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Systematic review of diabetes management among black African immigrants, white and South Asian populations

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Background This study aims to explore the differences in the management of diabetes outcomes and prevalence among black Africans, white and South Asian populations living in western countries from published evidence. This review incorporates findings from differences in diabetes management outcome among black Africans compared to white and South Asian populations.

Methods A systematic search of major electronic databases with peer review publications was conducted. PubMed, CIHNAL, Medline, Web of Science, Scopus, and Science direct databases were searched from 2007-2018. Relevant journals and citations from references were searched for selection in the review. Data were analysed to understand differences in diabetes outcomes among these populations.

Results Fifteen articles met the inclusion criteria out of the sixty-six articles retrieved and included in the review. Majority of the articles were cross-sectional quantitative studies (n=10) and qualitative studies (n=5). Diabetes prevalence and outcome measures such as haemoglobin A1c, blood pressure, cholesterol and body mass index were reported to be higher among black African than white populations. The data showed disparity in diabetes management among black Africans as compared to white and South Asian groups.

Conclusions The poorer health outcomes reported among black Africans as compared to white and South Asian populations suggest poor diabetes management. Further research is needed to understand why there is such disparity in the health outcome of black African populations living with diabetes in western countries. There is a need to have a consistent target outcome measure in studies. Further synthesis was not possible due to differences in outcome measures used by studies reviewed.

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The World Health Organization (WHO) reported diabetes to be among the ten leading causes of death in the last decade 2002-2012 (*1*). Diabetes is estimated to affect approximately 422 million people globally (*2*). This has been estimated to increase to over 642 million in 2040 (*3*-*5*). Overall, there has been an increasing trend in diabetes cases globally.

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Diabetes has constantly been a public health burden in western countries such as the United Kingdom (UK), United States of America (USA) and Canada (*6*). Specifically, in the UK, diabetes prevalence is put at 6.2% equivalent to more than 4 million people affected by the condition (*7*). In the USA, diabetes affects more than 30 million people (prevalence 9.4%) (*8*). Canada has 9.2% prevalence, translating to 3.5 million people (*9*, *10*). This global public health issue requires further research into prevention and management of subsets of the population.

However, diabetes burden is higher among immigrant groups that make up ethnic minority groups in western countries (*11*, *12*). According to the National Institute for Health and Care Excellence (NICE) ethnicity is a risk factor for the development of type 2 diabetes (*13*). Ethnicity is defined as the collection of individuals that can be grouped together as a result of shared national or cultural values, which can include religion, language, ancestry and society (*14*). Ethnic minority groups are individuals that belong to groups and have different cultural traditions from the main population (*15*). black African group is a minority group that are particularly affected by diabetes. They have been reported to have higher prevalence of diabetes in the literature (*16*, *17*). For instance, black Africans in Netherlands were reported to be more than five times more at risk of developing diabetes than the general population (*18*). Similarly, studies have reported health disparities among ethnic minorities as compared to the general population in the USA with reported health inequalities among these groups (*19*). Diabetes prevalence among African immigrants has been reported to increase with years of migration (*20*). This presents the need to understand disparity in health by comparing diabetes outcome measures among black Africans to white and South Asian populations.

The aim of this review is to explore the differences in diabetes management outcomes among ethnic groups with focus on black African population's management. The interest in black African immigrants is because of the growth in this population and also due to the disparity in diabetes prevalence among this group compared to the general population in the host country. For example, they are among the highest growing ethnic minority groups in the UK (*21*, *22*). Although reviews have been conducted on diabetes management among South Asian and Caribbean groups (*23*-*25*), not much have been done in respect to black African population. To our knowledge, this is the first review comparing diabetes management outcomes among black Africans, white and South Asian populations.

METHODS

Study design and data sources

This review was carried out based on Search, AppraisaL, Synthesis and Analysis (SALSA) systematic review framework (*26*-*28*). Major databases were searched including: PubMed, CIHNAL, Medline, Web of Science, Scopus, and Science Direct were searched because they offer a good selection of publications that are related to this review question. The main search terms for this work were 'Diabetes', 'Africa', 'ethnic minority', 'management' and their alternative synonyms were entered into the databases searched (Table 1). These search terms were combined using Boolean operators to allow full retrieval of all articles that are related to the focus of this review. The protocol for this review has been registered on PROSPERO (CRD 42018088311).

Table 1. Search terms with synonyms

SEARCH TERMS	
Diabetes (S1)	"Diabet*" OR "Non-Insulin depend*" OR "Insulin resist*" OR "impair* glucose toleran*" OR "Dm2" OR "NIDDM" OR "Type 2 diab*" OR "Slow onset diab*" OR "Blood sugar" OR "Blood glucose"
African (S2)	"Africa*" OR "black*" OR "Race* OR Afro* OR Afric*
Ethnic minority (S3)	BME OR Ethnic* OR Minorit* OR "Ethnic* Minorit*" OR migrant* OR immigrant*
Management (S4)	Manag* OR regulat* OR Control* OR maintain*
Search combination	S1 AND S2 AND S3 AND S4

Selection criteria

To meet the inclusion criteria, articles that are reported to be primary research, use either qualitative or quantitative methodology and peer-reviewed were selected for this review. The results of the search were screened from the title, abstract and finally full text. The First author (FA) screened all article's title and abstract to assess their eligibility as meeting the inclusion criteria for the review. Details of inclusion and exclusion criteria are presented in Table 2.

Assessing quality of the papers

Each paper was appraised to assess the quality using relevant Critical Appraisal Skills Programme CASP (*29*) checklist for cross-sectional quantitative studies and another for qualitative studies was used for the appraisal. This checklist was selected as it provides a structural approach to assessing rigour of the articles (*30*, *31*). A score was assigned to each article based on how the study answered screening questions giving No = 0 and Yes = 1 (*32*). Each study score was converted to the percentage of the total numbers of questions. It was decided to exclude any study that score below 50%, this was to avoid reviewing papers with less quality. No study had 100% of the screening score and no study was below 50% and so no study was excluded based on quality assessment as they were of satisfactory quality. Data were extracted from these studies to be included in the review.

