16*, 106. [CrossRef]
29. Page, M.J.; McKenzie, J.E.; Bossuyt, P.M.; Boutron, I.; Hoffmann, T.C.; Mulrow, C.D.; Shamseer, L.; Tetzlaff, J.M.; Akl, E.A.; Brennan, S.E.; et al. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ* **2021**, *372*, n71. [CrossRef]
30. National Heart, Lung, and Blood Institute. Study Quality Assessment Tools. Available online: https://www.nhlbi.nih.gov/health-topics/study-quality-assessment-tools (accessed on 19 December 2022).
31. Rodriguez, L.; Tighiouart, H.; Scott, T.; Lou, K.; Giang, L.; Sorensen, E.; Weiner, D.E.; Sarnak, M.J. Association of sleep disturbances with cognitive impairment and depression in maintenance hemodialysis patients. *J. Nephrol.* **2013**, *26*, 101. [CrossRef]
32. Bakker, J.; Weng, J.; Wang, R.; Redline, S.; Punjabi, N.; Patel, S. Associations between Obstructive Sleep Apnea, Sleep Duration, and Abnormal Fasting Glucose. The Multi-Ethnic Study of Atherosclerosis. *Am. J. Respir. Crit. Care Med.* **2015**, *192*, 745–753. [CrossRef]

33. Curtis, D.S.; Fuller-Rowell, T.E.; El-Sheikh, M.; Carnethon, M.R.; Ryff, C.D. Habitual sleep as a contributor to racial differences in cardiometabolic risk. *Proc. Natl. Acad. Sci. USA* **2017**, *114*, 8889–8894. [CrossRef]
34. DePietro, R.H.; Knutson, K.L.; Spampinato, L.; Anderson, S.L.; Meltzer, D.O.; Van Cauter, E.; Arora, V.M. Association between Inpatient Sleep Loss and Hyperglycemia of Hospitalization. *Diabetes Care* **2017**, *40*, 188–193. [CrossRef]
35. Wagner, J.; Tennen, H.; Finan, P.; Feinn, R.; Burg, M.M.; Seawell, A.; White, W.B. Exposure to Racial Discrimination and Ambulatory Blood Pressure in Women with Type 2 Diabetes. *Stress. Health J. Int. Soc. Investig. Stress* **2016**, *32*, 337–345. [CrossRef]
36. Yano, Y.; Gao, Y.; Johnson, D.A.; Carnethon, M.; Correa, A.; Mittleman, M.A.; Sims, M.; Mostofsky, E.; Wilson, J.G.; Redline, S. Sleep Characteristics and Measures of Glucose Metabolism in Blacks: The Jackson Heart Study. *J. Am. Heart Assoc.* **2020**, *9*, e013209. [CrossRef] [PubMed]
37. Mahmood, K.; Akhter, N.; Eldeirawi, K.; Onal, E.; Christman, J.W.; Carley, D.W.; Herdegen, J.J. Prevalence of type 2 diabetes in patients with obstructive sleep apnea in a multi-ethnic sample. *J. Clin. Sleep Med.* **2009**, *5*, 215–221. [CrossRef] [PubMed]
38. Andreozzi, F.; Van Overstraeten, C.; Ben Youssef, S.; Bold, I.; Carlier, S.; Gruwez, A.; André, S.; Bruyneel, A.-V.; Bruyneel, M. African ethnicity is associated with a higher prevalence of diabetes in obstructive sleep apnea patients: Results of a retrospective analysis. *Sleep. Breath. Schlaf. Atm.* **2020**, *24*, 857–864. [CrossRef]
39. Assari, S.; Sonnega, A.; Pepin, R.; Leggett, A. Residual Effects of Restless Sleep over Depressive Symptoms on Chronic Medical Conditions: Race by Gender Differences. *J. Racial Ethn. Health Disparities* **2017**, *4*, 59–69. [CrossRef]
40. Bermudez-Millan, A.; Schumann, K.P.; Feinn, R.; Tennen, H.; Wagner, J. Behavioral reactivity to acute stress among Black and White women with type 2 diabetes: The roles of income and racial discrimination. *J. Health Psychol.* **2016**, *21*, 2085–2097. [CrossRef] [PubMed]
41. Bidulescu, A.; Din-Dzietham, R.; Coverson, D.L.; Chen, Z.; Meng, Y.-X.; Buxbaum, S.G.; Gibbons, G.H.; Welch, V.L. Interaction of sleep quality and psychosocial stress on obesity in African Americans: The Cardiovascular Health Epidemiology Study (CHES). *BMC Public. Health* **2010**, *10*, 581. [CrossRef]
