Acculturation and Perceived Ethnic Discrimination as Potential Etiological Factors for Type 2 Diabetes among sub-Saharan African Immigrants in Australia

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Declaration by Author

This thesis contains no material that has been extracted in whole or in part from a thesis that I have submitted towards the award of any other degree or diploma in any other tertiary institution.

No other person's work has been used without due acknowledgment in the main text of the thesis.

All research procedures reported in the thesis received the approval of the relevant Ethics/Safety Committees (where required).

Sign:

_____

Paul Izaru Bilal

1st April 2020

Dedication

This work is dedicated to my parents, Mr Constantino Dangala Baru Bilal and Mrs Lasto Juwa Draikoa Bilal, for creating in me a passion for knowledge. Having no formal education did not stop them from understanding its value, and they encouraged me to take it seriously. I consider this piece of work a product of their effort.

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LIST OF ACRONYMS

ABS:	Australian Bureau of Statistics
APS:	Australian Psychological Society
BMI:	Body Mass Index
CALD:	Culturally and Linguistically Diverse
DAS:	Depression, Anxiety and Stress
DIAC:	Department of Immigration and Citizenship
EBGL:	Elevated Blood Glucose Level (BGL ≥ 6.1 to BGL ≤ 6.99mmol/l)
FBGL:	Fasting Blood Glucose Level
FFQ:	Food Frequency Questionnaire
GDM:	Gestational Diabetes Mellitus
HDI:	Human Development Index
NCD:	Non-Communicable Disease
OECD:	Organization for Economic Cooperation and Development
PA:	Physical Activity
PED:	Perceived Ethnic Discrimination
SD:	Severe Depression
SA:	Severe Anxiety
SS:	Severe Stress
SPSS:	Statistical Package for Social Science
T2DM:	Type two Diabetes Mellitus (BGL ≥ 7.0 mmol/l)
WHO:	World Health Organization

ABSTRACT

Background

Acculturation and perceived ethnic discrimination (PED) are established risk factors for elevated blood glucose level or type 2 diabetes mellitus (EBGL or T2DM). These factors are known to affect health of immigrants in various ways, including dietary transition, psychological, sociocultural and economic status change. Although numerous studies on acculturation and PED have been conducted among immigrants worldwide, few studies have been reported for sub-Saharan African migrants across the world.

Aim and objectives:

This study aims to determine the potential mechanisms by which acculturation and PED influence EBGL or T2DM and psychological health risk factors such as depression, anxiety and stress among sub-Saharan Africans in north-eastern Australia (Darwin and Brisbane). Specific objectives include the assessment of EBGL or T2DM, PED, depression, anxiety, stress (DAS), overweight and obesity prevalence, the distribution of acculturation modes and sociodemographic characteristics in the sample population; determination of EBGL or T2DM, PED, depression, anxiety and stress prevalence by sociodemographic characteristics and finally, the assessment of the associations between independent variables (acculturation, PED, depression, anxiety, stress, dietary factors, high BMI) and the dependent variable (EBGL or T2DM).

Methodology

A cross-sectional design and a purposive sampling method were used to recruit participants. A questionnaire was developed by the modification of validated acculturation scales, PED questionnaire, physical activity (PA) questionnaire, DAS

scale and food frequency questionnaire (FFQ). Face-to-face interviews with 170 adults (≥ 18 years old) sub-Saharan African migrants from 18 African countries were conducted. Fasting blood glucose levels (FBGL) of the participants were measured during the interviews.

Results

The results show that the prevalence of EBGL (High risk BGL) or T2DM (Diabetic BGL) was 17.6% (2.9% or 14.7%) in the sample population. This prevalence is higher than the recent Australian-wide prevalence (5.1%) and 41.8% of the sample population are in the integrated mode of acculturation, with 14.7% reporting a high level of PED. No previous data from Australia exists to compare these findings, since this study is the first of its kind in Australia. Of those who reported PED, 22.5% were in the integrated mode of acculturation. Similarly, 29.6% of those with EBGL or T2DM were in the integrated mode of acculturation. This is consistent with a previous finding that highly acculturated migrants are more likely to have EBGL or T2DM. Severe anxiety was higher (28.8%) than severe depression (18.8%) and stress (5.3%) in the sample population. The prevalence rates for anxiety and depression in the present study are higher than in the overall population of Australia, and they are higher in males than females. Overweight and obesity prevalence are 43.5% and 24.1%, respectively with more females (34.1%) than males (14.8%) in the obesity category, but more males (45.5%) than females (41.5%) in the overweight category. This is consistent with previous studies in sub-Saharan Africans, where females are more likely to be obese than males. According to literature, the condition was attributable to some African tradition that favours big body size for females as prestigious for the family. It is seen as a sign of fertility and success and wealth in a family. Forty-one-point two percent of the sample population had low income, and

those with high income status were more likely to have EBGL or T2DM, compared to low or medium-income groups. Those who migrated to Australia on skilled migration visas were more likely to report PED and have severe depression (SD) and EBGL or T2DM than those who migrated on humanitarian, student and family/spouse visa type. They are also more likely to have higher income than those in other migration visa types. This result contradicts findings of previous studies where socioeconomic status correlated inversely with EBGL or T2DM. Nearly two thirds (62.2%) of the sample population was employed, 88.8% educated. The majority (74.8%) of those that were educated were employed, while 84.2% of the uneducated were unemployed. Relative risk analysis indicates that participants who were employed were 20 times more likely to report discrimination than those that were unemployed, and participants who were educated and employed were 18 times more likely to report discrimination than those that were uneducated and employed. This is consistent with previous findings where ethnic discrimination is reported to occur in workplaces and highly educated migrants indicate being discriminated against more than less-educated migrants. There was no statistically significant association between socioeconomic status and SA or severe stress (SS). Neither was there a statistically significant association between overweight, obesity, central adiposity and EBGL or T2DM. The lack of a significant correlation between BMI, central adiposity and EBGL or T2DM is contrary to previous findings. Most previous studies that examine the relationship between BMI and EBGL or T2DM find a positive association between them. Inverse and statistically significant associations between the consumption of sweets and snacks, fast food, processed meat and EBGL or T2DM were observed. Further analysis reveals that those who were aware of their EBGL or T2DM status had low consumption rates of sweets and snacks, fast food and processed meat. This gave the

assumption that perhaps those who were aware of their EBGL or T2DM status had received some instructions on what to eat to manage their diabetic conditions. Australian vegetables were consumed more than the traditional African vegetables in the sample population. This implies that dietary acculturation is taking effect in the population. Correlation and multiple regression analysis show that an integrated and traditional mode of acculturation is significantly associated with EBGL or T2DM. The traditional mode was inversely associated while an integrated mode was positively associated. Strong associations were observed between PED, SD and EBGL or T2DM, reflecting a mediation effect between PED and SD in the association between acculturation and EBGL or T2DM, because when the relation was tested for mediation, the strength of the association between acculturation and EBGL or T2DM reduced, while that of PED remained strong, indicating that PED acts as mediator to acculturation in the association between acculturation and EBGL or T2DM.

Conclusion

The prevalence of EBGL or T2DM in this study is higher than the current Australian prevalence and acculturation and PED are risk factors for EBGL or T2DM in the sub-Saharan African immigrant population in north-eastern Australia. Education and employment are risk factors for PED and EBGL or T2DM, and the association between acculturation and EBGL or T2DM is partially mediated by both PED and SD. Generally, the overall results of this study are unique in comparison to previous similar studies in other migrant groups in OECD countries. Therefore, more confirmatory studies are required to develop a targeted health promotion strategy for community and workplace settings, if sub-Saharan Africans are to positively acculturate in Australia.

1 CHAPTER ONE: OVERVIEW OF THE RESEARCH

This chapter outlines the structure, introduction and background of this research program based on identified gaps in the literature related to the associations between acculturation, PED and EBGL or T2DM. The chapter also describes the theoretical framework of the research presenting acculturation and PED as baseline factors for various psychological and sociocultural changes that lead to T2DM and the associated morbidities. It concludes by listing the objectives and hypotheses of the research.

1.1 Structure of the thesis

This thesis has five chapters. Chapter One presents the overview of the research; Chapter Two contains the literature review; Chapter Three outlines the methodology; Chapter Four presents the results and preliminary discussion; and Chapter Five presents the general discussions and conclusion. The thesis examines the relationships between acculturation, PED, depression, anxiety, stress and EBGL or T2DM in sub-Saharan African immigrants in north-eastern Australia. To achieve this, several variables related to acculturation are examined, including dietary factors, BMI and sociodemographic characteristics of the sample population. Chapter Four which describes the results of the research, presents descriptive and inferential statistics taking into consideration five main aspects of the analysis. Firstly, the relationships of acculturation, PED and EBGL or T2DM. The analysis assesses the mediation impact of PED in the association between acculturation and EBGL or T2DM. Secondly, the analysis presents the relationships of sociodemographic characteristics and EBGL or T2DM. This analysis aims to examine the association between EBGL or T2DM and

sociodemographic characteristics in the sample population, to understand how age, sex and types of immigration visa may contribute to the process of acculturation and the prevalence of EBGL or T2DM. Thirdly, the analysis considers the relationship between depression, PED and EBGL or T2DM. The interaction between depression and PED and their collective impact on EBGL or T2DM risk is assessed. The analysis intends to assess whether the association between PED and EBGL or T2DM is partially influenced by SD. Fourthly, the analysis examines the relationship of socioeconomic status with PED to determine whether education and employment status predict PED among sub-Saharan African migrants in Australia as they resettle. The final section of the analysis takes into consideration whether an awareness of the EBGL or T2DM status is associated with dietary behaviour among the participants. The analysis assesses the association between dietary factors and high risk BGL or diabetic BGL in the sample population.

1.2 Introduction and background of the research

Evidence has shown that acculturation plays a role in changing migrants' behaviours across their lifespan (Mesoudi, 2018). Most of these studies record changes in eating habits and social lifestyle, which gave rise to multiple non-communicable diseases (NCD) (Pérez-Escamilla, 2011; Pérez-Escamilla & Putnik, 2007; Venkatesh, Conner, Song, Olson, & Weatherspoon, 2017). Acculturation is a well-known risk factor for the incidence and prevalence of T2DM and many studies find that there is a positive association (Kandula et al., 2008; Zheng et al., 2012). However, there are conflicting findings from previous studies on how acculturation contributes to T2DM. Some studies report lower acculturation as a risk factor for T2DM, while the majority of studies find the opposite (Deng, Zhang, & Chan, 2013; Mainous et al., 2006; Montesi,

Caletti, & Marchesini, 2016a). PED and internalised racism are also known risk factors for EBGL or T2DM and other psychological health issues (Tull & Chambers, 2001; Ikram et al., 2016; Tonsing, Tse, & Tonsing, 2016; Whitaker et al., 2017).

Although there is overwhelming evidence of acculturation and PED having an impact on T2DM, as shown in previous studies among other migrant communities across the world (Wagner, Tennen, Feinn, & Osborn, 2015; Zheng et al., 2012), no study that assesses the relationship of acculturation, PED and T2DM has been conducted among sub-Saharan African immigrants in Australia or elsewhere. In general, most studies relating acculturation and PED to T2DM have mostly been conducted among immigrants from Latin America, Asians in the USA, and some countries in Europe, but other migrant groups, especially those from Africa, have not received such attention in OECD countries (Ikram et al., 2016; Tonsing et al., 2016). Therefore, this thesis is designed to assess the potential contribution of acculturation and PED to the prevalence of EBGL or T2DM among sub-Saharan African immigrants in Australia (Ikram et al., 2016; Tonsing et al., 2016).

Sub-Saharan African migrants enter Australia via four main types of visas: Humanitarian/Refugee, Skilled, Student and Family/Spouse and they speak their native languages as their first language. In Australia, they are classified as a culturally and linguistically diverse (CALD) community (Rao, Warburton, & Bartlett, 2006) and categorised as a vulnerable population (Australian Bureau of Statistics [ABS], 2015). Some of these people, especially those who migrated through humanitarian/refugee visas have had serious traumatic experiences before entering Australia, and many still suffer mental health issues related to their past experiences in their countries of origin

(Lindencrona, Ekblad, & Hauff, 2008; Shawyer, Enticott, Block, Cheng, & Meadows, 2017). Previous studies have shown that migrants across the world undergo various difficulties, such as language barriers and social environmental change, resulting in reduced employment opportunities and dietary transition as they resettle in the new country (Goulão, Santos, & do Carmo, 2015; Renzaho & Burns, 2006). Therefore, sub-Saharan Africans may undergo similar processes as they acculturate in Australian society.

It is a known fact that all types of migration (voluntary or forced) have negative impacts on the immigrants in many ways including rapid weight increase and prevalence of NCD (Renzaho, Bilal, & Marks, 2014). The resettlement process of migrants, which usually involves adaptation to social and physical environmental changes (acculturation), is important in determining the wellbeing of the immigrants because the acculturation process is influenced by many factors such as diet and social behavioural changes (Hattar-Pollara & Meleis, 1995; Sanou et al., 2014; Goulão, Santos, & do Carmo, 2015). PED is one of the factors in the process of acculturation that impacts on the health of migrants. Studies have shown that both acculturation and PED are linked risk factors for multiple NCDs (Ikram et al., 2017, 2016; Tonsing et al., 2016). The positive associations of acculturation and PED with various NCDs vary according to length of stay in the host country (first or second generation of the immigrants) or levels of acculturation (Bernstein, Park, Shin, Cho, & Park, 2011; Pérez-Escamilla & Putnik, 2007).

1.3 Definitions

1.3.1 Diabetes

Diabetes mellitus is a disease whereby the body may not produce sufficient insulin or it responds to insulin poorly, resulting in elevated levels of glucose in the blood (American Diabetes Association, 2018). This disease is categorised into four main types: (1) type 1 diabetes is an outcome of automatic destruction of b-cells, giving rise to insulin deficiency; (2) T2DM is a result of a continuous loss of b-cells thus reducing the secretion of insulin, (3) gestational diabetes mellitus (GDM) is a disorder usually identified in the second or third trimester of pregnancy in the absence of overt diabetes prior to gestation and finally (4), specific types of diabetes due to other causes (American Diabetes Association, 2018).

1.3.2 Acculturation

The earliest published conceptualisation of acculturation comes from Redfield, Linton, and Herskovits (1936) who define it as a cultural behaviour exhibited when two different cultures come into continuous contact (as cited in Lakey, 2003). Later, Sam and Barry (2010a) differentiate between acculturation as communal (group-level) and individual (psychological). This distinction is important because it allows examination of the relationships between the categories (groups and individuals), and because not all individuals within a group experience the same process of acculturation (Brown & Zagefka, 2011; Oppedal, Roysamb, & Heyerdahl, 2005).

Originally, acculturation was viewed as a unidirectional process (Parks & Miller, 1921). This concept received criticism because it became synonymous with

assimilation (Flannery, Reise, & Yu, 2001). Therefore, the bidirectional model of acculturation emerged. Under both models, psychological acculturation is defined as a process of adapting to a new culture (Graves, 1967). The unidirectional model describes only one outcome, that acculturation is a gradual removal of old cultural attributes and replacement by the new culture of the mainstream population (Graves, 1967). The bidirectional model of acculturation, on the other hand, describes acculturation in terms of two cultural orientations: one refers to a person's relation to home culture and the other refers to a person's relation to host culture (Smokowski, Bacallao, & Evans, 2017). Acculturation has subsequently been described as a quadrilateral process comprising of traditional, integrated, marginalised and assimilated (Berry, Trimble, & Olmedo, 1986; Sam & Berry, 2010b; Schwartz, Unger, Zamboanga, & Szapocznik, 2010; Smokowski et al., 2017). When these four modes are used to describe the acculturation process in sub-Saharan Africans in Australia for example; the traditional mode of acculturation could mean that the sub-Saharan Africans in Australia may choose to retain their African heritage without attempting to adopt the behaviour of the host community in social aspects such as arts and music or in dietary habit change. They continue to socialise and perform social activities mostly with people of their traditional cultural heritage. The integrated mode of acculturation would mean that sub-Saharan Africans may choose to retain their African heritage as well as embrace Australian heritage, thus becoming 'integrated'. The marginalised mode of acculturation would mean that they neither practice behaviour of the original heritage nor cultural attributes of the host community. In this situation, they may end up losing their heritage without seeking integration into mainstream society, thus, becoming 'marginalised' or 'invisible' with little sense of belonging to any culture. Finally, assimilation describes when sub-Saharan Africans

choose to give up their African heritage and totally embrace Australian heritage, thus becoming an 'assimilated' group (Berry et al., 1986; Pérez-Escamilla & Putnik, 2007).

1.3.3 Discrimination

The Collins English Dictionary definition of discrimination states that it is "treatment or consideration of, or making a distinction in favour of or against, a person or thing based on the group, class, or category to which that person or thing belongs" (Definition of discrimination, 2019). According to Victoria's Equal Opportunity Act (2010), 'discrimination' is an unfair or detrimental treatment of different categories of people, based on race, age, or sex. Discrimination can be classified as direct or indirect. Direct discrimination is, for example, when an employer refuses to train an employee to introduce new skills due to his/her age or the refusal of a rented lease based on ethnicity (Equal Opportunity Act). On the other hand, indirect discrimination could occur, for example, when a service provider imposes a condition to an individual who may be protected by law not to possess certain documents due to infirmity. For example, when a service agent insists that a person produce a driver's license when they know that this person has vision impairment and therefore does not possess a driver's license.

1.3.4 Depression

Depression is a psychological state of mind whereby an individual has feelings of severe despondency and dejection. Depressive symptoms and disorders are very frequent over a lifetime, especially in the middle-aged (García-Portilla, 2009). In Australia, there are five major types of depressions: major depressive disorder, major

depressive disorder with melancholia, psychotic depression, persistent depressive disorder and dysthymic disorder (Black Dog Institute, 2018). Of all the types, the most occurring in Australia is major depressive disorder (Black Dog Institute, 2018).

1.3.5 Anxiety

Anxiety is a feeling of worry, nervousness, or uneasiness about something with an uncertain outcome. “Anxiety disorders are the most common mental disorders, affecting one in four Australians at some stage in their life” (Health Direct, 2016). There are four main types of anxiety: generalised anxiety, social anxiety, specific phobias and panic disorder (Beyond Blue, 2019). All these types of anxiety disorder have debilitating impact on daily activity of the sufferer (Health Direct, 2016). This research mainly assesses the generalised and social anxieties, which have potential to associate with PED. Women are more likely to develop anxiety than men (Health Direct, 2016).

1.3.6 Stress

“Stress is mental or emotional strain or tension resulting from adverse or demanding circumstances” (Healthline, 2016). There are many causes of stress in life: it could be workload at workplace or behaviour of children at home. Stress is the way the body responds to protect itself. There are three main types of stress: acute, episodic acute and chronic stress. However, stress can be debilitating leading to illness. Chronic stress is when acute stress persists and continues to occur frequently. It could suppress the immune system, distraught digestion, upset reproductive systems and may increase the probability of heart attack and stroke (Healthline, 2016). According to the

Australian Psychological Society (APS), the well-being of the Australian population is deteriorating.