Table 2. Literature inclusion and exclusion criteria

INCLUSION CRITERIA	EXCLUSION CRITERIA
Online articles	
Primary research	Review papers
Peer-reviewed	Not peer reviewed
Published between 2006-2018	Published before 2006
English written	Other language outside English
Considers Type 2 diabetes in black Africans	Considers other diseases in black Africans
Compares diabetes management among ethnic groups	No reported ethnic group measures
Measures diabetes management outcomes	Report other outcomes aside diabetes management
Primary research: Qualitative, quantitative and mixed method studies.	Reports, letters, editorials, conference papers, Abstracts, systematic reviews

Data extraction

Following the quality assessment of each paper, data were extracted using a data extraction tool. There are various types of data extraction tools that can be used in a review including paper, spreadsheets, email and web-based survey. The type used depends on the availability of funding, time for review and number of reviewers on the project (*33*). Data was extracted using Microsoft Excel (Microsoft Inc., Seattle WA, USA) spreadsheet by FA. Data were extracted on the aim of the study, the type of research methodology used, demographic information of the participants, key findings and conclusions from the study (Table 4).

Diabetes outcome measure targets

In the quantitative articles that were included in the review, diabetes prevalence and four outcomes measures were reported in most studies reviewed (haemoglobin a1c level, blood pressure, cholesterol level and body mass index). These outcomes were selected as they were reported by most of the articles reviewed. In addition, these outcomes are used as the most accurate measure of diabetes management and as an indicator of biomedical outcomes of care (*34*, *35*). Other measures like smoking, awareness, knowledge, self-management and complications were reported in some studies but are not reported in this review. Different outcome measures were used in the studies reviewed; this was mainly based on the geographical location of the study. For example, studies conducted in North American mainly use American Diabetes Association (ADA) and International Diabetes Federation (IDF) target recommendations. Studies conducted in the UK use NICE target recommendations while studies in Europe use WHO target recommendations. It was not possible to conduct a meta-analysis on the articles due to the heterogeneity of the data from the studies reviewed, particularly from target outcome measures used (Table 3).

Table 3. Biomedical target outcomes based on different health organisations

ORGANISATION	TARGET	CITATIONS
HbA1C		
IDF	<7% (53 mmol/L)	IDF 2017 (*66*)
WHO	<6.5% (48 mmol/L)	WHO 2007 (*67*)
NICE	<6.5% (48 mmol/L)	NICE 2015 (*68*)
ADA	<7% (53 mmol/L)	ADA 2016 (*69*)
Blood Pressure		
IDF	Systolic: 130-140 mmHg Diastolic: 80 mmHg	IDF 2017 (*66*)
WHO	130/80 mmHg	WHO 2007 (*67*)
NICE	<140/80 mmHg	NICE 2009 (*70*)
ADA	<140/90 mmHg	De Boer et al. 2017 (*71*)
Cholesterol		
IDF	LDL cholesterol <2.6 mmol/L	IDF 2017 (*66*)
WHO	Total cholesterol <4.0 mmol/L (152 mg/dl) LDL cholesterol <2.0 mmol/L (77mg/dl)	WHO 2007 (*67*)
NICE	LDL cholesterol <2.0mmol/L HDL cholesterol <1.4 mmol/L Total cholesterol <4.0 mmol/L	NICE 2012 (*72*)
ADA	LDL cholesterol <2.6mmol/L (100mg/dL)	Eldor and Raz 2009 (*73*)

IDF – International Diabetes Federation, WHO – World Health Organization, NICE – National Institute for Health and Care Excellence, ADA – American Diabetes Association

Table 4. Demographic of participants in studies review with key findings and conclusion

STUDY	AIM	STUDY DESIGN	STUDY QUALITY	PARTICIPANT'S DEMOGRAPHY	KEY FINDINGS	CONCLUSION
Ballotari et al. 2015 (*36*)	To compare prevalence of diabetes among immigrants and Italians and to evaluate the disparities in the management and glycaemic control.	Quantitative approach measuring clinical outcomes of prevalence and HbA1C value	17/20, 85%	Citizenship: High Developed Countries (HDC) High Migration Countries (HMC) And High Migration Pressure Countries (HMPC). Sampling: Population-based data Sample size: 17,195. 15,889 Italian, 11 HDC, 1,295 HMPC. Age Range: 20-74. Gender: Male and Female. Context: Italy	Foreigners younger with type 2 diabetes than Italians Sub-Saharan Africans with lowest mean age 44.6 years for Female and 44.9years for Male. Both sexes experience a higher prevalence of diabetes than Italian. Lower Italians not performing HbA1C compared to immigrants. Immigrants had worse indicator in HbA1C measure. Higher odds of not being tested for HbA1C than Italians. Immigrants experience higher odds compared to Italians for not being in the care of diabetes clinics, without HbA1C tests in 2010 and with HbA1C >=9%.	Confirmation of the higher prevalence of diabetes among immigrants than Italian. Immigrants are less compliant and more likely to experience worse levels of HbA1C
Dreyer et al. 2009 (*46*)	To establish the impact of ethnicity on the prevalence and severity of diabetes mellitus and Chronic Kidney Disease (CKD)	Quantitative Cross-sectional study	17/20, 85%	34,359 Adults coded white black and South Asia population	Overall prevalence for white 3.5%, 11% for South Asian and 8% for black population. Diabetic proteinuria was more frequent among Blacks compared to white group (22.4% vs. 14.1%) but similar in South Asia (21% Vs 22%). Lower CKD when compared with white population. Blood pressure is less controlled in black group regardless of CKD, less than 50% of diabetics achieve Bp =< 130/80mmHg. Black population receiving prescription more than South Asia or white groups.	Higher level of diabetes among ethnic minority groups was supported with this study. Black population have the worse outcome with higher levels of proteinuria and blood pressure than white and South Asia group. Severe CKD is higher among black and South Asian populations with mild CKD higher among white population.
James et al. 2012 (*44*)	To describe the independent influence of both ethnic and social group on HbA1C levels in people with type 2 diabetes routinely cared for by general practice for over 5 years.	Quantitative Cross-sectional from Web-enabled computer System	18/20, 90%	Whites: 5,206 (22%), Black Africa/Caribbean: 3,923 (17%), South Asia: 13,633 (58%) and Others 721 (3%). Age Range: 35-75 years. Sample size: 24,111.	White (69%) people were less likely to be on intensive diabetes treatment (Combined oral or Insulin) than South Asia (75%) and black African/Caribbean population (73%). Mean of HbA1C declined in white group by 0.4% from 8.2% to 7.8%: 0.5% for South Asian population and Africa/Caribbean group from 8.5% to 8.0%. The proportion of people with 7.5% or less HbA1C increased by 12% in White group, 14% in South Asia and 15% in Africa/Caribbean groups.	There was improvement in HBA1C among all ethnic groups. However, ethnic differences still persisted. Ethnic group and social deprivation are independently associated with HbA1C.
Kahn et al. 2012 (*51*)	To examine multi-ethnic participants' explanation of how their diabetes began, understandings about their illness, description of the symptoms experience. To analyse the extent to which themes persisted across ethnic, cultural and racial boundaries	Qualitative approach using semi-structured interviews	17/20, 85%	Refugee (Somalia, Sudan, Burma or Cuba). Sample Size: 34. Male: 8, Female: 26. Education: 13 secondary school completion	Unexpected and late diagnosis of diabetes was reported. Reaction to living with diagnosis was reported as grief, anger, depressive symptoms, and acceptance. Most patients understanding is focused on symptoms and diet	People living with diabetes express emotions similar to dying patients. There is a need for practitioners to include patients as partners in the development of patient centred approach to diabetes management
Kindarara et al. 2017 (*52*)	To describe Sub-Saharan African immigrants' health-illness transition experiences associated with type 2 diabetes mellitus self-management	Qualitative approach using face-to-face semi-structured in-depth interview	18/20, 90%	Sub-Sharan African immigrants Sample Size: 10. Mean Age: 60.3 years. Sampling: Purposive and Snowballing Sampling. Male: 5, Female: 5	Participants reported limited knowledge about diabetes. Dealing with the shock of diagnosis with diabetes, cultural beliefs can be inhibitors of self-management	Professionals need to access and recognise inhibitors that can influence diabetes self-management.
Kohinor et al. 2011 (*47*)	To determine the social-cultural factors affecting the dietary behaviour of Dutch Surinamese patients with type 2 diabetes	Qualitative approach using Grounded theory methodology	18/20, 90%	African Surinamese Hindustani Surinamese. Sample Size: 32. Mean Age: 55. Male: 12 Female: 20	Participants reported finding it difficult to choose good food products, Holding on to their traditional food as identity, culture plays important role in their food preparation.	Immigrants continue with their country of origin food and cultural considerations should be involved in advising people with diabetes on dietary recommendations.