42. Gaston, S.A.; Jackson, B.; Williams, D.R.; Jackson, C.L. Sleep and Cardiometabolic Health by Government-Assisted Rental Housing Status among Black and White Men and Women in the United States. *Sleep Health* **2018**, *4*, 420–428. [CrossRef]
43. Im, E.O.; Yang, Y.L.; Liu, J.; Chee, W. Sleep-related symptoms of midlife women with and without type 2 diabetes mellitus. *Menopause* **2019**, *26*, 1178–1184. [CrossRef]
44. Iyegha, I.D.; Chieh, A.Y.; Bryant, B.M.; Li, L. Associations between poor sleep and glucose intolerance in prediabetes. *Psychoneuroendocrinology* **2019**, *110*, 104444. [CrossRef]
45. Kalmbach, D.; Pillai, V.; Arnedt, T.; Drake, C. DSM-5 Insomnia and Short Sleep: Comorbidity Landscape and Racial Disparities. *Sleep* **2016**, *39*, 2101–2111. Available online: https://academic.oup.com/sleep/article/39/12/2101/2706340?login=false (accessed on 19 December 2022). [CrossRef]
46. Mathews, E.; Li, C.; Long, C.; Narcisse, M.R.; Martin, B.; McElfish, P.A. Sleep deficiency among Native Hawaiian/Pacific Islander, Black, and White Americans and the association with cardiometabolic diseases: Analysis of the National Health Interview Survey Data. *Sleep Health* **2018**, *4*, 273–283. [CrossRef] [PubMed]
47. Shankar, A.; Syamala, S.; Kalidindi, S. Insufficient rest or sleep and its relation to cardiovascular disease, diabetes and obesity in a national, multiethnic sample. *PLoS ONE* **2010**, *5*, e14189. [CrossRef] [PubMed]
48. Williams, N.J.; Castor, C.; Seixas, A.; Ravenell, J.; Jean-Louis, G. Sleep Disorders and Symptoms in Blacks with Metabolic Syndrome: The Metabolic Syndrome Outcome Study (MetSO). *Ethn. Dis.* **2018**, *28*, 193–200. [CrossRef] [PubMed]
49. Deuster, P. Allostatic Load and Health Status of African Americans and Whites. *Am. J. Health Behav.* **2011**, *35*, 641–653. [CrossRef]
50. Knutson, K.L.; Ryden, A.M.; Mander, B.A.; Van Cauter, E. Role of sleep duration and quality in the risk and severity of type 2 diabetes mellitus. *Arch. Intern. Med.* **2006**, *166*, 1768–1774. [CrossRef]
51. Ramos, A.R.; Wallace, D.M.; Pandi-Perumal, S.R.; Williams, N.J.; Castor, C.; Sevick, M.A.; Mcfarlane, S.I.; Jean-Louis, G. Associations between sleep disturbances and diabetes mellitus among blacks with metabolic syndrome: Results from the Metabolic Syndrome Outcome Study (MetSO). *Ann. Med.* **2015**, *47*, 233–237. [CrossRef]
52. Picarsic, J.L.; Glynn, N.W.; Taylor, C.A.; Katula, J.A.; Goldman, S.E.; Studenski, S.A.; Newman, A.B. Self-reported napping and duration and quality of sleep in the lifestyle interventions and independence for elders pilot study. *J. Am. Geriatr. Soc.* **2008**, *56*, 1674–1680. [CrossRef]
53. Gordon, N.P.; Hsueh, L. Racial/ethnic, gender, and age group differences in cardiometabolic risks among adults in a Northern California health plan: A cross-sectional study. *BMC Public. Health* **2021**, *21*, 1227. [CrossRef]
54. Shadyab, A.H.; Kritz-Silverstein, D.; Laughlin, G.A.; Wooten, W.J.; Barrett-Connor, E.; Araneta, M.R.G. Ethnic-specific associations of sleep duration and daytime napping with prevalent type 2 diabetes in postmenopausal women. *Sleep. Med.* **2015**, *16*, 243–249. [CrossRef]
55. Beihl, D.A.; Liese, A.D.; Haffner, S.M. Sleep Duration as a Risk Factor for Incident Type 2 Diabetes in a Multiethnic Cohort. *Ann. Epidemiol.* **2009**, *19*, 351–357. [CrossRef]