1.4 Rationale of the research

1.4.1 Rationale one

The need to understand the process of acculturation among sub-Saharan African migrants in Australia and how this might influence prevalence of EBGL or T2DM.

Despite strong evidence that acculturation is a risk factor for EBGL or T2DM among migrants, little is known of its impact on migrant health in Australia. Since the sub-Saharan African migrant population in Australia is a recent migrant group, it is plausible that little research on its health has been conducted (Hugo, 2009), justifying the limited knowledge on the health of sub-Saharan African migrants in Australia. This as such, makes development of appropriate public health policy for this emerging population group a challenging isssue for any level of Australian governments (Federal and State). Generally, the specific factors contributing to multiple NCDs including T2DM among this population have not been known. Numerous studies among migrants showing association between acculturation and EBGL or T2DM have been conducted in the USA (Kandula et al., 2008; Mainous et al., 2006; Zheng et al., 2012) and most of them reveal that the prevalence of EBGL or T2DM escalates with an increasing level of acculturation. Other studies indicate that lifestyle change during the process of acculturation is a major factor in the prevalence of T2DM (Afable-Munsuz, Gregorich, Markides, & Pérez-Stable, 2013; Colberg et al., 2010; Holmboe-Ottesen & Wandel, 2012). Therefore, with an increasing trend of T2DM in the sub-Saharan African population in Australian (Renzaho et al., 2014), the

investigation of acculturation impact on the prevalence of T2DM in sub-Saharan African migrant population in Australia is important and an impetus for this study.

1.4.2 Rationale two

There is a need to understand the prevalence of PED among sub-Saharan African immigrants and how this relates to the prevalence of EBGL or T2DM in the sub-Saharan African migrant.

Generally, the prevalence of PED and T2DM among sub-Saharan African migrants in Australia has not been clearly established. Furthermore, there has been no study done that relates both acculturation and PED to NCDs conducted among other migrant groups in Australia. One study that assesses dietary transition, weight increase and prevalence of NCDs in one of the sub-Saharan African migrant communities in Australia reveals that there is a rapid weight increase and prevalence of multiple NCDs (Renzaho et al., 2014), including T2DM. Despite the putative role of PED and acculturation in T2DM risk, these factors have not been assessed individually or in combination as influencing T2DM risk in this population. Therefore, it was necessary to undertake this study in the sub-Saharan population in Australia.

1.4.3 Rationale three

The need to understand the interaction between acculturation and PED as a potential driving factor for the psychological instability and other health risks in sub-Saharan African migrants.

Evidence has shown that acculturation for both voluntary and forced migrants is usually associated with depression, anxiety and stress connected to social and political relegation of immigrants and refugees (Butler, Warfa, Khatib, & Bhui, 2015; Henkin

et al., 2011; Kuo, 2014). Resettlement in a new setting is a difficult phenomenon for an unfamiliar person to adapt to. Multiple things confront the newcomer such as new cultural values, financial constraints and a new physical and linguistic environment. This acculturative process can have profound effects on the migrants resulting in physical and emotional adaptation to a new social and physical environment (Butler et al., 2015; Henkin et al., 2011). Studies show that the assimilation mode of acculturation inversely correlates with depression. Traditional and integrated acculturation modes also are inversely correlated with depression, although not statistically significant (Gupta, Leong, Valentine, & Canada, 2013). A separate study finds a lower risk of depression, and co-morbidities in host compared to migrant populations (Ünlü Ince et al., 2014). Similar studies among Mexican and Korean immigrants in the US indicates that there are higher levels of depression among immigrants compared to the host population (Gonzalez, Haan, & Hinton, 2001; Oh, Koeske, & Sales, 2002). Therefore, it is plausible that sub-Saharan African immigrants may experience similar processes as they acculturate in Australia.

1.5 Overall mitigating evidence for the study

Generally, considering the evidence from previous studies, it is apparent that acculturation and PED can influence a BMI increase among migrants through dietary transition and physical inactivity (Choukem et al., 2014; Novotny, Williams, Vinoya, Oshiro, & Vogt, 2009). High BMI and low physical activity are important T2DM risk factors (Alidu & Grunfeld, 2018; Gorman, Novoa, & Kimbro, 2016; Lesser, Gasevic, & Lear, 2014; Goulão et al., 2015). Though a high BMI is a known T2DM risk factor, some studies have shown that migrants with lower BMIs are more likely to have undetected EBGL compared to those born in the host country with a higher BMI

(Mainous et al., 2006). This indicates that other factors related to the acculturation process impact on the prevalence of EBGL or T2DM, independent of the BMI among the immigrant population as they acculturate into the host population culture. Thus, the rapid weight increases together with unknown acculturation factors impacting on EBGL or T2DM among the sub-Saharan African population in Australia may imply that sub-Saharan African migrants in Australia are at risk of multiple body weight associated NCDs such as T2DM.

Most studies on associations of acculturation with EBGL or T2DM and PED with EBGL/T2DM were conducted independently of each other in different samples and populations (Kaholokula, Nacapoy, Grandinetti, & Chang, 2008; Kandula et al., 2008; Pérez-Escamilla & Putnik, 2007; Williams & Mohammed, 2009). Therefore, the present study is designed to collect data on both acculturation and PED in a single population to assess associations of both factors in a single data set. In addition, most previous studies were conducted among Latinos and Mexican migrants in the US with sub-Saharan African migrants in OECD countries receiving less attention. Other studies that involve African migrants have been mostly among North African migrants in Europe. Studies on racial discrimination have mainly been conducted among African American populations in the US. The most recent studies among sub-Saharan African migrants in the US are those conducted by Onuoha-Obilor (2017) and Okafor, Carter-Pokras, & Zhan (2014), which focus on acculturation and its relationship with general health outcomes and dietary transition without assessing discrimination as a contributing factor for health outcomes. Given the trend of T2DM and other NCDs among sub-Saharan African migrants in Australia (Renzaho et al., 2014), examination of the associations between BMI, acculturation, PED and EBGL

or T2DM is warranted towards addressing future T2DM issues in sub-Saharan African immigrants in Australia. It is on this basis that the present study has been conceived and undertaken.

1.6 Conceptual framework

The conceptual framework has been developed to explain the theoretical assumption that acculturation and PED are influencing factors in the prevalence of NCDs including T2DM risk (see Figure 1). This process starts with the arrival of the migrants in the host country and continues as they acculturate in the host community.

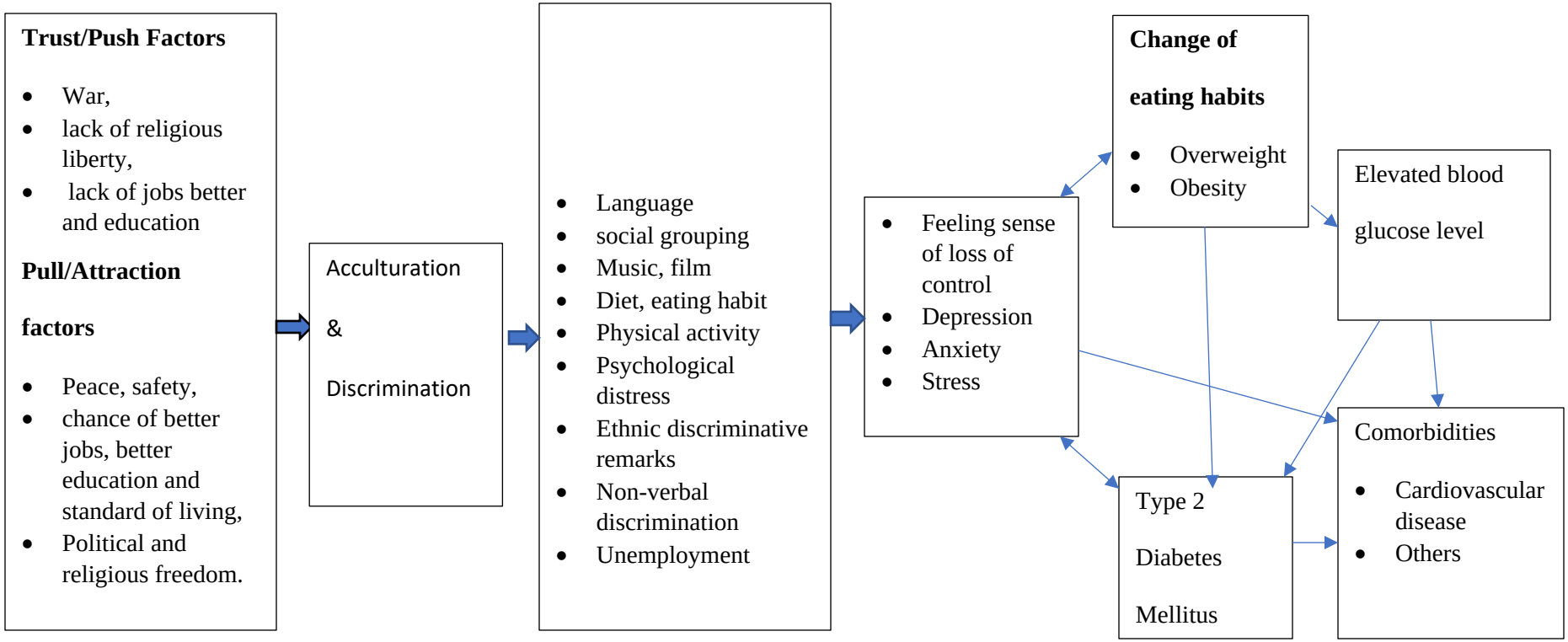

Figure 1. Conceptual framework indicating the potential impact of acculturation and perceived ethnic discrimination on type 2 diabetes among sub-Saharan African immigrants in north-eastern Australia (Queensland and Northern Territory

In general, migration, individual or collective, is influenced by two factors: thrust (push) or attraction (pull). The 'pull factors' comprise desirable attributes in the country of destination that attract individuals to migrate to a definite destination and these attributes include better standards of living, education and prospects of better employment (European Commission, 2000; Parkins, 2010). The second group of influencing factors are the 'push' factors, comprising situations forcing people to leave their home country of origin for another location. These factors are usually war, religious and political oppression, climatic variations and/or lack of jobs (Parkins, 2010; Reuveny, 2007). After migration, both groups must adapt to the new physical and sociocultural environment in the host community. This process is referred to as acculturation. Broadly, "acculturation is a psychological and behavioural change in individuals or groups that undergo long-term contact with another culture, or a process by which individuals adapt to a new living environment and potentially adopt the norms, values, and practices of their new host society" (Abraído-Lanza, Armbrister, Flórez, & Aguirre, 2006; Liebkind, 1996).

In the acculturation process, changes must occur at individual or group levels. The changes occur gradually and may take four forms of behavioural change: assimilation, integration, traditional (remaining unchanged) or marginalised (not portraying either of the two cultures) as they interact with the host society (Sam & Berry, 2010b; Schwartz et al., 2010; Smokowski et al., 2017). This process involves learning the host community's language, taking part in the sociocultural activities with the host community and adopting various social norms, music, arts and films, diets, eating habits and physical activity or inactivity. This process can result in psychological instability, such as depression, anxiety

and stress, leading to physical distress induced by a feeling of loss of control over one's traditional culture (Oppedal, Røysamb, & Sam, 2004). PED occurs concurrently with the acculturation process. PED is a perception of an individual that s/he has been treated unfairly due to his/her ethnicity. This perception may not necessarily imply that an act of discrimination has taken place in an interaction or event but may be a perception of the individual. Such a feeling may result in psychological instability, thus impacting on the affected individual's health.

Sub-Saharan Africans are already facing multiple barriers as they try to resettle in Australia (McCann, Mugavin, Renzaho, & Lubman, 2016). Therefore, the situation is exacerbated as they try to adopt to both physical and social environments of the host community. The potential prevalence of PED is believed to result in severe depression, anxiety and stress (Knauss, Günther, Belardi, Morley, & von Lersner, 2015), which may contribute to physical and psychological distress, leading to negative eating behaviour that results in overweight, obesity, EBGL or T2DM and associated morbidities (Björntorp, 2001, 2009; Luppino et al., 2010). Therefore, the theoretical concept of this study is that the combination of both acculturation and PED may influence the prevalence of EBGL or T2DM and other associated morbidities among sub-Saharan African migrants in north-eastern Australia (Brisbane and Darwin).

1.7 Purpose of the study

Based on this study's rationale and theoretical framework, the impact of acculturation and PED as potential risk factors for the prevalence of EBGL or T2DM, depression,

anxiety and stress in the sub-Saharan African migrants' population in north-eastern Australia is assessed. The aim of the study is to determine the potential mechanisms by which acculturation and PED influence EBGL or T2DM and psychological health risk among sub-Saharan Africans in north-eastern Australia (Northern Territory and Queensland, respectively) under the following specific objectives

1. To assess prevalence of EBGL or T2DM, PED, depression, anxiety stress, overweight and obesity and the distribution of acculturation, sociodemographic in the sample population.
2. To determine the prevalence of EBGL or T2DM, PED, depression and anxiety by sociodemographic characteristics.

3. To assess the associations of all the independent variables (dietary factors, acculturation, PED, depression, anxiety and high BMI) with the dependent variable (EBGL or T2DM).

1.8 Null hypotheses

1 There is no association between dietary factors, BMI and EBGL or T2DM.

2 There is no association between acculturation, PED, depression, anxiety, stress and EBGL or T2DM.

3 There is no difference in the prevalence of EBGL or T2DM, PED, depression and anxiety by sociodemographic characteristics status (type of immigration visa, age, sex, income, education and employment).

1.9 Study area and demography

Data was collected from sub-Saharan African migrants living in the cities of Darwin, Northern Territory and Brisbane, Queensland. Darwin is the capital city of the Northern Territory, located at the northern coast of Australia. Brisbane is the capital city of Queensland and the third largest city in Australia. At the time of data collection, no specific data on the sub-Saharan African population was found for both Darwin and Brisbane in the ABS. However, data from the African Australian Council of the Northern Territory and the Queensland African Community Council indicates that there is an estimated population of 570 and 2,500 sub-Saharan Africans in Darwin and Brisbane, respectively, at the time of this research. Thus, the population of sub-Saharan Africans living in Brisbane and Darwin by the time of the research was 3,070 people of which 170 (5.5%) participated in the study. In these two cities there were some suburbs where sub-Saharan African migrants were found in greater numbers. In Brisbane, these suburbs include Moorooka (see Figure 2), Redbank plains (see Figure 3) and Woodridge (see Figure 4). In Darwin, the sub-Saharan African community mainly resides in Palmerston (see Figure 5).

Figure 2. Map showing Brisbane City Council 2008 ward boundaries with arrow (modification) indicating the location of Moorooka, a centre where data for the study was collected. Retrieved from Brisbane City Council website.

Figure 3. Map showing Redbank Plains where some participants of the research were interviewed. Retrieved from *Google Maps*.

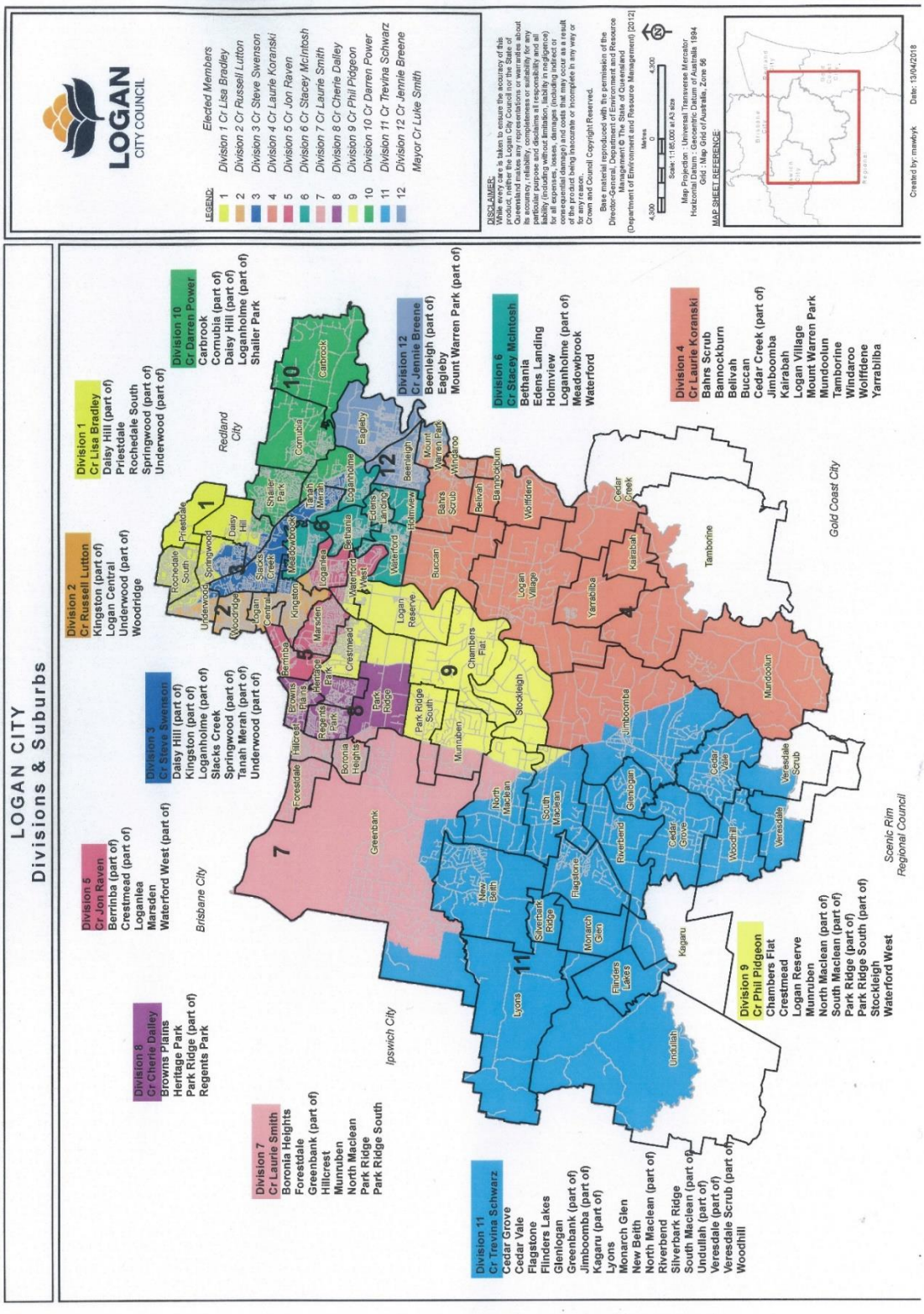

Figure 4. Map showing Logan City Council with Woodridge (Division 2) where data for the research was collected. Copyright holder *Logan City Council*.