Table 4. Continued

STUDY	AIM	STUDY DESIGN	STUDY QUALITY	PARTICIPANT'S DEMOGRAPHY	KEY FINDINGS	CONCLUSION
Snider et al. 2017 (*40*)	To explore both the age-specific prevalence of diabetes and the current level of awareness, medical treatment and glycaemic control among different ethnic groups.	Quantitative cross-sectional study	18/20, 90%	Dutch 4,541, South Asia Surinamese 3,032. African Surinamese 4,109, Ghanaian 2,232, Turkish 3, 591 and Moroccan 3,887. Sample size: 21,483. Sampling: Municipal register. Age range: 18-70	Diabetes prevalence increased among ethnic groups with age. Higher than Dutch and significant from age 31-40 years. There was higher awareness of diabetes (70-80%) among ethnic groups compared to Dutch (60%). The odd for receiving medical treatment for diabetes is also higher among all ethnic minority compared to Dutch. All ethnic minority men are significantly lower odds of controlled HbA1C than Dutch	Ethnic groups have higher prevalence of diabetes, although awareness is a higher than among Dutch. There was significant lower control of HbA1C among ethnic minority men than Dutch but no difference among women. There is need to understand the cause of poor glycaemic control among ethnic minority.
Verma et al. 2010 (*41*)	To determine the impact of quality improvement initiatives on ethnic disparities in diabetes management in the UK	Quantitative cross-sectional survey	18/20, 90%	4309 Participants. white population: 13.7%, black population: 16.1%. South Asians: 51.2%, Others: 18.3%. Age: 18 and above. Male: 2393 (55.5%) Female: 1871 (43.4%). No sex: 45 (1.0%)	No difference in evidence of the process of care among all ethnic groups The Proportion of patients meeting national treatment targets for Bp, cholesterol and HbA1C increased from 1997-2007. Black patients achieving the targets doubled but still remain less likely to meet target in 2006 compared to white group. Black population were less likely to meet all three targets than white group. South Asians were more likely to meet cholesterol target than white population by 2006. There is increase prescription of lipid-lowering, oral hypoglycaemic agents, insulin and antihypertensive medications since 1997. Increase in prescription medication for black population but lower lipid-lowering medication than white patients in 2006. Black patients were more likely to be on oral hypoglycaemia agent than white population.	There has been improvement in patients meeting the three targets since 1997. However, less than 20% were able to meet this target. Medication prescription also increased for all ethnic groups. There is need for better improvement in care and management.
Fosse-Edorh et al. 2014 (*42*)	To present an overview of type 2 diabetes among North African immigrants in France	Quantitative cross-sectional study using national survey	17/20, 85%	Race: Africans. France Sample technique: National survey records. Sample size: Born in North Africa (BNA). Male: 191. Born in France (BIF) Male: 5821 BNA (Female) 136. BIF (Female) 6890. Mean Age: BNA (Male) 58. BIF (Male) 61. BNA (Female) 56 BIF (Female) 63. Context: France. Ethnicity: black and white populations.	Type 2 diabetes prevalence and obesity is higher among BNA than BIF. HbA1c is also higher among BNA than BIF which indicate poorer control among this population.	Although a higher prevalence of type 2 diabetes and poorer glycaemic control was reported among BNA women. There is a poorer control among both Male and Female BNA than BIF contributing to complication disparity among this population
Wieland et al. 2012 (*50*)	To measure outcomes of diabetes care among Somali immigrants	Quantitative methodology	16/20, 80%	Race: Somalia And Non-Somalia. Sample technique: Medical record. Sample size: 81. Somalian 5,843, Non-Somalian. Mean Age: not mentioned. Context: USA. Socioeconomic status: Not mentioned. Ethnicity: black population and Others	Somalians were less likely to meet the optimum HbA1C control <7%. There was no significant difference in the lipid control level among the Somali and Non- Somali groups. Also, there was no difference in the achievement of blood pressure control between the two groups.	There is a disparity in diabetes control among Somali immigrants living with diabetes as compared to Non-Somali groups. This might be due to medical preference, socioeconomic factors, health literacy and culture. Community-practice based intervention is needed to improve diabetes management among this vulnerable population group.