56. Gamaldo, A.A.; McNeely, J.M.; Shah, M.T.; Evans, M.K.; Zonderman, A.B. Racial differences in self-reports of short sleep duration in an urban-dwelling environment. *J. Gerontol. B Psychol. Sci. Soc. Sci.* **2015**, *70*, 568–575. [CrossRef] [PubMed]
57. Hairston, K.; Bryer-Ash, M.; Norris, J.; Haffner, S.; Bowden, D.; Wagenknecht, L. Sleep duration and five-year abdominal fat accumulation in a minority cohort: The IRAS family study. *Sleep* **2010**, *33*, 289–295. [CrossRef]

58. Jackson, C.L.; Redline, S.; Kawachi, I.; Hu, F.B. Association between sleep duration and diabetes in black and white adults. *Diabetes Care* **2013**, *36*, 3557–3565. [CrossRef] [PubMed]
59. Maskarinec, G.; Jacobs, S.; Amshoff, Y.; Setiawan, V.; Shvetsov, Y.B.; Franke, A.A.; Kolonel, L.N.; Haiman, C.A.; Le Marchand, L. Sleep Duration and Incidence of Type 2 Diabetes: The Multiethnic Cohort. *Sleep. Health* **2018**, *4*, 27–32. [CrossRef]
60. Singh, M.; Drake, C.L.; Roehrs, T.; Hudgel, D.W.; Roth, T. The association between obesity and short sleep duration: A population-based study. *J. Clin. Sleep. Med. JCSM Off. Publ. Am. Acad. Sleep. Med.* **2005**, *1*, 357–363. [CrossRef]
61. Zizi, F.; Pandey, A.; Murrray-Bachmann, R.; Vincent, M.; McFarlane, S.; Ogedegbe, G.; Jean-Louis, G. Race/ethnicity, sleep duration, and diabetes mellitus: Analysis of the National Health Interview Survey. *Am. J. Med.* **2012**, *125*, 162–167. [CrossRef]
62. Joseph, J.J.; Echouffo-Tcheugui, J.B.; Talegawkar, S.A.; Effoe, V.S.; Okhomina, V.; Carnethon, M.R.; Hsueh, W.A.; Golden, S.H. Modifiable Lifestyle Risk Factors and Incident Diabetes in African Americans. *Am. J. Prev. Med.* **2017**, *53*, e165–e174. [CrossRef]
63. Ramos, A.R.; Guilliam, D.; Dib, S.I.; Koch, S. Race/ethnic differences in obstructive sleep apnea risk in patients with acute ischemic strokes in south Florida. *Sleep. Breath. Schlaf. Atm.* **2014**, *18*, 165–168. [CrossRef]
64. Rosen, D.M.; Kundel, V.; Rueschman, M.; Kaplan, R.; Guo, N.; Wilson, J.G.; Min, Y.-I.; Redline, S.; Shah, N. Self-reported snoring and incident cardiovascular disease events: Results from the Jackson Heart Study. *Sleep. Breath. Schlaf. Atm.* **2019**, *23*, 777–784. [CrossRef]
65. Ceïde, M.E.; Williams, N.J.; Seixas, A.; Longman-Mills, S.K.; Jean-Louis, G. Obstructive sleep apnea risk and psychological health among non-Hispanic blacks in the Metabolic Syndrome Outcome (MetSO) cohort study. *Ann. Med.* **2015**, *47*, 687–693. [CrossRef]
66. Ong, Z.L.; Chaturvedi, N.; Tillin, T.; Dale, C.; Garfield, V. Association between sleep quality and type 2 diabetes at 20-year follow-up in the Southall and Brent REvisited (SABRE) cohort: A triethnic analysis. *J. Epidemiol. Community Health* **2021**, *75*, 1117–1122. [CrossRef] [PubMed]
67. Rae, D.E.; Dugas, L.R.; Roden, L.C.; Lambert, E.V.; Bovet, P.; Plange-Rhule, J.; Forrester, T.; Riesen, W.; Korte, W.; Crowley, S.J.; et al. Associations between self-reported sleep duration and cardiometabolic risk factors in young African-origin adults from the five-country modeling the epidemiologic transition study (METS). *Sleep. Health* **2020**, *6*, 469–477. [CrossRef] [PubMed]
68. Ramtahal, R.; Khan, C.; Maharaj-Khan, K.; Nallamothu, S.; Hinds, A.; Dhanoo, A.; Yeh, H.-C.; Hill-Briggs, F.; Lazo, M. Prevalence of self-reported sleep duration and sleep habits in type 2 diabetes patients in South Trinidad. *J. Epidemiol. Glob. Health* **2015**, *5* (Suppl. S1), S35–S43. [CrossRef] [PubMed]