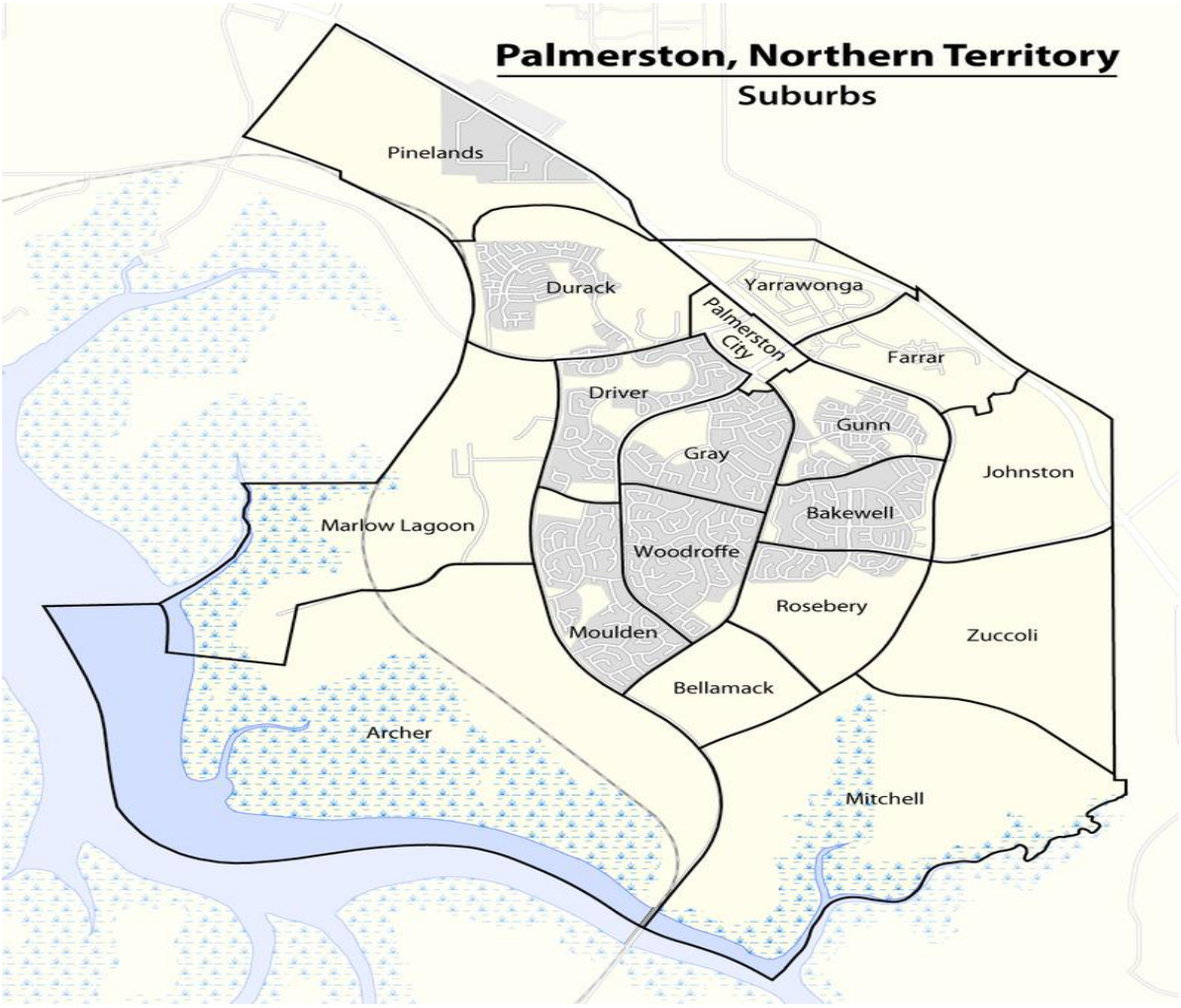

Figure 5. Map showing Palmerston where data for the research was collected. Retrieved from *Google Maps*.

1.9.1 The background of the study population

The population of sub-Saharan Africans who participated in this study migrated to Australia through various immigration visa types. According to the Australian Department of Immigration and Citizenship, there are several types of visa to enter Australia, but this study considers four types which most participants of the study used to enter Australia (Department of Home Affairs, 2019a).

1.9.2 Refugee and humanitarian visas

People who qualify for this visa type may be outside or inside their own country and being persecuted due to political, or any security, risk. The process for entry involves; health and character assessment, as well as signing a document outlining Australian values (Department of Home Affairs, 2019c). The health check is conducted to determine the health status of the applicant for the safety of the Australian public health system and to determine financial constraints that may result if the potential immigrant is unhealthy. The character check is meant to include the background of the migrant such as his/her criminal records or the kind of occupation s/he has in his/her own country before departure. The signing of the Australian value statement is meant to be an agreement between the migrant and the Australian government that when the applicant enters Australia, s/he will uphold Australian values.

There are two main types of processing for these visa types: offshore and onshore. The offshore process requires the applicant to be outside Australia, s/he should meet the United Nations' definition of refugee and must be persecuted in his/her own country. There are four categories in this processing. The first is *'Refugee subclass 200'*. This is when the person is referred to the Australian government by the United

Nations High Commission for Refugees (UNHCR); the second is *In-Country Special Humanitarian (subclass 201)* for people still living in their own country who are unable to leave; third is *'Emergency Rescue (subclass 203)'* for those who are under an eminent threat or danger, and the last one is '*Women at Risk'* (*subclass 204*)' for women who do not have the protection of a partner and are in danger of being victimised (Department of Home Affairs, 2019d). Most sub-Saharan African migrants who are now in Australia came here under the visa classification 200 and were living in refugee camps such as Kakuma in Kenya and many camps in Guinea where Liberia and Sierra Leone refugees came from. However, some members of this group did not stay in the refugee camps, but in cities of the countries where their migration processes were carried out, although they were registered by the UNHCR as refugees in the respective countries where their entry visas were processed.

Typically, the life of the refugees in the camps was not a comfortable one. Therefore, these people might have undergone various physical and psychological torture even before they left their countries for the camps outside their countries of origin. Even though they are now in a relatively stable, social and secure environment, the destructive psychological effects of war still haunt them (Getnet, Medhin, & Alem, 2019; Silove, Ventevogel, & Rees, 2017). This group consists of people of various socioeconomic status, implying that they may differ in mode of acculturation and perception of ethnic discrimination (Brown & Zagefka, 2011; Verkuyten, 2016).

1.9.3 Student visas

There are various types of visa entry to Australia for study purposes. Each of the visa types has its unique conditions. Some visas are issued for three months only. The

present research considers only those who enter to study for a period not less than three years in Australia. This requirement is consistent with the selection criteria for the study (that is, a participant should have lived at least two years in Australia by the time of the data collection).

1.9.4 Skilled migration visas

This visa type is intended for skilled persons who enter Australia to resettle and work. It is mostly processed by the Australian Visa Bureau which is an independent organisation based in the United Kingdom that is affiliated with the Australian government. There are six main requirements for obtaining a skilled migration visa: age, English language, nomination of occupation, skill, health and character assessments. All those who participated in this study migrated to Australia through the official process of the Department of Immigration.

1.9.5 Spouse or family visas

Those who enter Australia through this visa type are proposed to enter by their spouse or family members who are already in Australia and either holds Australian citizenship or permanent residency or another eligible type of visa. These people might have entered Australia temporally or permanently (Department of Home Affairs, 2019b).

2 CHAPTER TWO: LITERATURE REVIEW

This chapter details evidence of the association of acculturation, PED, DAS and EBGL or T2DM as observed in previous studies and identifies gaps in the previous studies specific to sub-Saharan African migrants globally. No research linking acculturation and PED to the prevalence of EBGL or T2DM was found for sub-Saharan African migrants anywhere in the world, thus, the present study has been proposed and conducted on this premise.

2.1 Migration

Human migration is defined as crossing of the boundary from one country to another for a predefined destination by one or more persons resulting in a change of residence (Kok, 1999). According to Castles, de Haas, and Miller (2013), migration is not a simple decision that an individual can easily take. Migration involves a process of resettlement, which is often a long drawn-out process that continues for the rest of an immigrant's life and may affect subsequent generations (Castles, Haas, & Miller, 2013). There are two main reasons for migration: 'thrust' and 'attraction' factors. The 'thrust factors' are negative conditions, which force people to move (Parkins, 2010) and these include wars, religious marginalisation and lack of jobs. 'Attraction factors' are those in a target country, which encourage people to move. These include peace, safety, improved employment opportunities, better education, social security, a higher standard of living, political stability and religious freedom (Parkins, 2010).

Globally, much human mobility occurs among OECD countries. Citizens from one OECD country move to another, however, migration links between developing and

OECD countries are important and growing (Gubert & Nordman, 2009). According to *International Migration Report 2017*, internationally migration increased by 4% between 2015 and 2017 (Department of Economic and Social Affairs, 2017).

2.1.1 Sub-Saharan African migration to OECD countries

Sub-Saharan Africa is a complicated part of the world to understand due to its contradictory nature. It is potentially rich in natural resources, but they are not effectively exploited to benefit the population. As a result the region is one of the poorest parts of the world (Adepoju, 2008). Adepoju (2008) classifies sub-Saharan Africa as a region known for its rampant civil wars and political instability that has given rise to a lack of progress since independence from colonial powers. These conditions in the region are fuelled by many issues that include: rapid population growth, unstable politics, ethnic conflict and persistent economic decline (Adepoju, 2008; Barrios & Bertinelli, 2006; Marchiori, Maystadt, & Schumacher, 2012). These have contributed to the migration of sub-Saharan Africans (Adepoju, 2008; de Brauw, Mueller, & Lee, 2014). Although migration by sub-Saharan Africans to OECD countries remains smaller when compared to other parts of the world, nonetheless, it is increasing and the economic impact it imposes on OECD countries is a recognised dynamic (Capps, McCabe, & Fix, 2011).

The USA, Canada and Australia seem to attract highly educated sub-Saharan African migrants compared to those migrating to Europe and the United Kingdom (Capps et al., 2011). Migrants in US are in employment more than migrants in other OECD countries. Over 70% of migrants in US are estimated to be in employment (Capps et al., 2011). Female sub-Saharan African migrants are actively engaged in the labour

force more than women from other immigrant groups, especially migrants from Muslim countries, excluding Egypt (Capps et al., 2011). This signifies that they are an active part of economic growth in the host countries where they are settled.

Sub-Saharan African migrant populations in OECD typically comprise a highly educated group. Most migrated in search of employment, although some were forced to migrate by wars and political instability (Minter, 2011). Most (33.1%) of sub-Saharan Africans who migrated to OECD countries in 2009 have advanced education. In general, African migrants in OECD countries are different from migrants from other parts of the world since most of them have higher tertiary qualifications (Minter, 2011). The whole world average for highly-educated migrants in OECD countries is 3.7%, but an average of 9.1% for the African continent, and 12.2% for sub-Saharan Africa (Minter, 2011).

2.1.2 General African migrants in Australia

The Australian population consists of many migrant population groups. According to the ABS, in the 2011 Census, there were 5.3 million Australians born overseas. This constitutes 26 percent of the Australian population, that is, one out of four Australians are born overseas.

According to the ABS, 248,699 Africans living in Australia in 2006 were born overseas. This constitute 5.6% of the population born overseas. The majority (72.6%) were from Southern and East Africa, while 22.9% from North Africa and 4.5% from the Central and West Africa region. South Africa comprises the majority (41.9%) of

the total population (ABS, 2016). The distributions for other African countries are shown in Table 1 with data from ABS (2008).

Table 1

Country of birth, three main regions of Africa, resident in Australia, 2006

Southern and East Africa	**no.**	**North Africa**	**no.**	**Central and West Africa**	**no.**
South Africa	104 133	Egypt	33 496	Ghana	2 769
Zimbabwe	20 155	Sudan	19 049	Nigeria	2 500
Mauritius	18 173	Libya	1 518	Sierra Leone	1 809
Kenya	9 935	Morocco	1 293	Liberia	1 523
Ethiopia	5 634	Algeria	1 004	Congo, Democratic Republic of	618
Somalia	4 314	Tunisia	444	Congo	521
Zambia	4 078	Other	72	Guinea	335
Seychelles	2 508	**Total**	**56 876**	Côte d'Ivoire	255
Tanzania	2 300			Senegal	199
Eritrea	2 015			Gambia	130
Uganda	1 712			Cameroon	125
Botswana	865			Other	465
Burundi	753			**Total**	**11 249**
Namibia	703				
Malawi	685				
Mozambique	632				
Angola	396				
Swaziland	233				
Rwanda	202				
Madagascar	188				
Réunion	126				
Other	834				
Total	**180 574**				

2.1.3 Sub-Saharan African migrants in Australia

The black African influx to Australia is relatively recent. Historically, the Australian policy for immigration was to control it following the Federation of Australia in 1901. The Australian government policy did not encourage migration of non-Europeans to Australia (Hugo, 2009; New South Wales Migration Heritage Centre, 2010). It was not until non-discriminatory approaches to immigration received strong public support in the 1970s that Africans began to arrive in Australia. Before 1976, intake was primarily South African white (Hugo, 2009). It was after 1976, when major political parties of Australia adopted non-racial approaches to immigration laws that non-white immigrants from Africa begin to enter Australia to settle, but on condition that those who were non-white, had to be educated and culturally Westernised and be ready to adopt to Australian modernity (Hugo, 2009). This liberality further developed gradually to the opening of immigration opportunities culminating in allocating humanitarian places to those internally displaced and refugees from Africa (Hugo, 2009).

The most recent sub-Saharan African migrants entered Australia through refugee and humanitarian entrance visas between 2005 and 2011; see Table 2). Table 3 shows the general African population in Australia, and that most of the people are skilled migrants and are occupying professional or managerial jobs, except for people who migrated recently and were driven by wars from places such as Sierra Leone, Liberia, Sudan, Eritrea and Somalia.

Table 2

Offshore humanitarian visa grants for sub-Saharan African by countries of birth from 2005-06 to 2010-1

Country	**2005-06**	**%**	**2006-07**	**%**	**2007-08**	**%**	**2008-09**	**%**	**2009-10**	**%**	**2010-11**	**%**
Sudan	3,726	50	2,276	40	1,158	38	631	34	298	22	243	30
Ethiopia	478	6	392	7	381	12		0		0		0
Democratic Republic of Congo	363	5	670	12	348	11	463	25	584	42	565	70
Somalia	456	6	317	6	190	6		0		0		0
Liberia	888	12	608	11	410	13	387	21	258	19		0
Sierra Leone	460	6	460	8	267	9	363	20	237	17		0
Burundi	740	10	703	12	303	10		0		0		0
Eritrea	274	4	253	4		0		0		0		0
Total	**7,385**	100	**5,679**	100	**3,057**	100	**1,844**	100	**1,377**	100	**808**	100

Note. Adopted from: DIAC population flow; 2005-2005; 2006-2007; 2007-2008; 2008-2009; 2009-2010. Chapter: Humanitarian program; DIAC. Fact sheet 60, Australia's refugees and humanitarian and Humanitarian Program; Humanitarian Program figures http://www.immi.gov.au/media/facandibctsheets/60refugee.htm

Table 3

Country of birth by occupational group ranked by percentage of managers and professionals

Place of birth	All identify occupation	% of Professional or managerial	% of Labourers
Uganda	975	59	3
Tanzania	1265	56	7
Nigeria	1634	53	9
Malawi	448	52	7
South Africa	63900	51	5
Zambia	3003	51	9
Congo	161	50	11
Kenya	5659	50	7
Namibia	432	50	8
Zimbabwe	13413	46	7
Southern & Eastern Africa	389	42	6
Other sub-Saharan Africa	1051	40	12
Burundi	86	37	37
Ghana	1635	36	13
Democratic Republic of Congo	246	34	14
Botswana	288	32	30
Angola	267	28	18
Sudan	3566	21	30
Eritrea	840	20	26
Somalia	967	19	16
Sierra Leone	716	17	29
Liberia	457	14	39

Note. From ABS cross tabulations made available by DIAC: missing data covers those not in workforce (female caregivers, children and retirees) or not given. These are current occupations and do not reflect occupations in country of origin.

2.1.4 Migration and health risk

In the world today, human migration is necessitated by factors such as wars, socio-political and economic instability. These movements usually have human rights and health significances. In most cases, migrants do not receive adequate healthcare services owing to some barriers such as discrimination, language as well as legal

status and some socioeconomic difficulties (Carballo & Nerukar, 2001; World Health Organization [WHO], 2013; WHO Regional Office for Europe, 2017). In some cases immigration policies can have momentous public health implications such as depression, anxiety, and post-traumatic stress disorder (Hacker, Anies, Folb, & Zallman, 2015; Kristiansen, Mygind, & Krasnik, 2007; Marceca, 2017; Martinez et al., 2015). Migrants also face occupational health risks due to inequality in employment that are influenced by various factors including racial discrimination (Orrenius & Zavodny, 2012). Most migrant employment is high risk, which usually exposes them to occupational health hazards (Orrenius & Zavodny, 2012). Recent research in numerous progressive economies indicates that immigrants usually occupy riskier positions than their host counterparts in the host countries where they settle. This has been demonstrated by the fact that immigrants have higher rates of work-related injuries and mortalities than the host community in most progressive economies (Orrenius & Zavodny, 2012).

Despite the aforementioned evidence, health issues among migrants are under reported owing to the difficulties of engaging migrants in any surveys as a result of negative experiences that they might have had in the past with official institutions (such as national security personnel who may pose as investigators) in their home countries, or when they first arrive in the host country without credible travel documents as well as other barriers such as language (Gabriel, Kaczorowski, & Berry, 2017; Hacker et al., 2015). The small amount of available data shows greater morbidity among migrants, especially relating to mental health including, depression, posttraumatic stress-disorder, psychosomatic complaints, anxiety and certain chronic diseases including diabetes, as well as infectious diseases such as tuberculosis and

hepatitis B (Kirmayer et al., 2011; Priebe, Giacco, & El-Nagib, 2017; Wagner et al., 2014).

These prevalence data however, are not consistent, some studies show that the morbidity patterns among migrants are not different from the host population, while others indicate a lower prevalence of certain diseases among migrants compared to the mainstream populations in the recipient countries (Syed et al., 2006; WHO, 2010). However, most studies show that migrants are markedly healthier than the host population at the time of their arrival and after a few years of residence in the host country (Gimeno-Feliu et al., 2015; Razum & Wenner, 2016; Syse, Strand, Naess, Steingímsdóottir, & Kumar, 2016). There's significant available data that indicates that morbidity patterns increase among immigrants over time, especially in the area of nutrition-related chronic diseases (Butler, Warfa, Khatib, & Bhui, 2015; Gimeno-Feliu et al., 2015; Wagner et al., 2014). Morbidities are lower among migrants than among the host population when they first arrive, but this gradually changes and rises to approach rates equal to that found among the mainstream population. In this process, morbidity resulting from infectious diseases common in their home countries (country of origin) and mental health issues associated with migration and resettlement usually, decreases and may be eliminated as the duration of their time in the destination country lengthens (Butler et al., 2015; Gimeno-Feliu et al., 2015; Wagner et al., 2014). A study conducted among Ghanaians in their homeland and as migrants in Europe shows that there is a difference in NCDs between Ghanaians in Ghana and those who live as immigrants in Europe. Those in Europe were found to have higher rates of cardiovascular and other NCDs due to a gradual change of exposure to various risk factors compared to their counterparts who remained in

Ghana (Boateng et al., 2017). A similar study in Singapore finds that second-generation Asian Indian migrants in Singapore are more likely to have a higher prevalence of T2DM than first generation migrants (Zheng et al., 2012).