Table 4. Continued

STUDY	AIM	STUDY DESIGN	STUDY QUALITY	PARTICIPANT'S DEMOGRAPHY	KEY FINDINGS	CONCLUSION
Wallin et al. 2007 (*48*)	To explore the daily life experience of Somalian diabetic patients living in Sweden with gender-related perspectives to diabetes-related problems management	Qualitative methodology Interviews	16/20, 80%	Race: Somalian Sample Technique: Not mentioned Sample size: 19 Participants interviewed with interpreter's help. Mean Age: 54.9 Context: Sweden Socioeconomic status: Not mentioned Ethnicity: black group	Experience of distress in daily life as participants find it difficult to maintain daily activities. Difficulty to follow the dietary advice by health professional	Cultural consideration is essential in health promotional services for immigrants. Religion and gender consideration is also essential in the prevention and management of diabetes among this ethnic group.
Choukem et al. 2014 (*43*)	To determine the contribution of migration on the characteristic of Type 2 diabetes comparing three populations living with diabetes	Quantitative cross-sectional study design	19/20, 95%	Race: Cameroonians, Caucasians. Sample technique: Cross-sectional survey. Sample size: Cameroonian 100, African immigrants 98, Caucasians 199. Age Range: Cameroonian 30-80, African migrant 26-75, Caucasian 28-89. Context: France. Socioeconomic status: Not mentioned. Ethnicity: black and white population	Diabetes was diagnosed at a later age among Cameroonian. There were no differences among Cameroonians and African immigrants in mean BMI, overweight, obesity and smoking but higher among Caucasians. Cameroonians had the highest rate of microvascular complications than the other groups.	Cameroonians are diagnosed with diabetes at a later age but present with higher complications than African immigrants and Caucasians which might be due to delayed diagnosis and poorer management among the Cameroonian population.
Abubakari et al. 2013 (*37*)	To investigate diabetes knowledge and illness perception on self-management and also to determine the relationship between self-management behaviour and glycaemic control among African-Origin patients in the UK.	Quantitative Methodology	18/20, 90%	Race: White British, African Caribbean and black Africans. Sample technique: Convenience sampling. Sample size: 137 white British, 123 African Caribbean and 99 black Africans. Context: UK. Socioeconomic status: Not mentioned. Ethnicity: white and black population.	High knowledge about diabetes does not influence better self-management in white group and was related to less self-management in Africans. High Illness perception among white-British was associated with less exercise self-management. In Africans, high illness perception was associated with fewer feet management and dietary regulation. Perceived personal control was related to frequent overall self-management	Type 2 diabetes knowledge and perception varies between ethnic groups in the UK which might influence the disease management outcome. These perceptions need to be identified and any misconceptions corrected to allow for efficient self-management recommendations for this population.
Bijlholt et al. 2018 (*39*)	To asses differences in awareness, treatment and control of diabetes among a relatively homogeneous population from Ghanaians living in \Rural, urban parts of Ghana and Ghanaian immigrants living in European cities	Quantitative Cross-sectional study	19/20, 95%	Race: Black population. Sample selection: Purposive. Sample size: 530. Amsterdam 172, Berlin 70, London 102, Urban Ghana 135, Rural Ghana 51. Mean Age: Amsterdam 52.2, Berlin 51.1, London 54.6, Urban Ghana 52.9, Rural Ghana 54.5. Gender: Male and Female. Context: Amsterdam, Berlin, London Ghana, Ethnicity: black-Africans (100%)	Type 2 diabetes awareness was lowest among people in rural Ghana and highest in European sites (Amsterdam, berlin and London). Diabetes control was similar in Amsterdam, Berlin and rural Ghana but lower in urban Ghana and lowest in London.	Although type 2 diabetes awareness and treatment rates were lowest in rural Ghana, type 2 diabetes control was lowest in London and urban Ghana sites.
Brämberg et al 2012 (*49*)	To describe the care provided by a Diabetes Nurse Specialist (DNS) and the care needs expressed by immigrants living with type 2 diabetes	Qualitative observational study	16/20, 80%	Race: black Caribbean (BC) and Middle-East. Sample selection: Purposive. Sample size: 10 observation of consultation interview. Gender: Male and Female. Context: Sweden	There was power imbalance with patients passive during the consultation. There was limited support provided by DNS in addressing patient's concerns due to lack of individualised care. There was limited support provided by DNS in addressing patient's concerns due to lack of individualised care	Balanced communication is urgently needed. Person-centred consultation and care for people from immigrant background is seen as an important approach to diabetes management among this population.

S/N – Serial Number

Data analysis

Understandings of ethnicity within this literature review were based on the original authors' concepts.

The term "Whites" was used to refer to people from the European or Caucasian origin. South Asia included people originating from Indian, Pakistan, Bangladesh, Maldives and Sri Lanka, while Black population was used to refer to people originating from Africa and the Caribbean. Studies review reported establishing ethnicity based on self-reported origin, country of birth or as indicated in the hospital records in the studies reviewed.

Articles reported recruiting black populations with no further clarification on the specific black group. Further information on specific group of black population recruited for study is needed due to several groups that make up the black population. This presented difficulty as it was not made clear if recruited African immigrants that migrated from Africa or African Caribbean that migrated from Caribbean countries. This is due to the cultural and social differences between the two groups, such as language, diet, religion, geography, acculturation and socioeconomic factors, combining these groups as one ethnic group does not allow imprecision and probably unreliable. Only two studies reported findings between Black African and African Caribbean in separate categories (*36*, *37*). This highlights the need to understand the heterogeneity Black population.

RESULTS

Search results

Articles published after 2006 were retrieved, this is to allow retrieval of more recent and current studies to be included in the review. Hard copies of all 66 full-text articles were printed out for a full screening; this led to the selection of 15 articles in the review with five qualitative and ten quantitative articles. A PRISMA flow diagram (Figure 1) was used to present details of the literature search and article retrieval (*38*). Full articles were printed to allow unbiased selection of articles to be included in the review and note taking on each article during appraisal.