69. Song, Y.; Ancoli-Israel, S.; Lewis, C.E.; Redline, S.; Harrison, S.L.; Stone, K.L. The Association of Race/Ethnicity with Objectively Measured Sleep Characteristics in Older Men. *Behav. Sleep Med.* **2012**, *10*, 54–69. [CrossRef] [PubMed]
70. Chen, X.; Wang, R.; Zee, P.; Lutsey, P.L.; Javaheri, S.; Alcántara, C.; Jackson, C.; Williams, M.A.; Redline, S. Racial/Ethnic Differences in Sleep Disturbances: The Multi-Ethnic Study of Atherosclerosis (MESA). *Sleep* **2015**, *38*, 877–888. [CrossRef]
71. Feinstein, L.; McWhorter, K.L.; Gaston, S.A.; Troxel, W.M.; Sharkey, K.M.; Jackson, C.L. Racial/ethnic disparities in sleep duration and sleep disturbances among pregnant and non-pregnant women in the United States. *J. Sleep Res.* **2020**, *29*, e13000. [CrossRef]
72. Carnethon, M.R.; De Chavez, P.J.; Zee, P.C.; Kim, K.-Y.A.; Liu, K.; Goldberger, J.J.; Ng, J.; Knutson, K.L. Disparities in sleep characteristics by race/ethnicity in a population-based sample: Chicago Area Sleep Study. *Sleep Med.* **2016**, *18*, 50–55. [CrossRef]
73. Makarem, N.; St-Onge, M.P.; Liao, M.; Lloyd-Jones, D.M.; Aggarwal, B. Association of sleep characteristics with cardiovascular health among women and differences by race/ethnicity and menopausal status: Findings from the American Heart Association Go Red for Women Strategically Focused Research Network. *Sleep Health* **2019**, *5*, 501–508. [CrossRef]
74. Nowakowski, S.; Matthews, K.A.; von Känel, R.; Hall, M.H.; Thurston, R.C. Sleep characteristics and inflammatory biomarkers among midlife women. *Sleep* **2018**, *41*, zsy049. [CrossRef]
75. Moon, C.; Hagen, E.W.; Johnson, H.M.; Brown, R.L.; Peppard, P.E. Longitudinal sleep characteristics and hypertension status: Results from the Wisconsin Sleep Cohort Study. *J. Hypertens.* **2021**, *39*, 683–691. [CrossRef]
76. Brouwer, A.; van Raalte, D.H.; Rutters, F.; Elders, P.J.; Snoek, F.J.; Beekman, A.T.; Bremmer, M.A. Sleep and HbA1c in Patients with Type 2 Diabetes: Which Sleep Characteristics Matter Most? *Diabetes Care* **2020**, *43*, 235–243. [CrossRef] [PubMed]
77. Ruiter, M.E.; Decoster, J.; Jacobs, L.; Lichstein, K.L. Normal sleep in African-Americans and Caucasian-Americans: A meta-analysis. *Sleep Med.* **2011**, *12*, 209–214. [CrossRef] [PubMed]
78. Meyer, M.L.; McKenny, M.C.; Liddell-Quintyn, E.; Nicolas, G.; St Louis, G. *Racial Stress and Racialized Violence among Black Immigrants in the United States*; Tummala-Narra, P., Ed.; American Psychological Association: Washington, DC, USA, 2021; pp. 147–163. [CrossRef]
79. Hart, A.R.; Lavner, J.A.; Carter, S.E.; Beach, S.R.H. Racial discrimination, depressive symptoms, and sleep problems among Blacks in the rural South. *Cult. Divers Ethn. Minor Psychol.* **2021**, *27*, 123–134. [CrossRef] [PubMed]
80. Fuller-Rowell, T.E.; Curtis, D.S.; El-Sheikh, M.; Duke, A.M.; Ryff, C.D.; Zgierska, A.E. Racial discrimination mediates race differences in sleep problems: A longitudinal analysis. *Cult. Divers Ethn. Minor Psychol.* **2017**, *23*, 165–173. [CrossRef] [PubMed]
81. Klingman, K.J.; Morse, A.; Williams, N.; Grandner, M.A.; Perlis, M.L. 1174 Assessing Sleep Disorders in Primary Care: A Provider Survey about the Importance of Sleep Health. *Sleep* **2020**, *43* (Suppl. S1), A448. [CrossRef]