2.1.5 Migration and risk of type 2 diabetes

Diabetes is an important health threat to immigrants in the world (Liang, Qu, Qu, & Jin, 2012; Montesi, Caletti, & Marchesini, 2016). Many factors including moving away from close relatives and friends does impact negatively, psychosocially, and physiologically. This mental and physical health condition could be sometimes triggered by fear of facing re-settlement in an unknown physical and social environment. These factors lead to migrants experiencing multiple NCDs, including T2DM (Chen & Choi, 2011; Shooter, 2008).

Evidence shows that migration and resettlement processes are associated with higher weights (overweight and obesity) and T2DM (Shah et al., 2017), and this may differ according to ethnicity (Spanakis & Golden, 2013; Zhang, Wang, & Huang, 2009). A study by Candib (2007) finds that migrants from South Asia, the Middle East, Africa, Latin America, the Caribbean and Indigenous people who present serious overweight or obesity problems have diabetes, hypertension, metabolic-disorder or dyslipidaemia(Candib, 2007)(Candib, 2007)(Candib, 2007)(Candib, 2007)(Candib, 2007) (Candib, 2007). The migration of Tokelauans from a traditional atoll in the Pacific to urban New Zealand was associated with an increased prevalence and incidence of T2D over the period of 1968-1982 (Stbye, Welby, Prior, Salmond, & Stokes, 1989). Studies conducted amongst Greeks and Italians in Australia, found that the prevalence and the cumulative incidence of T2DM were more than three times

higher in migrants born in Greece and Italy than those born in Australia (Hodge, English, O'Dea, & Giles, 2004).

2.1.6 Summary

Migration therefore has profound health risks as people resettle in a new country. The impact of migration, as shown in the preceding literature information, is not only on the host country's health services, but also on its entire economy. Therefore, effective evidence-based planning is required if health issues associated with migration are to be resolved. In Australia, information on chronic disease morbidity among the sub-Saharan African community is scanty and this study provides useful baseline data in the process of building comprehensive evidence on various morbidities in the sub-Saharan migrant population.

2.2 The global burden of diabetes

Diabetes is rapidly increasing globally in incidence, prevalence and mortality (WHO, 2016). According to the World Health Report, in 2014, "422 million people in the world had diabetes, a prevalence of 8.5% among the adult population" (WHO, 2016, p. 6). This occurrence has progressively been increasing over the last 30 years and has been rising more quickly in low and middle-income countries. Related risk factors, such as a high body mass index, are also increasing (WHO, 2016). In 2016, WHO reports that one and half million deaths worldwide happened directly from diabetes in 2012. It was among the first ten diseases that caused death in both sexes in that year (WHO, 2016). Diabetes prevalence is projected to reach 4.4% in 2030, from 2.8% in 2000. It has been projected that by 2030, 366 million people will have diabetes, a rise from 171 million in 2000. This is a significant rise of about 114% (Wild, Roglic,

Green, Sicree, & King, 2004).

2.3 Prevalence of T2DM in Australia

In Australia, the prevalence of diabetes is increasing, together with rising rates of overweight and obesity, and it is projected to affect two million Australians by 2025 (Magliano et al., 2009). A report by the ABS (2015b) indicates that the prevalence was 5.1% in 2014-15, an increase from 4.5% in 2011-12. Looking at the statistics describing the Australian population, sub-Saharan Africans in Australia are at high risk of T2DM as they acculturate.

2.4 Prevalence of T2DM in sub-Saharan Africa

The word ‘diabetes’ is only recent in African medical terminology. With advancing globalisation, the prevalence of diabetes is growing in Africa (Azevedo & Alla, 2008). This rapid growth in sub-Saharan Africa is mainly driven by urbanisation that comes with dietary transition from traditional foods in the rural areas to processed foods in the urban areas (Mbanya, Motala, Sobngwi, Assah, & Enoru, 2010). Estimates from 2009 by the International Diabetes Federation suggest that diabetes rates in sub-Saharan Africa will increase by 98%, from 12·1 million in 2010 to 23·9 million in 2030. This proportion is more than double the predicted global increase of 37% (Mbanya et al., 2010). Therefore, the rationale of this research has been developed with this literature information in mind.

2.5 Genetic pre-disposition to T2DM

T2DM is a disorder that involves manifold genes located on different chromosomes contributory to its predisposition (Ali, 2013; Radha & Mohan, 2007). These genetic

factors are known to contribute to the etiology of T2DM (Radha & Mohan, 2007). Numerous findings support the interpretation that genetic mechanisms play an important role in the development of T2DM (Keating, 2015; Lyssenko & Laakso, 2013; Talmud et al., 2010). Molecular biologists are faced with difficulties in the analysis of the genetic factors that determine T2DM since many environmental factors interact with genes to produce T2DM disorder. However, the evidence that still remains is that the prevalence of T2DM varies widely among populations (Radha, & Mohan, 2007). Variation also occurs within the same ethnic group living in a different environment. Those kinds of variations are considered to be non-genetic environmental factors (Radha & Mohan, 2007). However, an observation that shows the prevalence of disease differs greatly amid ethnic groups who share similar environment, supports the idea that genetic factors play a substantial part in predisposing some members of the population to the disease (Brück et al., 2016).

Franks, Uma-Jyothi, and Reddy (2015) report that "the genes of the common variety of T2DM also called polygenic or multifactorial is a result of the interaction between the environment and multiple genes". Samoch-Bonet and colleagues find this genetic interaction is associated with weight gain (Samocha-Bonet et al., 2010). Healthy people who are genetically predisposed to developing T2DM are more likely to gain weight than their non-genetically predisposed peers. As a result, they are susceptible to the development of greater insulin resistance (Samocha-Bonet et al., 2010). This phenomenon may help to explain their susceptibility to development of T2DM in an obesogenic environment of adverse effects of overfeeding. They also find that a family T2DM background does not only predispose obesity, but it can also be exacerbated by lack of physical fitness and reduced capacity of beta cells to

recompense for the increased insulin needs enforced by an increase in BMI (Samocha-Bonet et al., 2010). This implies that genetic predisposition could impact on T2DM in a population living under similar environment and social-economic conditions (Franks, 2011; Samocha-Bonet et al., 2010; Uma Jyothi & Reddy, 2015).

2.6 Association of SES, physical environment and T2DM

Prevalence of T2DM varies with SES within populations in the industrialised countries and it is associated with low SES, however, the results in developed countries conflict with that of developing countries (Suwannaphant, Laohasiriwong, Puttanapong, Saengsuwan, & Phajan, 2017; Wu, Meng, Wild, Gasevic, & Jackson, 2017; Xu, Yu, Yin, Zheng, & Li, 2017). Xu, et al. (2017), in their investigation of a relationship between SES and T2DM in systematic review find that T2DM prevalence is positively correlated with the national Human Development Index (HDI) in developing countries, and negatively correlated with HDI in developed countries. However, previously, Robbins, Vaccarino, Zhang, and Kasl (2001) find that there was no consistent association among men, even though there was a positive association between poverty income ratio and T2DM among women from African American and non-Hispanic White people. There was no direct association between SES and T2DM when they measured those factors of SES (that is, education, income, and occupation). They stratified the group into 4 strata; African American women, non-Hispanic white women, African American men, and white men. The results of the study that compared the prevalence of diabetes across high income, middle income and low-income countries shows that prevalence was higher among the low-income countries and lowest in the high-income countries (Dagenais et al., 2016).

Many reports of similar research in different populations show that low SES is associated with a higher rate of T2DM prevalence (Suwannaphant et al., 2017; Wu et al., 2017). This suggests that the occurrence is unlikely to be a chance or the result of confounding by some variable unpredictably associated with SES in a specific population. Some researchers argue that socioeconomic inequalities in health can be ascribed to many different mechanisms, such as unhealthy behaviours, insufficient access to healthcare, nutritional shortfalls and other inequalities in factual situations, and stress (Feinstein, 1993; Macintyre, 1997; Wilkinson & Pickett, 2006). Most of these occurrences are at least credible transitional risk factors for T2DM and since they occur mainly among people with low socioeconomic status, they could easily confound results in most studies that associate T2DM with low socioeconomic status (Connolly, Unwin, Sherriff, Bilous, & Kelly, 2000). But even the most recent study of a prospective cohort of female health professionals shows a progressive decrease in diabetes with increasing levels of education and income (Lee et al., 2011).

The most controversial research evidence indicates that living in an environment (neighbourhood) where the residences have lower socioeconomic status increases the risk of T2DM incidence even among higher income earners and better educated individuals (Krishnan, Cozier, Rosenberg, & Palmer, 2010; Lidfeldt, Li, Hu, Manson, & Kawachi, 2007). Krishnan et al (2007) find that both individual and neighbourhood socioeconomic status play a role in the development of diabetes in black women. Lower level of education and income and lower levels of neighbourhood socioeconomic status were associated with an increased risk of T2DM. Individuals with higher education levels and higher income are also found to have a similar incidence rate of T2DM (Krishnan, Cozier, Rosenberg, & Palmer, 2010). Since this

finding was also contrary to what most researchers' evidence has shown, the authors attribute this risk to the neighbourhood environment.

2.7 Acculturation

2.7.1 Role of Acculturation in nutrition and physical activity elsewhere

Acculturation plays an important role in the lifestyle of immigrants. Myriad behavioural characteristics would change in immigrants' lifestyle. These changes include nutrition and other attributes associated with their lifestyle, such as alcohol consumption and smoking. In a series of studies among Latinos and Indian immigrants in the US, researchers find that on arrival to the US, Latinos practice healthier behaviours than their mainstream population counterparts, but these behaviours change over time as they continue to associate and integrate into the mainstream lifestyle (Pérez-Escamilla, 2011; Pérez-Escamilla & Putnik, 2007; Venkatesh et al., 2017). Their altered lifestyle choices usually include poorer nutrition, more tobacco use, and substance abuse (Pérez-Escamilla, 2011; Pérez-Escamilla & Putnik, 2007). In Canada, a study among South Asian immigrants reports healthy eating as associated with higher acculturation, although insignificant members of the study population had poor dietary selection (Lesser et al., 2014). The study finds that there was an increase in the consumption of fruits and vegetables. Food preparation also improved (Lesser et al., 2014). Many adopted grilling and reduced deep frying when cooking. However, there was an insignificant report of increased consumption of sugar-sweetened beverages, red meat and eating out in restaurants (Lesser et al., 2014).

Previous studies report mixed results on the relationship between acculturation and physical activity. Some studies show inverse association between physical activity, while others indicate a positive association between physical activity and acculturation (Evenson, Sarmiento, & Ayala, 2004; Perez et al., 2017; Wolin, Colditz, Stoddard, Emmons, & Sorensen, 2006). Evenson et al. (2004) report that Latinos who had higher English language proficiency had a high probability of engaging in physical activity than those with lower English language proficiency. Similarly, those women who migrated to US when less than 25 years of age had greater probability of being physically active than women who migrated when 25 years or older. The length of residence in the US was not associated with physical activity. Whereas Perez et al. (2017) report the exact opposite among Latinos in another study. They find that a group of Latinos who had lived longer in the United States is inversely associated with transportation or occupational physical activity and it is meeting the recommended amount of physical activity hours per week. Those who were assimilated/bicultural have significantly less total physical activity and higher sedentary time than their lower acculturated counterparts. So, they conclude that higher acculturation is related to less activity.

2.7.2 Nutrition acculturation among immigrants in Australia

In Australia, migrants also tend to experience a shift in their traditional nutrition practices to the Australian way of eating as they adapt to the culture of mainstream Australian society. This change is often negative, and has been found to result in increased risk of obesity and its co-morbidities (Renzaho & Burns, 2006). Evidence has shown that many migrant communities from various countries are experiencing deterioration in their health due to decreased access to their traditional foods, adoption

to available foods in the Australian supermarket, and lifestyle in Australia (Anikeeva et al., 2010). As such they replace traditional healthier foods with those that are typically high fat and energy dense (for example, fast food and processed foods) which are easily accessible to them. This process leads to overweight and obesity (Williams & Harris, 2011). Renzaho & Burns (2006) find that although sub-Saharan migrants in Australia have food in abundance, they are more likely to experience food insecurity due to difficulties in locating familiar or traditional foods. They also have issues with taste and lack of knowledge of some Australian foods in the major supermarkets (Renzaho & Burns, 2006). As a result, they consume readily available foods such as cakes and doughnuts that exposes them to the risk of chronic diseases (Renzaho & Burns, 2006).

No acculturation study like those described among Latino migrants in the US has been conducted among sub-Saharan African migrants in Australia or elsewhere. Data are scanty, the only available reports available on people from Africa (not sub-Saharan) are of North African migrants in Europe. This study, therefore, is the first of its kind among sub-Saharan Africans and will form a benchmark for further research among sub-Saharan migrants across OECD countries.

2.7.3 Role of acculturation in overweight, obesity and type 2 diabetes

Studies have shown that weight increase is associated with acculturation (Pérez-Escamilla & Putnik, 2007; Renzaho et al., 2014). A study among the Mexican women who moved from Mexico to US showed that BMI and waist circumference was closely associated with degree of acculturation (Morales-Campos et al., 2010). The study finds that women with low BMI and waistline measurements were either middle

range English language proficiency or those who had immigrated to the US between the ages of 16-25 (Morales-Campos et al., 2010). Similar studies conducted among Filipinos and other Pacific Islanders reveal that BMI is associated with the level of acculturation and the length of stay in US (Novotny et al., 2009). The male Pacific Islanders, living longer in US, eating less fruit, but more meat and drinking more sweetened drinks were heavier than those who spent less time in US (Novotny et al., 2009). In England, Smith, Kelly, and Nazroo (2012) find that second generation Indian and Chinese immigrants are more likely to be obese than the first generation of migrants

It is a known fact that overweight and obesity are major risk factors for chronic health conditions, such as T2DM; coronary heart disease (CHD); hypertension; stroke; some forms of cancer, and osteoarthritis (Maskarinec et al., 2009). In Australia, and other parts of the world, there is evidence to show that migrants are at an increased risk of obesity, T2DM and hypertension (Anikeeva et al., 2010; Ibiebele, Wattanapenpaiboon, Hsu-Hage, & Wahlqvist, 2000; Williams & Harris, 2011; Yaturu, 2011). Nguyen, Nguyen, Lane, and Wang (2011) find that "the prevalence of adults with diabetes increased with increasing weight, from 8% for normal weight individuals to 43% for individuals with obesity class 3". The prevalence of overweight and obesity was associated with T2DM in survey data between 1995-2010 in Pennsylvania, US (Garcia-Dominic et al., 2014).

2.7.4 Association of Acculturation with T2DM

Many studies find that there is a positive association between acculturation and T2DM (Kandula et al., 2008; Zheng et al., 2012). Kandula et al. (2008) find that of

the four modes of acculturation (traditional, integration, marginalised and assimilation), the Indigenous Hawaiians in a traditional mode of acculturation were more likely to have T2DM compared to those in the integrated, assimilated or marginalised modes and this could not be ascribed to any of the socio-demographic or biological factors included in their study. They conclude that the results could be attributed to "psychological or other factors associated with the traditional mode of acculturation not accounted for in their study and that this could have increased the risk of T2DM among the Native Hawaiians in a traditional mode of acculturation" (Kandula et al., 2008). Mainous and colleagues find a similar result among Hispanic people (Mainous et al., 2006). They find that members of the Hispanic population with low levels of acculturation were more likely to have diagnosed T2DM compared to those born in the US or who had higher acculturation. At the same time, groups with reasonable levels of language acculturation had the greatest prevalence of undetected elevated blood glucose (Mainous et al., 2006). While Hispanics born in the US or with higher levels of language acculturation were more likely to have BMI ≥30, yet they had less prevalence of T2DM. This scenario may suggest that other factors different from the acculturation level or BMI are contributing to the diabetes.

Other studies of acculturation carried out among some migrant ethnic groups in the USA link acculturation to T2DM due to lifestyle and environmental changes such as diet, physical activity, and exposure to environmental stressors (Afable-Munsuz, Gregorich, Markides, & Pérez-Stable, 2013; Colberg et al., 2010; Holmboe-Ottesen & Wandel, 2012). An increase in the prevalence of diabetes associated with acculturation among migrants in Western countries has been reported in numerous studies (Deng et al., 2013; Montesi et al., 2016). The strength of this association is

increased with the length of time migrants spend in the host country (Anderson, 2015).

Despite fair knowledge about the factors that are associated with the poor health of migrants after spending some time in the host country, not enough data are in place to determine an association among sub-Saharan African migrants in developed countries. In general, most of the studies associating acculturation with T2DM have been conducted among immigrant groups in the USA, but a dearth of such studies exists among sub-Saharan African migrant populations even within the US and other OECD countries including Australia where sub-Saharan Africans have migrated. Past studies of acculturation and T2DM in the USA and Australia use proxy factors of acculturation such as length of stay in the host country, generational status, and language preference, but do not look at factors such as depression, anxiety, stress and PED (Kefallinos, 2016; Mainous et al., 2006; Zheng et al., 2012).

2.7.5 Association of acculturation with depression, anxiety and stress

Acculturation of both voluntary and forced migrants has been known to be associated with depression, anxiety and stress, attributable to socioeconomic and political relegation of the immigrants and refugees (Butler et al., 2015; Henkin et al., 2011; Kuo, 2014). New arrivals are challenged by resettlement in a fresh setting. They must familiarise themselves in the new cultural orientations, changed financial conditions and the new physical and social environments. This acculturative process has profound effects on the settlers as they physically and emotionally adapt to the new country's social and physical environments (Butler et al., 2015; Henkin et al., 2011).

2.8 Discrimination

2.8.1 Impact of ethnic discrimination in human relationships and health

Usually, ethnic discrimination derives from racism. The term racism is employed to describe the treatment of a particular population group in a special way due to its race (Jones, 2000). This is institutionally carried out by an established organisation or a government. Categorisations are done within a society to allocate goods and resources in favour of particular categories in that society believed to be more superior than the others (Bonilla-Silva, 1997). Essential to racism is intricately entrenched acceptance that some racial groups are inherently superior to others. Such a conviction supports the social norms and institutions that implement this ideology (Jones, 2000). Racism repeatedly develops arrogance in racially bigoted groups and disparity in fair treatment of those in the prejudiced group by individuals and/or social institutions (Jones, 2000).

Basically, the entrenched discriminative attitude of the host community towards immigrants, or generally people of different race, fuels discriminatory behaviour even among people who may not be intolerant (Williams & Mohammed, 2009). Those who are ranked as different and being discriminated against understand some discriminatory behaviour focused at them and such discernments of unfair treatment can produce stress leading to impaired health conditions for those individuals (Clark, Anderson, Clark, & Williams, 1999; DeLilly & Flaskerud, 2012). Unfortunately, since racism is extremely entrenched in the culture and institutions of society, discrimination may continue in institutional structures and policies (Gee, 2002).

Disparities in health caused by racial discrimination are perpetual and they sometimes seem to increase (Williams & Collins, 2001; Williams & Sternthal, 2010). Practical, institutional racism tends to be significantly reduced globally in current government policies, but indirect practices of discrimination are nevertheless in existence in some societies. For example, in Australia, one and a half million believe that certain races are inferior or superior to others (Australian Human Rights Commission, 2014).