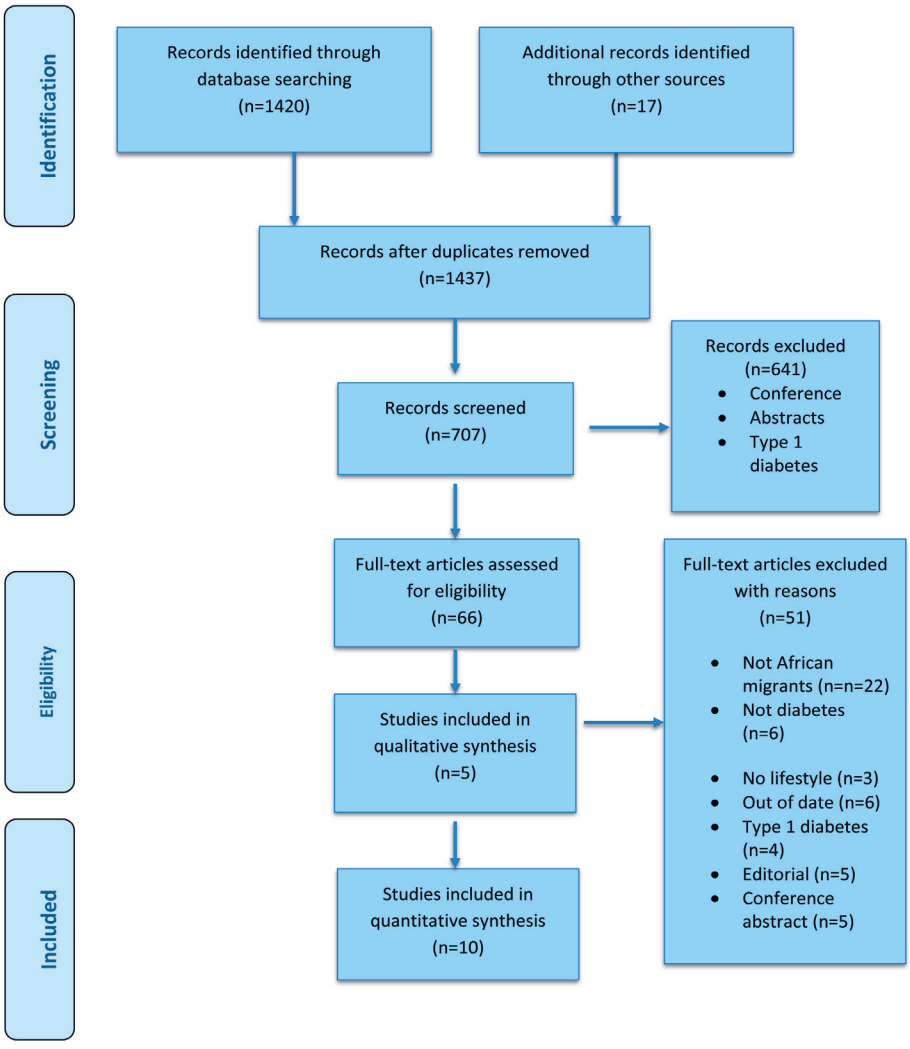

Figure 1. PRISMA flow chart diagram of study selection process in the review.

Study characteristics

The ten quantitative studies included in this review were all cross-sectional studies. Sample size ranged from 359 to 34,345 with 127,273 total participants from all ten studies. All studies recruited participants aged 18 years and above. All the studies involved both male and female participants. Twelve studies were conducted in Europe with nine quantitative studies (*36*, *39*-*46*) and three qualitative studies (*47*-*49*). Three studies were conducted in American with quantitative study (*50*) and two qualitative (*51*, *52*) studies. Characteristics and key findings of each study are presented in Table 4.

Heterogeneity of black population

The heterogeneity of black population globally has necessitated the need for definition of specific groups of people in the black population. This is because of the sensitivity of findings from healthcare research requires focus on the specific group of blacks recruited in studies which may not be valuable if different groups of blacks are grouped as one. Therefore, there is a need to define subset groups within the black population. black population are defined as the groups of individuals with dark-skin and used for racial classification (*53*). black African which is a specific group in black population is used to describe individuals that originate from Sub-Saharan African countries. African Caribbean is used to refer to individuals that originated from Caribbean countries such as Jamaica, Trinidad and Tobago. Finally, African American refers to individuals that are citizen of America. Although the ancestral linage of African Caribbean and African American originates from Sub-Saharan African countries, the influence of slave trade has caused their movement to continents outside Africa.

Using phenotypic, racial classification for these groups will result in classification as one group. However, classifying using ethnicity will result in at least the three major groups described above. This is mainly because classifying using ethnicity goes beyond phenotypic characteristics to include characteristics such as language, diet, religion, geography (*53*). The importance of specific classifications in this review is due to the aim of the review. It is therefore essential to differentiate the black African immigrant population as the population of interest from other subset groups of black population (*54*).The interest in black Africans is because this group is the smaller than African Caribbean and African-American and is underrepresented in healthcare research.

In the search of studies for this review, it was noted that majority of the articles retrieved recruited African Americans in the USA and African Caribbean in the UK. To meet the aim of this review, studies that only recruit African American or African Caribbean were excluded. Studies have to recruit black African immigrants to be included in this review for analysis.

Diabetes prevalence

Diabetes prevalence was one of the results reported among studies reviewed. This was reported by four studies included in this review (*36*, *40*, *42*, *46*). Diabetes prevalence was reported to be higher among black Africans and South Asians than the white population in all four studies. The lowest prevalence was reported among white population, followed by black African population and highest prevalence was reported among South Asian population in all studies. Diabetes prevalence was 1.3-4 times higher in black Africans than white group. The highest prevalence was recorded among South Asians; diabetes was reported to be at least 2.2-7.3 times higher than white population. See Table 5 for diabetes prevalence reported in studies reviewed.

Haemoglobin A1c (HbA1c)

Three papers (*37*, *43*, *46*) reported mean HbA1c differences among all three ethnic groups. All studies reported higher mean HbA1c among black Africans and South Asians than the white population. Although differences were not statistically significant, black Africans had highest mean HbA1c values.