2.8.2 Perceived ethnic discrimination, depression, anxiety and stress

Perceived discrimination is a perception by an individual that s/he has been treated unfairly by another person or an institution because of his/her personal characteristics such as ethnicity, sex and religion. Researchers across the world are treating perceived ethnic discrimination as an important aspect of public health research as it creates psychological conditions that could create severe health disparities in society (Black, Johnson, & VanHoose, 2015).

Ethnic, or any other form of, discrimination is a social ill that excludes individuals or a group of people from opportunities available to some groups based solely on ethnicity, sex or skin colour (Klumpp & Su, 2013). Mostly such treatments are not directly observable but they manifest themselves only indirectly, in the form of inequality across population groups (Ensher, Grant-Vallone, & Donaldson, 2001; Klumpp & Su, 2013). This indirect discrimination is usually felt by the individuals who perceive that such acts done against them are acts of discrimination against them due to their race or any other characteristic (Klumpp & Su, 2013). It implies that age, gender, religion or race are influencing factors (determinants) of perceived discrimination.

Perceived discrimination is a potential culprit for health disparity among migrants. This study's literature review indicates that perceived discrimination has harmful effects on the health of the individuals who perceive they have been discriminated against (Ensher et al., 2001; Pascoe & Smart Richman, 2009; Todorova, Falcón, Lincoln, & Price, 2010). They usually suffer from depression, psychological distress, anxiety, and other related health problems (Pascoe & Smart Richman, 2009; Todorova et al., 2010). Other health issues related to perceived ethnic discrimination are hypertension; obesity; cardiovascular reactivity; poor self-reported health; and numerous morbidities (Williams & Mohammed, 2009). These conditions may be worsened when there is overt institutional racial discrimination. Perceived racial discrimination results in a psychological stressor. This has been proven in studies that investigate the role of stress as a determinant of social disparities in health (Lehavot & Simoni, 2011; Pearlin, Schieman, Fazio, & Meersman, 2005; Thoits, 2010). Stress seems to quicken cellular aging (de Magalhães & Passos, 2018; Epel, 2009; O'Donovan et al., 2012; Wolkowitz, Epel, Reus, & Mellon, 2010) and the enduring stressors prompted by multiple environmental factors can lead to degeneration that can deregulate numerous biological systems and give rise to untimely disease and death (Miller, Chen, & Parker, 2011).

Racism is linked to the psychological stressor that can lead to diverse health problems, including poor glycaemic control (Piette, Bibbins-Domingo, & Schillinger, 2006). Szanton, et al. (2012) find that "self-report of racial discrimination was associated with increased red blood cell oxidative stress across the biracial sample, and when they classified by race, the association remained statistically significant for African Americans and not for whites". Earlier Piette et al. (2006) in a qualitative

study find that some women believe that racism might cause behavioural and physiological tensions that prompt or aggravate poor glycemic regulation and long-term complications. Williams, Isasi and Mohammed (2009) posit that "gender may moderate the relationship between discrimination and health". That is, racism is a factor that affects gender differently. Men tend to report higher levels of discrimination than women (Williams & Mohammed, 2009). Carter (2007) finds a similar result. However, the consequences of exposure to traumatic events manifest differently between men and women. "For example, men report higher levels of exposure to traumatic events than women, but post-traumatic stress disorder is more prevalent in women than in men" (Stam, 2007). In a research project where men and women documented having reported a similar frequency of racist events, women rate those events as more stressful than men (Wagner & Abbott, 2007).

2.8.3 Perceived ethnic discrimination and weight increase

Researchers worldwide have shown great interest in the relationship between risk factors such as depression, anxiety and stress and excess body weight and fat accumulation (Hillman, Dorn, & Bin Huang, 2010; Isasi et al., 2015; Luppino et al., 2010; Scott, Melhorn, & Sakai, 2012). These factors are known to be associated with perceived discrimination (Lee et al., 2016; van Dijk, Agyemang, de Wit, & Hosper, 2011). Internalised racism (the admission of damaging labels by the stigmatised group) has a race-related psychosocial risk factor leading to overweight and obesity (Cozier et al., 2014; Krieger & Sidney, 1996; Mays, Cochran, & Barnes, 2007; Mwendwa et al., 2011; Paradies, 2006). Internalised racism was related to an amplified possibility of overweight or abdominal obesity among black Caribbean women in the Dominican Republic and Barbados (Cozier et al., 2014; Tull et al.,

1999). These researchers postulate that people with comparatively high levels of internalised racism have adopted a pessimistic mindset, which is thought to be connected to the physiological path related with excess body fat build-up.

However, Vines et al. (2007) find that perceived racism is related to lower waist-to-hip ratios among black women in the US. The study of Vines and colleagues could be slightly different, but the assessment of race-related risk factors varies across many studies. Generally, findings suggest that race-related beliefs and experiences may be related to excess body fat accumulation. Clark and Hill (2009) also find that there is a relationship between body mass and cardiovascular reactivity to racism. They find that obese participants have high levels of cardiac output and stroke volume than participants of normal weight when exposed to a racially noxious scene indicating that their bodies respond effectively to the stressor as opposed to normal weight participants. They attribute their finding to the racially noxious stressor. The reason they give for such an occurrence is that the obese and overweight do experience weight prejudices on a daily basis and they are used to such scenes compared to their normal-weight counterparts, they therefore respond unconsciously compared to those of normal-weight (Clark & Hill, 2009). A similar experiment was earlier conducted by Fang and Myers (2001). The underlining facts from those studies indicate that discrimination causes health disparity for those who are discriminated against and those who are not.

2.8.4 Perceived ethnic discrimination and T2DM

Studies on discrimination related to diabetes suggest that internalised racism is associated with glucose intolerance among African Americans in the US Virgin

Islands (Tull & Chambers, 2001). This confirms the hypothesis by Björntorp (1988) that "certain individuals who are prone to defeat-oriented response to environmental stressors may exhibit a dysfunctional response of the hypothalamic-pituitary-adrenal (HPA) axis to stress, resulting to abdominal obesity and metabolic abnormalities including glucose intolerance". Later Chambers et al. (2004) examine "the relationship of internalised racism and hostility to body fat distribution and insulin resistance in black adolescent children aged 14-16 years on the Caribbean island of Barbados" and find further evidence of a significant association of high levels of internalised racism to an increased metabolic health risk in Caribbean blacks (Chambers et al., 2004). Internalised racism may be indicative of a detrimental coping strategy that impairs an individual's ability to manage stressful life situations and this can persist for generations of a discriminated group (Kaholokula et al., 2012). Psychological stress results from a perceived discrimination imbalance in cortisol secretion as well as elevated blood pressure (Kaholokula et al., 2012). Furthermore, its relationship with T2DM suggests that psychosocial stress is an important contributor to the occurrence of T2DM (Hackett & Steptoe, 2016).

2.8.5 Association of perceived ethnic discrimination with acculturation

In the relationship between acculturation and perceived ethnic discrimination, there are mixed research findings. Some studies find that migrants who are highly acculturated have higher PED than those with lower acculturation levels (Aichberger et al., 2015; Ikram et al., 2016; Kulis, Marsiglia, & Nieri, 2009). Meanwhile, other studies cannot find a direct relationship between acculturation and PED, but mediation through variables, such as stress and depressive syndrome, find no clear

relationship between acculturation and PED (Baldwin-White, Kiehne, Umaña-Taylor, & Marsiglia, 2017; Ikram et al., 2016; Tonsing et al., 2016).

2.8.6 Summary

From the review so far, no study has directly assessed the association of perceived discrimination with T2DM and acculturation, but rather they have listed risk factors such as stress, anxiety and depressive syndrome as mediators between perceived ethnic discrimination and acculturation for ethnic disparity in health, including higher BMI, which is a well-established risk factor for T2DM. In other words, PED could be regarded as an influencing factor for many other risk aspects for T2DM.

2.9 Depression

There is evidence to suggest that acculturation is related to depression (Gupta et al., 2013) Thirty-eight studies that examine relationships between acculturation and depression among US Asians have been analysed in meta-analysis and the result reveals that the assimilation mode of acculturation is inversely correlated with depression. Traditional and integration modes are also inversely correlated with depression, although this is not statistically significant (Gupta et al., 2013). In a separate study that assesses depression among natives and migrants, participants from the host population show a lower risk of depression, and co-morbidities in comparison to migrants (Ünlü Ince et al., 2014). Studies conducted about Mexican and Korean migrants in the US indicate that depression levels are higher among migrants in comparison to the mainstream population (Gonzalez et al., 2001; Oh et al., 2002). This evidence indicates that there is a link between acculturation and depression, and conversely, there is evidence that depression and T2DM are linked (Bădescu et al.,

2016). Therefore, it is plausible that depression is a potential mediator between acculturation and T2DM.

2.10 Anxiety

Anxiety among migrants has widely been reported (Fritz, Chin, & DeMarinis, 2008; Hovey & Magaña, 2002; Potochnick & Perreira, 2010). A longitudinal study conducted among Latino migrant mothers and daughters to examine the association between acculturation and anxiety reveals that connection to Latino culture is inversely associated with anxiety (Concha, Sanchez, Rojas, Villar, & De La Rosa, 2016). Similarly, a study conducted among Turkish and Moroccan migrants in the Netherlands finds a significant association between acculturation modes, depressive disorders and anxiety (Borra, 2011). These findings all indicate that anxiety in migrant populations increases with the rising level of acculturation.

2.11 Stress

Acculturative stress that usually occurs among migrants is triggered by many factors that include separation from family, traditionalism and language difficulties among others (Arbona et al., 2010; Lueck & Wilson, 2011; Thomas, 1995). This stress can contribute to mental health issues (George, Thomson, Chaze, & Guruge, 2015; Kirmayer et al., 2011). In a comprehensive review on the acculturation of both economic and refugee migrants, three fundamental factors are identified as affecting immigrants' mental health; acculturation related stressors, economic uncertainty, and ethnic discrimination (George et al., 2015). Numerous acculturation studies report that acculturation stress is higher when migrants first arrive in the host country

and have low levels of acculturation (Hyung-Chul, Ji-Young, Soon-Jeong, & Kwon, 2015; Lueck & Wilson, 2010).

Although acculturation stress impacts on both economic and refugee migrants, the level of impact differs among the two groups (Liebkind, 1996). Refugee migrants seem to be more exposed to stress than those who migrate on skilled visas. Skilled migrants move to the host country and are immediately employed unlike refugees who usually are not certain of any employment prospects (Warfa et al., 2012). In most aspects, refugees are discriminated upon in the labour market, although the term refugee does not mean unskilled group of people, but rather people who left their home country due to war or a threat to their lives (Colic-Peisker & Tilbury, 2007). Colic-Peisker and Tilbury (2007) find that refugees from sub-Saharan Africa and Bosnia have qualifications but their skills are not recognised in Australia, thus they have a significant per cent of unemployment. Skilled refugees are being disadvantaged in the labour market. Their key findings include: “High levels of unemployment among skilled refugees, Massive loss of occupational status among skilled refugees”. Some segments of employment are racially and culturally visible bas they are occupied by migrants and refugees (Colic-Peisker & Tilbury, 2007). Most of this employment requires low-skilled qualifications, notwithstanding the skill levels the immigrants and refugees may have. Colic-Peisker and Tilbury (2007) conclude that this situation is “a loss of human capital benefits to Australia and a waste of skills currently in short supply”. In their study, some participants were doctors and engineers, but they report that they were driving taxis, and teachers were cleaning offices.

Typically, refugees face fundamental disadvantage in the employment process due to such things as qualifications recognition, racial discrimination, religion or ethnicity. Employers discriminate based on whether a migrant has knowledge of Australian culture and workplace experience (Colic-Peisker & Tilbury, 2007). Employment, therefore, could be one of the factors that may contribute to stress and illnesses among migrant communities such as sub-Saharan Africans who constitute the majority of the unemployed (Colic-Peisker & Tilbury, 2007). Refugees also experience stress due to changes in the level of exposure, difference in gender roles, language, ethnicity, spiritual, social behaviour and political environment (Antony, Bieling, Cox, Enns, & Swinson, 1998).

2.12 Summary

The preceding discussion about acculturation clearly reports that the acculturation process of migrants in host countries plays a greater role in the morbidity among migrants. In Australia, the sub-Saharan African migrants are experiencing rapid weight increase and prevalence of T2DM (Renzaho & Burns, 2006). This phenomenon could be associated with acculturation factors including perceived ethnic discrimination. Since data are scarce on this population it would be very difficult for any level of government in Australia to plan effectively for healthcare among this population, in addition to language and cultural barriers. But we know that this population is entitled to enjoy a possible standard of health as one of the ultimate rights of every human being without discrimination of his/her race, religion, political beliefs, economic or social condition (WHO, 1946). It is therefore, of great importance the we undertake studies to investigate the association between immigration and physical and mental health among migrants. It would provide

evidence for effective public health planning and implementation. It is on this basis that this study has been planned and is therefore well placed to assess the influence of acculturation in sub-Saharan African migrants as they settle in Australia.

2.13 Summary of the literature review

No specific literature has been identified that establishes a direct link between acculturation, perceived discrimination and T2DM. Most of the reviewed research lists other risk factors such as stress and higher BMI as leading risk factors for multiple health problems including T2DM. In other words, perceived discrimination could be regarded as an indirect risk factor that activates other risk factors such as stress, depression and anxiety leading to the malfunctioning of the body resulting in obesity or other risk factors that have a direct effect on T2DM.

The link between acculturation and T2DM is not clear either. Most studies associate acculturation with change in diet that gives rise to overweight and obesity which is the direct risk factor for T2DM (Pérez-Escamilla & Putnik, 2007; Venkatesh et al., 2017). Association of various acculturation modes to diabetes have been explained in terms of stress that might have arisen from discrimination or migration (Hillman et al., 2010; Isasi et al., 2015; Luppino et al., 2010; Scott et al., 2012). As such, it is easy to draw a conclusion from the reviewed literature that there are no direct relationships between acculturation, perceived ethnic discrimination and T2DM.

There are mixed findings from the reviewed studies. Some suggest that the traditional mode of acculturation is a risk factor for T2DM, while others find higher acculturation associated with both perceived ethnic discrimination and T2DM (Deng

et al., 2013; Kandula et al., 2008; Montesi et al., 2016; Zheng et al., 2012). However, no study combines acculturation and discrimination in their data collection to see the combined effects of the variables on the incidence or prevalence of T2DM. This study therefore aims to provide an opportunity for the combination of the two variables in a single population and data set. Data were collected on both acculturation and perceived ethnic discrimination and their association with elevated blood glucose level or T2DM was tested in combination and when one of the variables was controlled for.

3 CHAPTER THREE: METHODOLOGY

3.1 Design and recruitment of participants to the study

This study was cross-sectional and used a purposive sampling method for the selection of migrant participants from 18 sub-Saharan African countries (the Sudan, South Sudan, Eritrea, Ethiopia, Somalia, Kenya, Uganda, Democratic Republic of Congo, Rwanda, Burundi, Tanzania, Zambia, Zimbabwe, South Africa, Nigeria, Ghana, Sira Leone and Liberia). These people migrated to Australia through humanitarian/refugee, skilled, student and family/spouse immigration visa types. The selection of potential participants was based on participants' residency in Australia for at least two years.

Recruitment was carried out through existing community networks. In Australia, African communities have community organisation networks through which they coordinate their social and developmental issues with service providers, state and federal governments of Australia. African Community Councils of Queensland and Northern Territory were contacted to request approval to conduct this study among sub-Saharan African communities in Brisbane and Darwin. These councils approved the study and invited various sub-Saharan African communities in Brisbane and Darwin to participate in an introductory meeting with the researcher. Two separate meetings were conducted in Brisbane and Darwin in which the research project was explained, and volunteers were invited to participate in the study. Two hundred and fifty people accepted to participate and were registered to form an initial sampling frame. Out of the 250, 170 participated (68% response rate) in the study. Those who registered but did not participate had typically moved away from their registered addresses and were thus

inaccessible. To participate, a participant had to be 18 years old or older and must have lived in Australia for at least 2 years.

An information sheet outlining the role of participants was given to them to read. This document explained everything pertaining to the research and the safety of the participants including keeping confidentiality and their anonymity. The information sheet was in English and those who could not read English listened to the information being read and explained in their own language by volunteers from their community who understood English. Those who agreed to participate were given a consent form to sign before they were interviewed. Ethics approval was obtained from the University Human Research Ethics Committee.

3.2 Data collection

A comprehensive questionnaire was developed from validated questionnaires that have been used in acculturation, PED, DAS dietary intake and sociodemographic characteristics for data collection. Fasting blood glucose level and anthropometrical measurements were also conducted during the face-to-face interviews.

3.2.1 Measures

3.2.1.1 Assessment of acculturation

A combination of the Vancouver Index of Acculturation and Acculturation Scale by Suinn Lew (Ryder, Alden, & Paulhus, 2000; Suinn, Ahuna, & Khoo, 1992) was used. The two acculturation scales were modified to suit the African migrants' situations. The Vancouver Index of Acculturation contained a total of 20 items. Out of the 20 items, 10 items refer to the participants' original cultural heritage. The remaining 10

items refer to the cultural heritage of the host population. Each statement of the 20 items were rated from 1 to 9: *'disagree' to 'agree'*. The average score for each participant was calculated for each heritage category: original heritage and the host heritage. If the participant scored highest in the original heritage, s/he was categorised in the traditional mode of acculturation and if s/he scored highest in the host heritage s/he was categorised in the assimilation mode of acculturation. Thus, the Vancouver Index of Acculturation categorised the participants into two categories (traditional or assimilated) of acculturation modes, but since acculturation is not unidirectional but multi-dimensional (Suinn et al., 1992), 5 items from the Suinn Lew acculturation scale were added to the 20 items to classify the participants into four categories of acculturation (assimilation, marginalisation, integration and traditional). The categorisation was computed as shown in the Suinn Lew acculturation scale (Suinn et al., 1992).

3.2.1.2 Assessment of perceived ethnic discrimination

A validated life-time PED questionnaire (Ryder, Alden, & Paulhus, 2000) was used to assess PED. The questionnaire had 25 items and each of the 25 items was rated from 1 to5. 1 represented never discriminated, 2, 3 and 4 represented moderate discrimination and 5 denoted a high level of discrimination. These scores were categorised as: never discriminated, moderate and high level of discrimination in the final analysis.

3.2.1.3 Assessment of depression, anxiety and stress (DAS)

Depression, anxiety and stress were accessed using a universally known and validated scale called DAS. DAS is a 42-item scale, which measures depression, anxiety and

stress. The 42 questions measure emotional reaction in a person and each of the three psychological reactions (depression, anxiety and stress) have 14 questions and the assessment of various levels was obtained as described by Lovibond and Lovibond (1995).

3.2.1.4 Dietary intake Assessment

A validated Food Frequency Questionnaire (FFQ) commonly used in dietary assessment in large epidemiologic studies of diet and health was used for collection of data on dietary intake (Liu et al., 2013). Data were collected on type and quantity of vegetables traditional - African and locally available - Australian. Wheat bread; traditional maize meal porridge, sweets and snacks, fast food, processed meat, red meat, fish and dairy intake were the dietary factors on which data were collected. Traditional African vegetables were added to the list of locally available Australia vegetables. The frequency of dietary intake was based on daily, weekly and monthly frequencies for a period of twelve months and categorised into consumption of vegetables, sweets and snacks, fast food, processed meat, red meat, fish, and dairy intake.

3.2.1.5 Assessment of anthropometric data

Measurements of participants' body weight, height and waistline were conducted at the time of interview. Body weight was measured using a body weight electronic scale (model: WW58A) to the nearest of 0.1kg, height was measured using electronic height measuring rod (KERN MSE 210 version 1.0 10/2009) to the nearest of 0.5cm., and waistline was measured using a tape measure developed and used by Diabetes Australia.

3.2.1.6 Assessment of physical activity

Data on physical activity was collected through a validated physical activity (PA) questionnaire internationally used to collect data on PA related to employment, transportation, housework/family care, recreational and sports participation (Craig et al., 2003). Participants recorded the time they spent in low, moderate and vigorous physical activity in minutes and hours per week and these were classified into low (≥5.01); moderate (0 ≥ 3.0); and high (≥ 3.01 and ≤ 5.0) hours/week.

3.2.1.7 Assessment of fasting blood glucose level

Fasting blood glucose levels (FBGL) were conducted at interviews, which were scheduled before the participants' breakfast to accommodate the measurement of FBGL at the time of the interview. I made appointments with the participants prior to the interview time and asked them to fast for 8 hours before the interview so that measurement of the FBGL could take place at time of the interviews. Blood Glucose Metre (Accu-Check, Performa) was used to measure FBGL and the BGLs were categorised as: low (BGL ≤ 3.9 mmol/l); normal (BGL ≥ 4.0 to BGL ≤ 6.09 mmol/l); high risk (BGL ≥ 6.1 to BGL ≤ 6.99mmol/l); and diabetic (BGL ≥ 7.0 mmol/l); based on the standard WHO cut-off values. Participants were also asked during the interviews whether they had been previously been diagnosed with diabetes by their doctors. Those who had been informed answered 'Yes' and those who were not told anything about their glucose status responded 'No'.

3.2.1.8 Assessment of sociodemographic characteristics

Data on sociodemographic characteristics included immigration types of visa (humanitarian/refugee, skilled, student and family/spouse), country of origin, age, sex,

income, education, and marital status. Age was stratified into age group ranging from ≥18 ≤72 years old. Household income categorisation was based on the ABS (2013) and was categorised as low ≥ 0 ≤ 41,236 AU$; medium ≥ 41,237 ≤ 94,328 AU$; and high ≥ 94,329. Education levels were categorised as: have not gone to school; primary school; high school; trade certificate; diploma; bachelor's degree; and postgraduate qualification. Relationship status was categorised as married; single; divorced; never married; and de facto.

3.2.2 Data analysis

Analysis was conducted using the Statistical Package for Social Sciences (SPSS) version 24. Descriptive statistics were used to determine prevalence of EBGL of T2DM, PED, DAS, overweight, obesity and the distribution of acculturation modes, sociodemographic characteristics and PA. Those who did not attend formal education and those who completed primary education were classified as uneducated (≤ Primary). Those who completed high school and beyond it were classified as educated (≥. High school). Linear multiple regression with backwards elimination and cross-tabulation analyses were conducted to determine relationships between independent variables (acculturation modes, sociodemographic characteristics, overweight, obesity, central adiposity and dietary factors) and the dependent variable (EBGL or T2DM).

4 CHAPTER FOUR: RESULTS AND PRELIMINARY DISCUSSION

4.1 Distribution of acculturation, sociodemographic characteristics in the sample population

The general distributions of sociodemographic characteristics and acculturation in the sample population and their distributions by sex are shown in Table 4. The frequency distribution of acculturation was determined based on the categorisation of acculturation mode as described in previous research (Kandula et al., 2008). Thus, the sample population was categorised as traditional, marginalised, integrated and assimilated modes of acculturation. The proportion of males in the sample population was slightly higher than females. There was a high proportion of well-educated participants. Over half of the sample population had undergraduate or postgraduate degrees. Females who had a bachelor's degree were in equal proportion to males. Most of the sample population migrated to Australia with a humanitarian/refugee visa and more than two thirds of them were employed, although 41.2% had low incomes. The majority of those with a higher income were female, however, 70.4% of those who were unemployed were female. The majority (60.9%) who migrated to Australia on a student visa were male.

Table 4

Sociodemographic characteristic distribution of the sample population

Variables	**Sex**		**Total**
	Males (n/%)	Females (n/%)	
Overall population	88 (51.8)	82 (48.2)	170 (100)
Married			93 (54.7)
Single			21 (12.4)
Divorced			18 (10.6)
Never Married			32 (18.8)
De facto			6 (3.5)
No formal education	2 (40.0)	3 (60.0)	5 (2.9)
Primary level	4 (28.6)	10 (71.4)	14 (8.2)
Secondary level	3 (37.5)	5 (62.5)	8 (4.7)
Trade certificate	18 (58.1)	13 (41.9)	31 (18.2)
Diploma	14 (60.9)	9 (39.1)	23 (13.5)
Bachelor's degree	24 (50.0)	24 (50.0)	48 (28.2)
Postgraduate degree	23 (56.1)	18 (43.9)	41 (24.2)
Income			
Low	34 (48.6)	36 (51.4)	70 (41.2)
Medium	27 (64.3)	15 (35.7)	42 (24.7)
High	27 (46.6)	31 (53.4)	58 (34.1)
Immigration Visa type			
Humanitarian/Refugee	53 (53.5)	46 (46.5)	99 (58.2)
Student	14 (60.9)	9 (39.1)	23 (13.5)
Skilled	13 (48.1)	14 (51.9)	27 (15.9)
Family/Spouse	8 (38.1)	13 (61.9)	21 (12.4)
Employment status			
Employed	16 (29.6)	38 (70.4)	116 (68.2)
Unemployed	72 (62.1)	44 (37.9)	54 (31.8)
Acculturation modes			
Assimilated	5 (5.7%)	3 (3.7%)	8 (4.7)
Marginalised	11 (12.5%)	14 (17.1%)	25 (14.7)
Integrated	41 (46.6%)	30 (36.6%)	71 (41.8)
Traditional	33 (37.5%)	34 (41.5%)	67 39.4)

Over half of the sample population reported being officially married, nevertheless 3.5% were living in de facto (cohabitation) relationships. Large proportions of the sample were in the integrated and traditional modes of acculturation. Since this study

is the first that examines acculturation among sub-Saharan African or other migrant groups in Australia, there was no benchmark data available for comparison.

4.2 Prevalence and association of EBGL, PED, DAS, BMI and their distribution by sex

4.2.1 Prevalence of EBGL or T2DM

The prevalence of EBGL or T2DM PED, DAS and BMI and their distribution by sex are shown in Table 5. This table indicates that the prevalence of diabetic BGL (T2DM) in this cohort was 14.7%, compared to 5.1% of the general Australian population (ABS, 2015). Although it is not a representative sample, the higher T2DM prevalence among the sub-Saharan African migrants in the present study is consistent with findings in other migrant groups in Australia (Abouzeid, Philpot, Janus, Coates, & Dunbar, 2013) and elsewhere (Montesi et al., 2016). A comprehensive systematic review covering Europe, the United States and Australia confirms this difference between host population and migrants (Montesi et al., 2016), suggesting that immigrants are more susceptible to T2DM risk than members of the host communities. However, the higher prevalence in this migrant cohort resembles that of the sub-Saharan African populations where the participants of this study originated. In sub-Sahara Africa, T2DM prevalence was 12% in the urban population in 2011 (Hall, Thomsen, Henriksen, & Lohse, 2011). This is a trend found across the African continent, however, an important point to note is that the Africans issued with Australian entry visas were healthy, according to a prerequisite for rigorous health checks (Department of Home Affairs, 2019a). This implies that T2DM may have developed subsequent to arrival. It is clear that T2DM and other NCDs are increasing rapidly in this population (Mbanya et al., 2010; Renzaho et al., 2014), signifying

potential risk of multiple NCDs as their years in Australia increase. This indicates a significant need for targeted health promotion strategies for this population in Australia.

Table 5

Prevalence of elevated blood glucose level (EBGL/T2DM), perceived ethnic discrimination (PED), depression, anxiety, stress (DAS) and body mass index (BMI)

Exposure Variables	**Sex**		**Frequency**
Fasting Blood Glucose level (FBGL)	**Male (n/%)**	**Female n/%)**	Total
Low FBGL	11 (55.0)	9 (45.0)	20 (11.8)
Normal FBGL	56 (46.7)	64 (53.3)	120 (70.6)
High risk FBGL	3 (60.0)	2 (40.0)	5 (2.9)
Diabetic FBGL	18 (72.0)	7 (28.0)	25 (14.7)
PED			
No discrimination	3 (33.3)	6 (66.7)	9 (5.3)
Moderate discrimination	70 (51.5)	66 (48.5)	136 (80.0)
High level discrimination	15 (60.0)	10 (40.0)	25 (14.7)
DAS			
No depression	51 (46.4)	59 (53.6)	110 (64.7)
Mild depression	3 (42.9)	4 (57.1)	7 (4.1)
Moderate depression	14 (66.7)	7 (33.3)	21 (12.4)
Severe depression	20 (62.5)	12 (37.5)	32 (18.8)
No anxiety	49 (50.5)	48 (49.5)	97 (57.1)
Mild anxiety	5 (38.5)	8 (61.5)	13 (7.6)
Moderate anxiety	4 (36.4)	7 (63.6)	11 (6.5)
Severe anxiety	30 (61.2)	19 (38.8)	49 (28.8)
No stress	51 (47.7)	56 (52.3)	107 (62.9)
Mild stress	10 (58.8)	7 (41.2)	17 (10.0)
Moderate stress	20 (54.1)	17 (45.9)	37 (21.8)
Severe stress	7 (77.8)	2 (22.2)	9 (5.3)
BMI			
Underweight	0 (0.0)	2 (66.7)	2 (1.2)
Normal weight	35 (66.0)	18 (34.0)	53 (31.2)
Overweight	40 (54.1)	34 (45.9)	74 (43.5)
Obese	13 (31.7)	28 (68.3)	41 24.1)

4.2.2 Prevalence of PED and DAS

The general prevalence of PED in the population was 94.7%, where males constitute the majority (see Table 5). There are no past data on PED in Australia to date, with the exception of the reports that focus on Indigenous Australians (Larson, Gillies,

Howard, & Coffin, 2007; Paradies, 2005) Therefore, this prevalence level could not be compared to any pre-existing PED data in Australia. Although no specific data on the impact of PED on disease prevalence among migrants in Australia have been reported, there is evidence supporting a link between PED and the prevalence of depression, anxiety and EBGL or T2DM in the present study, coupled with the positive associations between discriminatory treatment and poor health of Indigenous Australians (Larson et al., 2007; Paradies, 2005). Furthermore, other studies of discrimination elsewhere show that PED and poor health are associated (Whitaker et al., 2017). It is plausible that the prevalence of depressive symptoms, anxiety and EBGL or T2DM in the present study are linked to PED. The total prevalence of depression (mild + moderate + severe) and anxiety (mild + moderate + severe) in this study was 35.3% and 42.9%, respectively (see Table 5) and this was higher than the prevalence across the general Australian population (9.3% and 11.2%, respectively). The prevalence of anxiety was even higher than that of depression and higher in males than females in this study (69.8% and 43.4%, respectively) in contrast to the general Australian distribution where prevalence was higher in females (13.0% and 9.4%) (ABS, 2015).

4.2.3 Prevalence of overweight and obesity

The prevalence of overweight and obesity in the present study was 43.5% and 24.1%, respectively (see Table 5). The prevalence of overweight was higher in this study population than the recent Australian prevalence (35%), however, obesity prevalence was lower than the Australian prevalence (28%) (ABS, 2019). This is consistent with usual distributions observed in other populations (Murphy, Robertson, & Oyebode, 2017). A key difference was that females were more likely than males to be obese in

the present study, contrary to the Australian population (ABS, 2019). Other studies in sub-Saharan African populations in Africa find a higher prevalence of obesity or overweight in females than in males (Agyemang, Boatemaa, Agyemang Frempong, & de-Graft Aikins, 2016; Damian, Kimaro, Mselle, Kaaya, & Lyaruu, 2017). This appears to be consistent with results of other developing countries where females are more likely to be obese than males (Ajayi et al., 2016), perhaps due in part to differing physical activity levels between males and females (Guthold, Stevens, Riley, & Bull, 2018). However, in the present study, there was no significant difference between males and females in physical activity levels. Similarly, no significant difference in the relationship between physical activity levels and BMI or EBGL or T2DM was found. Cultural norms in some African communities also favour a larger body size for women as a sign of healthfulness, fertility and family prosperity (Appiah, Otoo, & Steiner-Asiedu, 2016; Naigaga et al., 2018). Such ideology may still exist in some sub-Saharan African migrant groups in Australia. In the present study, no association between overweight, obesity and central adiposity with EBGL or T2DM was observed, contrary to previous evidence that overweight, obesity and central adiposity are risk factors for T2DM (Al-Goblan, Al-Alfi, & Khan, 2014).

4.3 Association of acculturation and sociodemographic characteristics with PED, DAS and EBGL/T2DM

Table 6 presents binary correlations and Table 7 presents hierarchical regression analysis. The binary correlations reveal that both traditional and integrated modes of acculturation are strongly correlated with EBGL or T2DM, with the traditional mode being inversely associated. There is also a strong association between PED and EBGL or T2DM. Acculturation and PED were incorporated into a single model to explore

their interaction in the hierarchical regression (see Table 7). This table shows a change in the strength of association between an integrated mode of acculturation and EBGL or T2DM when PED was included in the analysis at model 2. This change is indicated by the reduction of standardised coefficient from β = .494 in model 1 to β = .418 in model 2. Whereas the strength of the association between PED and EBGL or T2DM remained strong, as shown in the binary correlation (see Table 6). When this was further analysed by cross-tabulation to estimate the risk of each acculturation mode on EBGL or T2DM, the relative risk indicated that an integrated mode of acculturation was 4.2 times more likely to have EBGL or T2DM than other modes of acculturation and that the traditional mode was 80% less likely to have EBG or T2DM compared to other acculturation modes (see Table 8).

Table 6

Binary correlation of acculturation with EBGL/T2DM and PED

Independent variables	**Correlation**			
	Dependent variable (EBGL/T2DM)	**P value**	**PED**	**P value**
PED	.592**	0.000		
Assimilation	0.043	0.579	-0.014	0.858
Marginalised	0.015	0.844	0.069	0.37
Integrated	.256**	0.000	.187*	0.015
Traditional	-.247**	0.001	-.165*	0.032

Table 7

Hierarchical regressions of acculturation modes, PED as independent variables with EBGL/T2DM as dependent variable

	unstandardized coefficients		**Standardized coefficients**			
Variable	**Beta**	**Std error**	**Beta**	**t**	**P-value**	**Model**
Constant	-0.103	0.127		-0.811	0.418	1
Assimilated	0.353	0.181	0.196	1.951	0.053	
Marginalised	0.297	0.134	0.276	2.213	0.028	
integrated	0.382	0.126	.494**	3.024	0.003	
Traditional	0.151	0.131	0.194	1.153	0.25	
Constant	-0.522	0.136		-3.843	0.000	2
Assimilated	0.370	0.165	0.206	2.245	0.026	
Marginalised	0.283	0.122	0.263	2.314	0.022	
integrated	0.323	0.116	.418**	2.799	0.006	
Traditional	0.177	0.120	0.227	1.483	0.140	
PED	0.155	0.026	.406**	5.876	0.000	

Note * Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.01 level (2-tailed).

Table 8

Cross-tabulation between acculturation modes and EBGL in the sample population

Variable	% of Elevated BGL in exposed	% of Elevated BGL in non-exposed	unadjusted Odds ratio	P value
Assimilated	25.0	17.3	1.6 (0.3, 8.3)	0.576
Marginalised	24.0	16.6	1.6 (0.6, 4.4)	0.367
Integrated	29.6	9.1	4.2 (1.8, 9.9)	0.001**
Traditional	6.0	25.2	0.2 (0.1, 0.6)	0.001**

These strong associations between integrated and traditional modes of acculturation and EBGL or T2DM, and between PED and EBGL or T2DM are consistent with previous studies that show greater levels of acculturation associated with a higher prevalence of T2DM and PED (Kandula et al., 2008; Whitaker et al., 2017). Analysis in model 2 (see Table 7) was carried out to test for a relationship between acculturation and PED and this revealed that PED might have partially mediated the relationship between acculturation and EBGL or T2DM. This is consistent with previous studies that demonstrate that acculturation is associated with poor health of immigrants, and that this association is amplified by the effect of PED (Aichberger et al., 2015). Aichberger et al. (2015) find an elevated level of PED associated with higher levels of stress among second generation Turkish migrant women in Germany. Many other studies support the potential link between acculturation, PED, depression, anxiety stress and EBGL or T2DM risk (Janssen-Kallenberg et al., 2017; Nguyen, Le, & Meirmanov, 2019; Ünlü Ince et al., 2014; Whitaker et al., 2018). It is well-established that an increased risk of many chronic health conditions is associated with migration and resettlement (Castañeda et al., 2015; Gushulak, Weekers, & MacPherson, 2009; Hahm, Ozonoff, Gaumond, & Sue, 2010). The movement of

migrants from their habitual domicile to resettlement in unfamiliar physical and social environments impacts on their psychological and physical well-being (Ikram et al., 2016; Lakey, 2003; Mainous et al., 2006; Virupaksha, Kumar, & Nirmala, 2014).

A large body of literature has established strong links between PED, depression, anxiety, stress, hypertension and T2DM in various migrant groups worldwide (Paradies, Paradies, & Kelaher, 2015; Paradies, Ben, et al., 2015; Todorova et al., 2010; Viruell-Fuentes, Miranda, & Abdulrahim, 2012; Whitaker et al., 2017). For example, a study in the Netherlands which included multi-ethnic (South-Asian Surinamese, African Surinamese, Ghanaian, Turkish and Moroccan) participants finds that PED is positively associated with metabolic syndrome risk in some ethnic groups (Ikram et al., 2017). A similar study in some European countries shows a positive association between PED and poor health outcomes in migrants from low-income countries (Borrell, Palència, Bartoll, Ikram, & Malmusi, 2015). Many studies confirm the impact of PED on the occurrence of T2DM (Misra & Hunte, 2016; Rodríguez-Álvarez, González-Rábago, Borrell, & Lanborena, 2017).