In addition to the mean HbA1c, control HbA1c was reported among eight studies reviewed (*39*-*44*, *50*). The control target differ among the studies with some studies using target of HbA1c < 7.0% (*39*-*41*, *43*, *50*), while James et al. (*44*) used HbA1c < 7.5% target and Fosse-Edorh et al. (*42*) used HbA1c < 8% target, Ballotari et al. (*36*) reported percentage of participants with HbA1c > 9%. Most studies reported higher percentage of white population meeting HbA1c target than black African and South Asian populations (*36*, *40*-*44*, *50*). In comparison among black African immigrants in different European cities, Biljholt et al. (*36*) reported a higher percentage of HbA1c target met among Ghanaian immigrants in Amsterdam, Berlin while lower percentage was reported in London. Interestingly, the percentage of HbA1c control target was similar in rural Ghana as compared to immigrants in Amsterdam and Berlin while the lowest percentage to meet target was reported in urban Ghana. Table 6 presents detailed HbA1c outcome measures reported.

Table 5. Diabetes prevalence reported in reviewed studies

DIABETES PREVALENCE (%)			
Authors	Black Africans	South Asians	White group
Ballotari et al. 2015 (*36*)	Male: 4.3 Female: 6.5 Black-Caribbean Male: 3.2 Female: 4.3	Male: 10.2 Female: 9.7	Male: 5.5 Female: 3.6
James et al. 2012 (*44*)		NR	
Dreyer et al. 2009 (*46*)	8	11	3.5
Snijder et al. 2017 (*40*)	Male: 14.9 Female: 9.6	Male: 21.5 Female: 12.2	Male: 5.0 Female: 2.4
Fosse-Edorh et al. 2014 (*42*)	Male: 12 Female: 17	NR	Male: 8.6 Female: 6.5
Weiland et al. 2012 (*50*)		NR	
Bijlholt et al. 2018 (*39*)		NR	
Choukem et al. 2014 (*43*)		NR	
Abubakari et al. 2013 (*37*)		NR	
Verma et al. 2010 (*41*)		NR	

NR – not reported

Table 6. HbA1c outcome measures

AUTHORS	HBA1C OUTCOME MEASURE	BLACK AFRICANS	SOUTH ASIANS	WHITE GROUP
Ballotari et al. 2015 (*36*)	HbA1c > 9% (%)	Male: 27.8 Female: 37.5 Caribbean Male: 50.0 Female: 28.6	Male: 29.8 Female: 42.3	Male: 12.0 Female: 12.6
James et al. 2012 (*44*)	≤ 7.5%	49%	45%	52%
Dreyer et al. 2009 (*46*)	Mean	8.1%	8.0%	7.6%
Fosse-Edorh et al. 2014 (*42*)	≤ 8%	30%	NR	15%
Weiland et al. 2012 (*50*)	≤ 7%	40.7%	NR	53.9%
Biljholt et al. 2018 (*39*)	≤ 7%	Amsterdam 73.3% Berlin 72.9% London 66.7% Urban Ghana 56.3% Rural Ghana 37.3%	NR NR NR NR NR	NR
Choukem et al. 2014 (*43*)	Mean	Cameroonian 9.9% African immigrants 8.6%	NR	8.1%
Abubakari et al. 2013 (*37*)	Mean	8.33% African Caribbean 8.15%	NR	8.04%
	Percentage with HbA1c > 7% (%)	59 African Caribbean 64		57
Snijder et al. 2017 (*40*)	Percentage with HbA1c ≤ 7% (%)	Male: 45.6 Female: 54.0	Male: 38.5 Female: 38.2	Male: 67.4 Female: 47.1
Verma et al. 2010 (*41*)	1997	33.6	34.1	32.5
	2006	77.7	75.5	77.3
	≤ 7.0% (%)1997	3.9	4.1	0
	≤ 7.0% (%) 2006	39.0	35.7	40.6

HbA1c – haemoglobin A1C, NR – not reported

Blood pressure

Blood pressure measure was reported by five of the studies reviewed (*41*-*43*, *46*, *50*). Blood pressure measure was reported to be higher among black Africans than white and South Asian groups. Similarly, the percentage that met blood pressure target was lowest among black Af-

ricans than white and South Asia populations. Although blood pressure target was not significantly different among all ethnic groups in four studies, one study reported a significant difference. Choukem et al. (*43*) reported a similar percentage of participants with hypertension among Cameroonian and Caucasians respectively, while significantly lower percentage was reported among Cameroonian immigrants (See Table 7 for detailed blood pressure outcome measures reported).

Table 7. Blood pressure outcome measures

AUTHORS	BLOOD PRESSURE (MMHG) OUTCOME MEASURE	BLACK AFRICANS	SOUTH ASIANS	WHITE GROUP
Ballotari et al. 2015 (*36*)		NR		
James et al. 2012 (*41*)		NR		
Dreyer et al. 2009 (*46*)	Mean (mmHg)	135.4/ 78.3	129.1/ 76.0	133.1/ 76.0
Fosse-Edorh et al. 2014 (*42*)	Self-reported Hypertension	57%	NR	60%
Weiland et al. 2012 (*50*)	≤130/80 mmHg (%)	51.9%	NR	52%
Biljholt et al. 2018 (*39*)		NR		
Choukem et al. 2014 (*43*)	Hypertension (%)	Cameroonian 72 African immigrant 52		70
	Mean Systolic Bp (mmHg)	Cameroonian 144 African immigrant 128	NR	130
	Mean Diastolic Bp (mmHg)	Cameroonian 86 African immigrant 75	NR	72
Abubakari et al. 2013 (*37*)		NR		
Snijder et al. 2017 (*40*)		NR		
Verma et al. 2010 (*41*)	(%) 1997	57.4	50.7	59.2
	(%) 2006	89.0	89.0	89.3
	≤140/80 mmHg 1997	15.7	29.2	28.2
	≤140/80 mmHg 2006	34.3	45.0	43.5

Bp – blood pressure, NR – not reported

Cholesterol

Total cholesterol measure was reported by six studies reviewed (*41*-*44*, *46*, *50*). Although different cholesterol targets were used in these studies, black Africans were slightly lower in cholesterol target percentage than white and South Asian populations. However, one study reported mean total cholesterol to be lower among Cameroonian immigrants than white groups (*43*). South Asians had the lowest cholesterol level among all ethnic groups. In general, cholesterol measure was not significantly different among all groups. Table 8 presents cholesterol outcome measures as reported in studies reviewed.