Table 9 shows that skilled migrants are more likely to have both high risk and diabetic BGL as well as PED than other migration visa types. Given the evidence from previous studies linking PED to EBGL or T2DM, it is plausible that PED might contribute to the strong and positive correlation of the skilled migration visa type with EBGL or T2DM in the present study. A previous multi-ethnic study finds that PED is strongly linked with atherosclerosis and T2DM incidence (Whitaker et al., 2017). Adverse effects of discrimination on glucose control in both black and white women with diabetes have also been observed in the USA (Wagner et al., 2015). Considering

the previous evidence that PED increases risk for multiple NCDs, it is plausible that a similar situation may apply in the sub-Saharan African migrant population in Australia, in view of the high level of PED found in the present study. Table 9 also shows that low income is inversely associated with both high risk and diabetic BGL, whereas high income is positively associated with both high risk and diabetic BGL. Skilled visa migrants are more likely to have high risk and diabetic BGL, respectively. The relative risk (see Table 10) shows that those with high income status are more than six and five times more likely to have high risk and diabetic BGL, compared to those in low and medium-income groups. In contrast, previous studies show that socioeconomic status (SES) is associated inversely with the incidence and exacerbation of EBGL or T2DM risk (Tull & Chambers, 2001; Ikram et al., 2016; Rao et al., 2006; Wagner et al., 2015). In a study of South Korean migrants in Hong Kong, SES is found to be associated inversely with EBGL or T2DM among them (Tonsing et al., 2016) like many previous studies examining the relationship between SES and prevalence of NCDs.

In comparison with the present study, the possible explanation for this difference is that the Korean study has characteristics of a higher level of acculturation that has given rise to a later stage of nutrition transition and increased risk of NCD (Deng et al., 2013; Lesser et al., 2014). In a review that investigates the relationship between SES and T2DM in 45 population-base surveys from 32 countries, the prevalence of diabetes and patients' SES is found to have a positive association in developing countries as observed in the present study, and was inversely related in the developed countries such as Australia (Xu et al., 2017). This phenomenon was also seen in similar studies (Khazaei, Rezaeian, Khazaei, & Nematollahi, 2016).

Table 9

Binary correlation of socio-demographic variables with high risk and diabetic BGL

Independent variable	**Correlation with high risk fasting blood glucose level**	**Correlation with diabetic fasting Blood Glucose level**
Low income	-.014	-.168*
Medium income	0.019	0.032
High income	0.174*	.249**
Humanitarian visa type	0.135	0.086
Student visa type	0.033	0.03
Skilled visa type	.210**	.229**
Family/Spouse visa type	0.065	.156*

Note *Correlation is significant at $p < 0.05$, NS = Non-Significant **Correlation is significant at $p < 0.01$.

Table 10

Cross-tabulation of socio-demographic variables with high risk and diabetic BGL

Independent variable	% of High risk in exposed	% of High risk in non-exposed	Unadjusted odds ratio (95% CI)	p value	% of Diabetic in exposed	% of Diabetic in non-exposed	Unadjusted odds ratio (95% CI)	p value
Low income	2.7	3.2	0.8 (0.1, 5.2)	NS	8	20	0.4 (0.1, 0.9)	NS
Medium income	2.4	3.1	0.8 (0.1, 7.0)	NS	16.7	14.1	1.2 (0.5, 3.2)	NS
High income	11.8	2	6.7 (1.0, 43.1)	0.023	41.2	11.8	5.3 (1.8, 15.5)	0.001
Humanitarian visa	1	5.6	0.2 (0.0, 1.6)	NS	12.1	18.3	0.6 (0.3, 1.4)	NS
Student visa	4.3	2.7	1.6 (0.2, 15.2)	NS	17.4	14.3	1.3 (0.4, 4.1)	NS
Skilled visa	11.1	1.4	8.8 (1.4, 55.5)	0.006	33.3	11.2	4.0 (1.5, 10.3)	0.003
Family/Spouse visa	0	3.4	1.0 (0.9, 1.0)	NS	0	16.8	0.8 (0.8, 0.9)	0.042

This suggests that sub-Saharan African immigrants in Australia may reflect similar patterns of change to that seen in rural to urban migration in sub-Sahara African countries (Agyemang, Meeks, et al., 2016). However, it is unclear why the pattern in sub-Saharan Africa is replicated in an industrialised country such as Australia. The sub-Saharan Africa phenomenon of rural to urban drift is explained on the basis of movement from undernutrition to overnutrition and from a high physical activity to a low physical activity environment, which amplifies T2DM risk (Goulão et al., 2015; Renzaho et al., 2014; Renzaho & Burns, 2006). However, this result may mean that African migrants have a similar accelerated form of nutrition transition characterised in rural to urban migration in sub-Saharan African countries (Agyemang, Meeks, et al., 2016).

Table 10 indicates that the skilled migrants were more than eight and four times more likely to have high risk and diabetic BGL or T2DM, than the humanitarian, student and family/spouse visa types respectively. They were 11 times more likely to have high incomes than those who migrated through other visa types (see Table 11). Despite a better income level, they were more likely to have EBGL or T2DM than those in a low income level, which is contrary to previous evidence that low SES is more likely than high SES to have T2DM (Berkowitz et al., 2014; Hwang & Shon, 2014). Therefore, this calls for more investigation to confirm this finding in this population. Another important aspect in the finding of the present study to be noted is that those in age group 40-50 years displayed a high prevalence level of PED and the majority in this study were in age group 29-39, and if indeed the effect of PED is contributory to the occurrence of T2DM, it might be expected that many would

progress to middle age with T2DM, implying a major future wave of disease burden in this population in Australia.

Table 11

Cross tabulation of immigration visa types with high income to show relative risk of the visa types on the income

Exposer variables	**% of high income in exposed**	**% of high income in non-exposed**	**Unadjusted odds ratio (95% CI)**	**p value**
Humanitarian	2	21.1	0.1 (0.0, 0.4)	0.000
Student	13.6	9.5	1.3 (1.4, 5.2)	NS
Skilled	37	4.9	11.4 (3.8, 34.0)	0.000
Family/Spouse	9.5	10.1	0.9 (0.2, 4.4)	NS

Table 12 shows that most of those with a postgraduate degree had diabetic BGL (T2DM) and 38.9% of the divorced participants had EBGL (high risk + diabetic). The cross tabulation between socio-demographic characteristics and PED and severe anxiety (SA) is shown in Table 13. The risk estimate indicates that the educated participants were 13.1 times more likely to perceive being discriminated against than their well uneducated counterparts, whereas, the low uneducated were 90% less likely to perceive being discriminated against. Similarly, the employed participants were 20 times more likely to experience PED than those who were unemployed, and the latter were 90% less likely to experience PED. When education and employment status were combined, 99.1% of the educated-employed participants reported PED and the well-educated-employed were 18 times more likely to report PED than those who had low-education levels and were employed. These findings are consistent with previous similar studies (Daldy, Poot, & Roskruge, 2013). Daldy et al. (2013) find that highly

educated migrants are more likely to perceive discrimination than those with a lower education status.

Similarly, highly educated women are found to have higher levels of perceived discrimination than those less educated (Watson, Scarinci, Klesges, Slawson, & Beech, 2002). In the present study, all the skilled migrants were highly educated and 88.9% were employed with 99.1% of the employed participants reporting PED. These results imply that events participants interpret as discriminative occur mostly within workplaces and that such events are more likely to be perceived as discrimination by those who are highly educated. This is consistent with previous studies that show positive associations of education status with PED (Halanych et al., 2011; Zhang & Hong, 2013). Zhang and Hong (2013) find that education moderated discrimination distress. They find that the detrimental effect of discrimination is stronger among Asian Americans with college or higher levels of education than among Asian Americans with lower than college levels of education. Another study reveals that perceived racial discrimination occurs in the workplace (Triana, Jayasinghe, & Pieper, 2015). A meta-analysis that analyses the perception of racial discrimination in the workplace found that racial discrimination negatively relates to the desire for a job (employment), physical health, psychological health, organisational citizenship behaviour, and perceived diversity climate, but positively relates to coping behaviour. One plausible explanation for the results of the present study may be that most of the lower educated were unemployed and may have experienced language barriers, thus their level of interaction with mainstream Australians was reduced. Therefore, they may have had minimal opportunity to experience events they could interpret as discriminative. However, the positive association between PED and education status

does not occur in all migrant population groups across the world and varies according to the social environment and the country in which the immigrants live (Schneider, 2013). No statistically significant association was observed between socioeconomic status and severe anxiety.

Table 12

Descriptive statistics showing frequency and cross-tabulation distribution

	Income			Fasting Blood Glucose Level			
Variable	**Low income N (%)**	**Medium income N (%)**	**High income N (%)**	**Low BGL N (%)**	**Normal BGL N (%)**	**High risk BGL N (%)**	**Diabetic BGL N (%)**
Income level							
Low income				12 (17.1)	51 (72.9)	1 (1.4)	6 (8.6)
Medium income				7 (16.7)	30 (71.4)	2 (4.8)	3 (7.1)
High income				1 (1.7)	39 (67.2)	2 (3.4)	16 (27.6)
Low BGL							
Normal BGL							
High risk BGL							
Diabetic BGL							
Age group							
18-28	26 (65.0)	11 (27.5)	3 (7.5)	11 (27.5)	29 (72.5)	0 (0.0)	0 (0.0)
29-39	14 (29.2)	16 (33.3)	18 (37.5)	3 (6.3)	37 (77.1)	2 (4.2)	6 (12.5)
40-50	13 (24.1)	14 (25.9)	27 (50.0)	4 (7.4)	33 (61.1)	3 (5.6)	14 (25.9)
51-61	13 (56.5)	1 (4.3)	9 (39.1)	2 (8.7)	18 (78.3)	0 (0.0)	3 (13.0)
62-72	4 (80.0)	0 (0.0)	1 (20.0)	0 (0.0)	3 (60.0)	0 (0.0)	2 (40.0)
Education level							
Not been to school	5 (100)	0 (0.0)	0 (0.0)	0 (0.0)	4 (80.0)	0 (0.0)	1 (20.0)
Primary	13 (92.9)	0 (0.0)	1 (7.1)	1 (7.1)	11 (78.6)	0 (0.0)	2 (14.2)
High school	5 (62.5)	2 (25.0)	1 (12.5)	4 (50.0)	4 (50.0)	0 (0.0)	0 (0.0)
Trade certificate	15 (48.4)	9 (29.0)	7 (22.6)	5 (16.1)	21 (67.7)	1 (3.2)	4 (12.9)
Diploma	16 (69.6)	7 (30.4)	0 (0.0)	3 (13.0)	18 (78.3)	0 (0.0)	2 (8.7)
Bachelor’s degree	11 (22.9)	18 (37.5)	19 (39.6)	4 (8.2)	38 (79.2)	2 (4.2)	4 (8.3)
Postgraduate degree	5 (12.2)	6 (14.6)	30 (73.2)	3 (7.3)	24 (58.5)	2 (4.9)	12 (29.3)

Marital status							
Married	36 (38.7)	16 (17.2)	41 (44.1)	10 (10.8)	63 (67.7)	4 (4.3)	16 (17.2)
Single	10 (47.6)	10 (47.6)	1 (4.8)	2 (9.5)	17 (81.0)	0 (0.0)	2 (9.5)
Divorced	7 (38.9)	3 (16.7)	8 (44.4)	0 (0.0)	11 (61.1)	1 (5.6)	6 (33.3)
Never Married	15 (46.9)	12 (37.5)	5 (15.6)	7 (21.1)	25(78.1)	0 (0.0)	0 (0.0)
De facto	2 (33.3)	1 (16.7)	3 (50.0)	1 (16.7)	4 (66.7)	0 (0.0)	1 (16.7)

Table 13

Cross tabulation of education and employment status with PED

Exposure	% of Discriminated in exposure	% of discriminated in non-exposure	Unadjusted Odds	P-Value
Education Status				
Educated	97.4	73.7	13.1 (3.2, 54.5)	0.000
Uneducated	73.7	97.4	0.1 (0.0, 0.3)	0.000
Employment Status				
Employed	99.1	85.2	20.0 (2.4, 164.4)	0.000
Unemployed	85.2	99.1	0.1 (0.0, 0.4)	0.000
Education _employment Status				
Educated-Employed	99.1	86	18.3 (22.2, 150.2)	0.000
Uneducated-Employed	68.8	97.4	0.1 (0.0, 0.3)	0.000
Educated-Unemployed	92.1	95.5	0.6 (0.1, 2.3)	0.400
Uneducated-Unemployed	68.8	97.4	0.1 (0.0, 0.3)	0.000

4.4 Dietary intake distribution and its associations with BMI and EBGL or T2DM

Dietary data of the sample population are shown in Table 14. Participants were asked how frequently they consumed specific dietary factors over the past 12 months. Frequency was rated from once per month to several times per week. Key findings are that 5.9% of the sample population consumed mainstream Australian vegetables 4-7 times weekly, while the same proportion consumed traditional African vegetables 2-3 times weekly within the same period. Reportage of the consumption of sweets and snacks, fast-food and processed meat was low in the sample population. Similarly, the consumption of fish and dairy products was low, with 75.9% of the population consuming fish 1-3 times per month and 55.8% consuming dairy products 1-3 times

per month. In contrast, red meat consumption was high, with a large proportion of the sample population consuming red meat 8-9 times per week.

It is well-established that dietary factors are associated with the prevalence of T2DM (Krishnan et al., 2010; Odegaard, Choh, Czerwinski, Towne, & Demerath, 2012). In the present study, sweets, snacks and processed meat consumption are inversely associated with EBGL or T2DM, contrary to established evidence (Krishnan et al., 2010; Odegaard et al., 2012). In previous prospective studies, higher consumptions of sugar-sweetened beverages and fried foods are associated positively with a greater magnitude of weight gain and increased risk for T2DM (Cahill et al., 2014; Krishnan, Coogan, Boggs, Rosenberg, & Palmer, 2010). In the present study, cross-tabulation was conducted to determine the consumption rates based on whether the participants' awareness of their EBGL or T2DM status affected rates of their consumption of various dietary factors. The results show that those aware of their EBGL or T2DM status reported lower consumption of sweets and snacks, fast-foods and processed meat, and higher rates of vegetables consumption compared to those who did not know or did not have EBGL or T2DM (see Figures 6 and 7). However, Table 14 also shows that the general population had a low rate of sweets and snacks, fast-food and processed meat consumption. Similarly, the consumption rates of red meat remained high among those aware of their high BGL status, with 40% consuming red meat 3-7 times a week.

The inverse relationship between sweets and snacks, fast-food and processed meat consumption may reflect a change in eating behaviour among those who were aware of their EBGL or T2DM status. Dietary data were self-reported, and it is therefore

uncertain how closely these data reflect actual consumption. However, those who were aware of their EBGL or T2DM status often reported diets closely matching recommendations rather than their actual consumption (Samuel-Hodge, Fernandez, Henríquez-Roldán, Johnston, & Keyserling, 2004). The high rate of red meat consumption in this study is consistent with dietary transition for people moving from undernutrition to food abundant environments, as observed in rural to urban migration in sub-Saharan Africa or from developing to industrialised countries (Agyemang, Boatemaa et al., 2016; Holmboe-Ottesen & Wandel, 2012; Vorster, Kruger, & Margetts, 2011). Since previous studies show that meat consumption is positively associated with the incidence of EBGL or T2DM (Barnard, Levin, & Capp, 2014; Mari-Sanchis et al., 2016; Pan, Sun, Bernstein, Manson, & Willett, 2013), to reduce the future prevalence of T2DM in this population, interventions moderating red meat consumption in this migrant population are warranted.

Dairy consumption was generally low in this population which is consistent with a qualitative study among Sudanese refugees in the US where participants considered dairy products, especially milk in the US less palatable (Willis & Buck, 2007). Notwithstanding this low consumption, dairy intake was significantly inversely correlated with EBGL or T2DM, independent of awareness of elevated BGL status. Since intake of dairy products is generally, associated with lower risk of EBGL or T2DM (Chen et al., 2014), further investigation to understand the reasons for low dairy consumption in this population is warranted.

Fish consumption was also low in the sample population. Although not significant, fish intake was inversely correlated with FBGL or T2DM. General evidence on the

benefits of fish intake in T2DM risk is unclear. Large US and Japanese prospective studies find that essential long chain omega-3 fish oil is associated with lower risk of metabolic syndrome and T2DM (Chen et al., 2014). In other studies, higher lean fish and total fish intake is found to reduce T2DM risk in both men and women (Nanri et al., 2011). This has been confirmed both in a meta-analysis and a randomised control trial where intake of fatty fish improved postprandial glucose regulation compared to lean fish intake (Rylander, Sandanger, Engeset, & Lund, 2014), although some contrary findings have emerged (Hagen et al., 2016). The overall low consumption of fish in this study is consistent with a study on sub-Saharan African migrants in the US where fish mainly of fresh water origin was consumed in small quantities by Sudanese refugees (Willis & Buck, 2007). Although enhanced fish consumption in this group could potentially result in lower cardiometabolic risk, the apparent cultural barriers (Krishnan, Rosenberg, Djoussé, Cupples, & Palmer, 2007) may preclude this.

Vegetable intake plays an important role in the prevention of multiple chronic diseases such as heart disease, cancer, diabetes and obesity and several micronutrient deficiencies (Wang et al., 2014; Woodside, Young, & McKinley, 2013). Increased vegetable consumption reduces overweight and obesity risk, and consequently T2DM risk (Boeing et al., 2012; Cooper et al., 2012). A significant positive correlation was observed between consumption of commonly available Australian vegetables and EBGL or T2DM in this study. Australian vegetables were also more often consumed than traditional African vegetables, which is consistent with previous Australian studies (Gichunge, Harris, Tubei, Somerset, & Lee, 2015; Pereira, Larder, & Somerset, 2010). The increased consumption of vegetables was associated with the participants' awareness of their EBGL/T2DM status. This implies that those who

were aware of the EBGL or T2DM status were cognisant of population advice on dietary factors appropriate for diabetic conditions. The results of the binary correlation between dietary factors, overweight, obesity and EBGL or T2DM are presented in Table 15. No significant association between overweigh, obesity, central adiposity (waistline) and EBGL or T2DM were found.

Table 14

Consumption rates of various dietary factors

Consumption rate	**Vegetable**		**Sweet and snacks**	**Fast foods**	**Processed meat**	**Red meat**	**Fish**	**Dairy**
	Traditional	**Australian**						
Never consume	23 (13.5)	4 (2.4)						
Consume one a month	86 (50.6)	42 (24.7)						
Consume 1 times a week	51 (30.0)	70 (41.1)						
Consume 2-3 times a week	10 (5.9)	44 (25.9)						
Consume 4-7 times a week	0 (0.0)	10 (5.9)						
Never consume			14 (8.2)	10 (5.9)	22 (12.9)	4 (2.4)	34 (20.0)	18 (10.6)
Consume 1-3 times a month			83 (48.8)	87 (51.1)	81 (47.6)	34 (20.0)	129 (75.9)	95 (55.8)
Consume 1-2 times a week			27 (15.9)	36 (21.2)	17 (10.0)	21 (12.4)	6 (3.5)	34 (20.0)
Consume 3-7 times a week			18 (10.6)	30 (17.6)	27 (15.9)	41 (24.1)	1 (0.6	23 (12.5)
Consume 8-9 times a week			28 (15.5)	7 (4.1)	23 (13.5)	70 (41.2)		

Table 15

Binary correlation of dietary factors with overweight, obesity, waistline and EBGL/T2DM

Dietary factors	**Overweight**	**Obesity**	**EBGL/T2DM**
Traditional vegetables	-0.113	.189*	-0.058
Australian vegetables	0.118	0.028	.211**
Sweets and Snacks	-0.094	0.080	-0.357**
Fast foods	-0.021	0.065	-0.196*
Processed meat	-0.044	.184*	-0.161*
Red meat	0.046	.153*	-0.014
Fish	0.011	-0.010	-0.067
Dairy	0.112	0.112	-0.202
Waistline	0.039	-0.494	0.028
Overweight			-0.002
Obesity			0.045

Note. *Correlation is significant at $p<0.05$; **Correlation is significant at $p<0.01$.