Body Mass Index (BMI)

BMI was reported by four studies in this review (*39*, *40*, *43*, *44*). Three out of the four studies reported lower mean BMI among black Africans than white population (*39*, *43*, *44*). Bijlholt et al. (*39*) reported lowest BMI among participants in rural Ghana and urban Ghana as compared to immigrants in European sites. Among immigrants in European sites, BMI was similar in Amsterdam and Berlin while highest BMI was reported in London. Choukem et al. (*43*) reported similar BMI value among Cameroonian and Cameroon immigrants with the highest BMI reported among Caucasian.

Similarly, James et al. (*44*) reported lower BMI among immigrants than the white population. Lowest mean BMI was reported among South Asia, followed by black population while highest BMI was reported among white group. However, Snidjer et al. (*40*) was the only study that reported lowest mean BMI among white participants while Ghanaian immigrants were reported to have mean BMI higher than white group. Table 9 presents detailed measure outcomes among quantitative articles reviewed.

Table 8. Cholesterol outcome measures

AUTHORS	CHOLESTEROL OUTCOME MEASURE	BLACK AFRICANS	SOUTH ASIANS	WHITE GROUP
Ballotari et al. 2015 (*36*)	NR			
James et al. 2012 (*41*)	Total (Mean)	4.4	4.1	4.3
Dreyer et al. 2009 (*46*)	Total (Mean)	4.4	4.2	4.3
Fosse-Edorh et al. 2014 (*42*)	Self-reported hypercholesterolemia (%)	57%		56%
Weiland et al. 2012 (*50*)	LDL ≤ 100mg/dL (%)	53.1		61.3%
Biljholt et al. 2018 (*39*)	NR			
Choukem et al. 2014 (*43*)	Total cholesterol (mg/dL)	Cameroonians 202 African immigrants 185		194
	HDL cholesterol	Cameroonians 40 African immigrants 50		50
	LDL cholesterol	Cameroonians 130 African immigrants 119		116
Abubakari et al. 2013 (*37*)	NR			
Snijder et al. 2017 (*40*)	NR			
Verma et al. 2010 (*41*)	Total (%) 1997	11.6	20.1	13.3
	Total (%) 2006	80.0	77.2	82.0
	≤ 5.0 mmol/L (%) 1997	38.9	43.2	31.3
	≤ 5.0 mmol/L (%) 2006	71.9	79.2	72.6

LDL – low-density lipoprotein, HDL – high-density lipoprotein, NR – not reported

Table 9. BMI outcome measures

AUTHORS	BMI	BLACK AFRICANS	SOUTH ASIANS	WHITE GROUP
Ballotari et al. 2015 (*36*)		NR		
James et al. 2012 (*41*)	Mean BMI	30.8	27.8	33.3
Dreyer et al. 2009 (*46*)		NR		
Fosse-Edorh et al. 2014 (*42*)		NR		
Weiland et al. 2012 (*50*)		NR		
Biljholt et al. 2018 (*39*)	Mean BMI (kg/m^2)	Amsterdam 29.7 Berlin 29.2 London 30.8 Urban Ghana 27.1 Rural Ghana 23.9	NR	NR
Choukem et al. 2014 (*43*)	Mean BMI	Cameroonian 27.9 African immigrant 27.4	NR	30
	BMI ≥ 25 kg/m^2 (%)	Cameroonian 74.0 African immigrant 68.4		81.4
	BMI ≥ 30 kg/m^2 (%)	Cameroonian 32.0 African immigrant 24.5		44.2
Abubakari et al. 2013 (*37*)	Mean BMI	31.35	31.43	33.44
Snijder et al. 2017 (*40*)	Mean BMI	Male: 26.7 Female: 29.6	Male: 25.8 Female: 26.7	Male: 25.2 Female: 24.4
Verma et al. 2010 (*41*)		NR		

BMI – body mass index, NR – not reported

Qualitative findings

Five qualitative articles were included in this review (*47*, *48*, *51*, *52*). These articles focus on explaining some factors that may contribute to the management of diabetes among immigrant population. Some of these factors help to explain the findings of diabetes management from the quantitative articles reviewed.

Delayed diagnosis

Studies reviewed reported how diabetes diagnosis is delayed among participants. Many individuals were reported to know about their diabetes status after visiting hospital for when other health issues. Kahn et al. (*51*) reported that participants finding out about having di-

abetes when in emergency units for other health conditions. Many of the participants were diagnosed with diabetes only after noticing symptoms that made them require me require medication. This was reported to contribute to the management among these individuals, mainly as the late diagnosis can contribute to diabetes complications.

Emotions at being diagnosed

Emotions at being diagnosed with diabetes were reported to influence the management of diabetes (*51*, *52*). Participants were reported to be surprised at being diagnosed as it was not expected. Emotions such as denial, anger, acceptance and depression are some of the feelings participants were reported to go through after diagnosis. These emotions have different ways of contributing to the management of diabetes. Denial, anger and depression can be a barrier to proper management of their diabetes as recommended by healthcare professionals.

Knowledge of cause of diabetes

Many of the participants were reported to have limited knowledge about diabetes as a disease condition (*51*, *52*). Kandarara et al. (*52*) reported how participants explain not to have adequate knowledge about diabetes before diagnosed with the condition. As a result of limited knowledge prior to diagnosis, their management process has been affected. They reported having to learn everything about the condition after diagnosis which makes following management recommendation difficult.

Barriers to management

Some factors were reported as barriers to optimal management of diabetes in studies reviewed. Dietary struggle was a factor that was reported by participants as a barrier to their management of diabetes. Another barrier was unfamiliar diets recommended by healthcare professionals in managing diabetes (*47*, *52*). Difficulty in healthy cooking and cultural influence in dietary habits were also reported as barriers to management (*47*, *51*, *52*). Long hours of working due to the high cost of living were reported to hinder the management of their condition (*51*). Bramberg et al. (*49*) used observational method for data collection reported the lack of individualised care by healthcare professionals as barrier to diabetes management. The observational study of diabetes appointment between diabetes nurse and patients reported how patients' concerns on diabetes management were not properly addressed due to the lack of individualised care for these patients.

Facilitators to management

Studies also reported some factors that enhance better management of their diabetes (*48*, *52*). This was reported by participants to help in managing their diabetes. Social support and having consistent routines or everyday practices to follow in managing diabetes was reported to enhance their diabetes management (*48*, *52*). Having culturally tailored recommended dietary plans was reported to facilitate diabetes management among participants (*47*). There are important implications of the findings from this review that requires further discussions.

DISCUSSION

This review was conducted to explore management outcomes differences among black Africans, South Asians and white population. This review found poorer diabetes management outcomes among black Africans as compared to South Asia and white population. Diabetes prevalence was higher among black Africans than the white population in all studies reviewed. In addition, diabetes management outcomes like HbA1c, blood pressure and cholesterol level were slightly higher among black Africans than other groups. Blood glucose level using HbA1c outcome was slightly higher among black Africans while white population had the lowest measure.

Black African participants in all studies were less likely to meet blood pressure target than white and South Asian populations except for one study where immigrants had lower blood pressure than Caucasians (*43*). It is worthy to note that these studies use different targets for all outcomes measured which might influence their findings. Studies conducted in the UK used stricter target measures of 130/80mmHg than the 140/90mmHg used in studies conducted in the USA. It is important to note that recently, blood pressure classification for hypertension have been moved from 140/90mmHg to 130/80mmHg which will make more than 46% of American hypertensive (*55*). New studies after this review may use the stricter target than studies in this review which may affect their findings.

In general, black Africans were reported to be least likely to meet all three outcome targets, although lower BMI was reported in three of the four studies that reported BMI measure. This review shows diabetes management disparity among ethnic minority groups when compared to white population; this disparity is particularly pronounced among black Africans. Similar findings have been reported in reviews (*56*, *57*). Agyemang et al. (*58*) showed that blood pressure increase among African Caribbean population with increasing age exceeding other ethnic groups like white population.

Lower likelihood of meeting all HbA1c, blood pressure and cholesterol levels have been reported to increase the risk of developing diabetes complications (*59*).

Another interesting finding is the differences in immigrant management on different European sites as reported in the review. London was a site that reported significantly lower management outcomes among other European sites although higher education percentage was reported among African immigrants from this site. This shows that there is poorer management outcome among immigrants, vary with country residence. It is therefore important to look into environmental influence on diabetes management.

Looking into diabetes management, some explanations for poorer management among black Africans were reported among the qualitative studies reviewed. These include the late diagnosis of diabetes, dietary struggles, and lack of individualised care. These factors are important in contributing to the adequate management of diabetes as they relate to lifestyle factors in the management of diabetes (*60*). Lifestyle factors have been shown to greatly influence the successful management of diabetes (*61*). This is particularly as diabetes management is importantly a self-management condition (*72*). Another explanation for the poorer management among black Africans might be due to lower awareness about diabetes. Lower awareness has been reported among this group concerning diabetes (*62*). Many of whom do not know their diabetes status and limited knowledge about diabetes as a condition was reported in the qualitative studies reviewed.

From the studies conducted in the UK in this review, only two studies reported separate diabetes management among black African and African Caribbean (*36*, *37*). This highlights the need to study these groups separately rather than combining all African groups as one homogeneous group. It has already been recommended to explore cardiovascular disease risk factors and health behaviours by country of emigration (*63*). This is of particular importance as it was not possible to know the percentage of black Africans and African Caribbean, which makes up "blacks" as reported in some studies. This makes interpreting the findings from these studies to each group difficult. In terms of the black populations, it is known that African Caribbean has a higher population and higher integration into the UK society due to the long years of stay than black Africans making them less represented in health research (*22*). However, black Africans are among the fastest growing ethnic groups in the UK (*64*, *65*). This should be reflected in studies that are conducted among "blacks".

The variation in study methodology, measurement method, outcome target measures and the combination of black African and African Caribbean populations in some study should be put into consideration when interpreting the findings of this review. Standardizing the target measures for diabetes management outcome will be valuable to future research. In addition, there is a need for meta-analysis among African Caribbean and black African due to

the difference among these groups. Better exploration of diabetes outcome among African immigrants in various locations in Europe is needed to understanding diabetes management as differences noted in this review. More research needed among black Africans residence outside London as this was the study location used in most studies conducted in the UK.

Limitations

Since the early 2000s, several reviews have been conducted to explore health differences among ethnic minority groups in western countries (*23*-*25*). However, no review has focused on comparison of health outcomes among ethnic groups living with diabetes with particular focus on black Africans. This therefore presents the findings of the review to be unique and relevant in terms of diabetes management among ethnic groups. However, several limitations were noted in conducting this review.

Limitations of this review include the small number of studies that were reviewed as relevant to the study aim. This reflected the limited literature available for comparison of diabetes management outcomes among black African, South Asian and white populations. Studies varied in terms of the research goal with only four studies having the primary goal of diabetes management outcome as primary aim of the studies (*36*, *41*, *43*, *44*). This in effect can influence the findings of this review as this highlights the lack of comparison studies among these three population groups.

In this review several decisions were made that might have affected the retrieval of studies that were included in the review. One of such decisions is the year of publication criteria that was used to retrieve only articles published after 2006. This was done to ensure that articles that have current information are included in the review. In addition, only peer review articles were included to reduce retrieval of low quality articles. Finally, only articles published in English were included in the review; this might have the effect of excluding relevant articles written in other languages. However, this was managed by ensuring that all articles were searched and relevant articles retrieved before exclusion based on language limiters. Abstracts of articles that have potential to be included in the review were translated before decision to include or exclude. However, none of the articles written in other languages was found to be relevant for inclusion in this review.

CONCLUSION

Diabetes prevalence is higher among black Africans than the white population. In addition, poorer management outcomes was observed among this population compared to both white and South Asian populations as noted in the reported biomedical outcomes (HbA1c, blood pressure, cholesterol). This disparity in diabetes management needs to be addressed to narrow the inequality gap among ethnic groups. Due to different targets used in the studies review, it was not possible to perform a meta-analysis. Standardised target measure is needed in future research to better use findings from studies. In terms of black group, there is need to for future research to recognise the different subsets of black population to allow findings tailored to a particular group in this population.

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