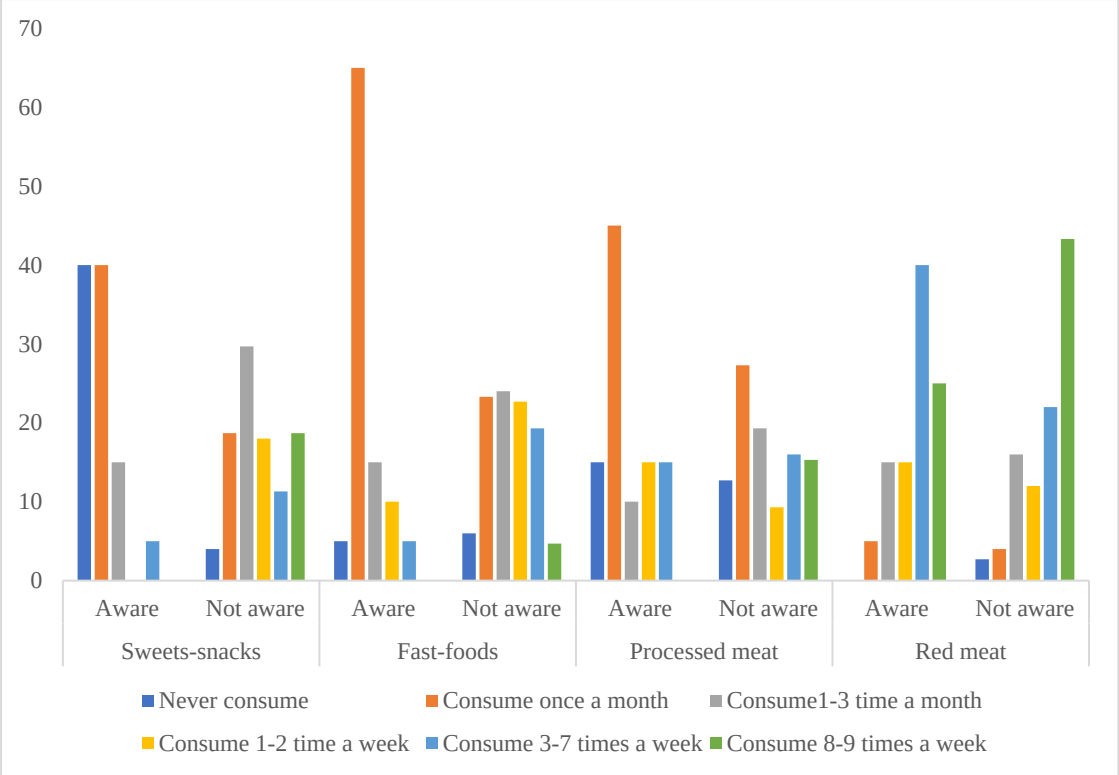

Figure 6. Percent rates of sweets and snacks, fast-foods, processed-foods and red meat consumption of those aware (Yes) and those unaware (No) of their EBGL/T2DM status in the sample population.

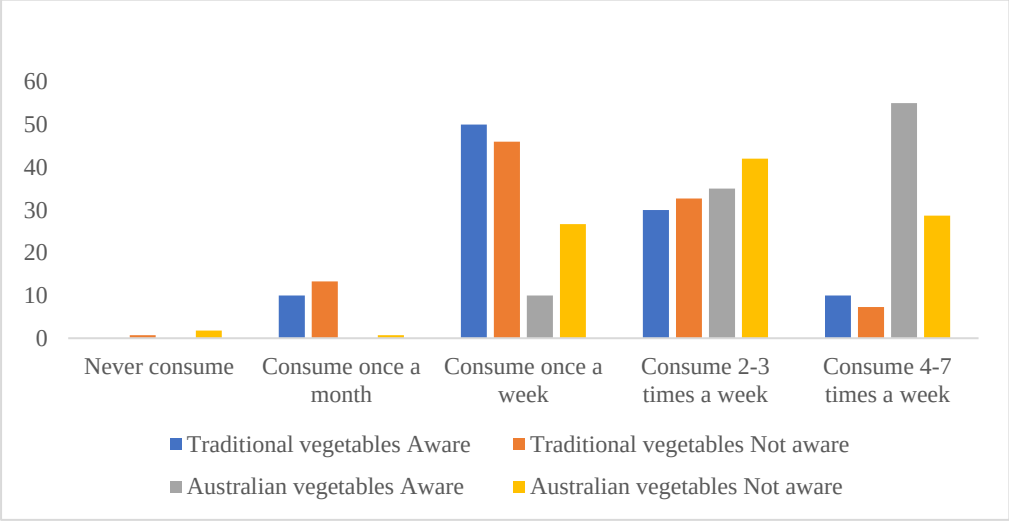

Figure 7. Percent rates of traditional and Australian vegetables consumption of those aware (Yes) and those unaware (No) of their EBGL/T2DM status in the sample population.

5 CHAPTER FIVE: GENERAL DISCUSSION AND CONCLUSION

5.1 Introduction

This section discusses the overall findings of the study as a single integrated body of scientific evidence. It summarises the overall findings and presents the key ones in relation to established evidence. It discusses them in tandem with potential implications for public health policy planning. Finally, it presents the limitations of the research, the key contributions of the thesis to knowledge, suggestions for future research and the conclusion.

5.2 Overall summary of the research

This study aims to determine potential mechanisms by which acculturation and PED predict the prevalence of EBGL or T2DM in sub-Saharan African immigrants in north-eastern Australia (Northern Territory and Queensland). Several objectives were undertaken to achieve these aims. The first objective assessed the prevalence of EBGL or T2DM, PED, depression, anxiety, stress and high BMI (overweight and obesity). The second determined the distribution of acculturation modes in the sample population. The third determined the distribution of PED, depression, anxiety, stress and EBGL or T2DM by sociodemographic characteristics (type of immigration visa, age, gender, income, education and employment). The last assessed the associations between all the independent variables (dietary factors, physical activities, acculturation, PED, depression, anxiety, stress and high BMI) and the dependent variable (EBGL or T2DM).

Of the three null hypotheses posed for this investigation, two were rejected, and one that stated “no association exists between dietary factors, physical activities, BMI and EBGL or T2DM” was partially rejected, since there was a strong inverse relationship between fast-foods and EBGL or T2DM. The most important point emerging from this research is that most findings are contrary to previous research related to the impact of acculturation and PED on NCDs worldwide. A detailed discussion of the findings is presented in the following sections.

5.3 Established evidence about acculturation of migrants and prevalence of NCDs

Well-established evidence has shown that movement of populations from one location to another due to political, humanitarian, economic and environmental reasons is increasing globally, and that this movement has both health and human rights implications (Carballo & Nerukar, 2001; Priebe et al., 2017; WHO, 2013; WHO Regional Office for Europe, 2017). Migrants are faced with multiple health issues and other barriers such as language and other cultural differences, legal status, economic and social difficulties (Carballo & Nerukar, 2001; Priebe et al., 2017; WHO, 2016, 2013; WHO Regional Office for Europe, 2017). Various factors contribute to poor physical and mental health. Among these are migration policies that have significant public health consequences physically (for example, hypertension and diabetes) and mentally (for example, depression, anxiety, and post-traumatic stress disorder) (Hacker et al., 2015; Kristiansen et al., 2007; Marceca, 2017; Martinez et al., 2015).

Inequality in employment influenced by various factors including ethnic discrimination also is reported by migrants (Orrenius & Zavodny, 2012), and this

exacerbates mental and physical health issues (Paradies, Paradies, et al., 2015). Recent research in numerous economies specifies that immigrants are more likely to work in risky careers than the host communities. This is confirmed by job-related injury and mortality data in most progressive economies (Orrenius & Zavodny, 2012). Generally, health issues among migrants are under reported due in part to difficulties in recruitment (Fête, Aho, Benoit, Cloos, & Ridde, 2019). This may be due to fear of the exposure of their identity (Fete, et al., 2019). Other barriers such as language are also plausible (Lee, Sulaiman-Hill, & Thompson, 2014). The small amount of available data show greater morbidity among migrants, especially relating to mental health issues including, depression, post-traumatic stress disorder, psychosomatic complaints, anxiety, and certain chronic diseases including diabetes, as well as infectious diseases such as tuberculosis and hepatitis B (Kirmayer et al., 2011; Priebe et al., 2017; Wagner et al., 2014). Most of these health conditions are to some extent linked to the acculturation process (Concha et al., 2016; Fritz et al., 2008; George et al., 2015; Hovey & Magaña, 2002; Kirmayer et al., 2011; Potochnick & Perreira, 2010). The findings of the present study uncover some of those complex conditions faced by migrants. The way these factors contribute to physical and mental well-being of the sub-Saharan African migrants is discussed below.

5.4 Disease manifestation and visa types

The most significant finding of this study is the differing association of EBGL or T2DM according to immigration visa type. This indicates that stratification of migrants according to such sociodemographic characteristics may represent a pathway towards more effective targeted health promotion in this migrant population. Skilled migrants had a significantly higher prevalence of EBGL or T2DM, SD and anxiety

compared to humanitarian migrants, and the humanitarian migrants were 80% less likely to have EBGL or T2DM. Therefore, when the number of skilled and humanitarian migrants in the sample are compared, the humanitarian visa holders are the majority (58.2%), while skilled migrants constitute only 15.9%. So, the large number of the humanitarian participants could be an expected confound in the significance result in the relationship of EBGL or T2DM and skilled migrants. Nevertheless, the numerical representation did not confound the result. Therefore, it is plausible that the significant result was not by chance. Another very important finding that requires attention is that the humanitarian/refugee migrants constitute the majority (58.2%/n=99) of the sample and out of the 99 participants, almost half (47) of them came from South Sudan while the rest were from other African countries, so, the low prevalence of EBGL or T2DM in humanitarian/refugees could not be attributed to a single cultural background (see Table 16). Similarly, skilled migrants were not from a single African country, therefore, the high prevalence of EBGL or T2DM among them could not be attributed to a single cultural background. The only factors that could be implicated in the incidence and prevalence of EBGL or T2DM may be acculturation, PED, depression and anxiety as they were found to be positively associated with EBGL/T2DM.

Table 16.

Distribution of participants according to the country of origin and type of entry visa to Australia

Countries of Origin	**Total Number**	**Type of visa**			
		Humanitarian	**Student**	**Skilled**	**Family**
South Sudan	49	47	0	0	2
Sudan	6	5	1	0	0
Uganda	10	1	4	1	4
Kenya	11	0	5	3	3
Rwanda	1	1	0	0	0
Burundi	6	6	0	0	0
Congo	14	14	0	0	0
Tanzania	1	0	0	1	0
Zimbabwe	11	0	3	8	0
Nigeria	7	0	1	3	3
Sierra Leone	16	14	0	0	2
Liberia	10	7	0	0	3
Ghana	9	0	5	2	2
South Africa	7	0	1	5	1
Ethiopia	4	2	2	0	0
Eritrea	2	1	0	0	1
Somali	2	1	1	0	0
Zambia	4	0	0	4	0
Total	**170**	99	23	27	21

5.5 Impact of acculturation and PED on EBGL or T2DM, depression and anxiety

Most previous studies have assessed associations between acculturation and T2DM or between PED and T2DM, separately but not in combination (Kaholokula et al., 2008; Kandula et al., 2008). Studies that analyse both factors together explore their effect on psychological distress (stress, anxiety and depression) (Aichberger et al., 2015). The present study combines both factors in a single analysis, to determine associations

between acculturation, PED, and EBGL or T2DM. The partial-mediation effect of PED in the relationship between acculturation and EBGL or T2DM may explain why highly acculturated migrants are more likely to have EBGL or T2DM than those who are less acculturated and educated (Jatrana, Pasupuleti, & Richardson, 2014; Kaholokula & Iwane, 2010; Zheng et al., 2012). This is because those who are highly acculturated, educated or integrated are more exposed to the wider host population than those in the traditional mode or are marginalised. Their level of interaction with the host community might increase their chance of interpreting any interactions as discriminatory. Those migrants in the traditional mode have had limited exposure to the host community and therefore have a lower chance of experiencing events that could be interpreted as discriminatory, and thus manifest an inverse relationship with EBGL or T2DM compared to those in the integrated mode. Given the link between PED and poor health among migrants (Ikram et al., 2015; Kaholokula et al., 2008), the results of this study may suggest that the positive association between the integrated mode of acculturation and EBGL or T2DM is partially attributed to PED. This implies that the perception of discrimination is a risk factor for developing EBGL or T2DM in the sample population. An initiative to create better harmony between sub-Saharan African migrants and the wider Australian society may reduce the EBGL or T2DM risk.

5.6 Nutritional acculturation, BMI and EBGL or T2DM

In general, after migration, migrants undergo a process of behavioural transformation. This process involves behavioural change of a group or individuals (Graves, 1967) and usually culminates in changes in cultural patterns that manifest in dietary transition and other lifestyle alterations such as smoking and alcohol consumption

(Graves, 1967; Lakey, 2003; Oppedal et al., 2005; Sam & Berry, 2010b). Most of these changes are known to be negative and are associated with various NCDs including EBGL or T2DM (Pérez-Escamilla & Putnik, 2007). In the present study, sub-Saharan African migrants were found to adopt eating behaviours like those of the Australian population. It seems this group experiences a dietary intake habit shift from traditional dietary consumption to the newly discovered diets in their surroundings, although they still consume traditional food to some considerable degree. This change was observed in the vegetable consumption rate in this study (see Table 14). Traditional vegetables were consumed less than the commonly available Australian ones. This may be due to the scarcity of the traditional vegetables. However, another plausible explanation is that the population is undergoing dietary acculturation towards consuming more locally available Australian fresh produce. Further research is required to elucidate the underlying processes.

Although the population is adopting a broader consumption of Australian vegetables, the consumption of sweets, snacks and processed food was generally reported as low (see Table 14). Such changes in dietary intake are known to occur gradually. For example, numerous studies among Latinos in the US, reveal that on arrival to the USA, they practice healthier behaviours than the mainstream population, but these change over time as migrants continue to associate and integrate into the mainstream lifestyle (Pérez-Escamilla, 2011; Pérez-Escamilla & Putnik, 2007; Venkatesh et al., 2017).

Although no significant association between BMI and acculturation was observed in the present study, BMI has been found to be associated positively with acculturation

as migrants resettle (Morales-Campos et al., 2010; Novotny et al., 2009; Pérez-Escamilla & Putnik, 2007; Renzaho & Burns, 2006). For example, BMI and waist circumference were closely associated with the degree of acculturation of Mexican women who moved to the US (Morales-Campos et al., 2010). The study found the lowest BMI and waist circumference among women of either middle range English language proficiency or those who had emigrated to the US between the ages of 16-25 (Morales-Campos et al., 2010). Similarly, studies among Filipinos and Pacific Islanders show that BMI is associated with the level of acculturation and the length of stay in the US (Novotny et al., 2009). Those Pacific Islanders who had lived longer in US, ate less fruit, but more meat, consumed more sweetened drinks and were heavier than those who had spent less time there (Novotny et al., 2009). In Europe, Smith et al. (2012) find that second generation Indian and Chinese immigrants were more likely to be obese than first-generation migrants. These findings indicate that BMI increases with increasing acculturation levels in migrants moving from developing to industrialised country environments.

In most studies that have assessed prevalence of overweight and obesity, higher levels of overweight and obesity were reported among male than female migrants (Kowal, Woronkowicz, Kryst, Sobiecki, & Pilecki, 2016; Zhang et al., 2018). However, this is contrary to the findings of the present study where females were more likely to be obese than males. Nevertheless, this is consistent to some findings in sub-Saharan African populations in Africa (Kirunda, Fadnes, Wamani, Van den Broeck, & Tylleskär, 2015; Ofori-Asenso, Agyeman, Laar, & Boateng, 2016), where this gender trend is considered normal in some African traditions. Some African ethnic communities consider a woman's larger body size to be a sign of prestige, health and

success, not as an unhealthy condition (Kanter & Caballero, 2012). This may imply that some sub-Saharan African migrants in Australia still maintain that belief and practice.

This study was conducted among first-generation migrants since most African migrants in Australia are recent arrivals. The study sample was drawn mainly from those who migrated to Australia as adults. They were found to have a high prevalence of overweight and obesity. Although BMI did not show significant association with EBGL or T2DM in the present study, previous studies indicate that the length of stay in the host community may influence migrant health due to adoption of unhealthy eating habits (Morales-Campos et al., 2010; Novotny et al., 2009; Pérez-Escamilla & Putnik, 2007; Renzaho & Burns, 2006). It is therefore plausible that this population may follow this trend as their years in Australia increase. For example, meat consumption was high in the study population and consumption of meat is known to associate positively with weight increase (Dabbagh-Moghadam et al., 2017; Zhang et al., 2009). Thus, although the association between BMI and EBGL or T2DM was not statistically significant, it may only be a matter of time before EBGL or T2DM prevalence will increase in this population. Overweight and obesity are major risk factors for chronic health conditions such as T2DM, coronary heart disease (CHD), hypertension, stroke, some forms of cancer, and osteoarthritis (Maskarinec et al., 2009; Nguyen et al., 2011). Significantly, studies have regularly linked overweight and obesity with T2DM. Nguyen and colleagues (2011) find that prevalence of diabetes among adults increases with BMI class, from 8% for normal weight to 43% for obesity level three. Therefore, the lack of significant association between BMI and EBGL or T2DM in this study implies that the main factors implicated for the risk

of EBGL or T2DM are PED, depression, anxiety and stress, although overweight and obesity may still have some degree of influence. This is reflected by the large proportion (56.7%) of those with EBGL or T2DM not being overweight.

Acculturation also is known to be directly associated with EBGL or T2DM and previous studies have found positive associations (Kandula et al., 2008; Zheng et al., 2012). One study among Native Hawaiians finds that those in the traditional mode of acculturation are more likely to have T2DM than those in the assimilated, marginalised or integrated modes of acculturation. Similarly, Mainous et al. (2006) find that Hispanics with low levels of acculturation are more likely to have a T2DM diagnosis compared to those either born in the US or with higher acculturation levels. At the same time, groups with moderate levels of language acculturation have the greatest prevalence of undetected EBGL (Mainous et al., 2006). While Hispanics born in the US or with higher levels of language acculturation are more likely to have BMI ≥30 and have lower prevalence of T2DM. This previous finding, contradicts many recent studies that examine associations of acculturation and poor health among migrants where higher acculturation levels have significant association with T2DM (Domnich, Panatto, Gasparini, & Amicizia, 2012; Kennedy, Kidd, McDonald, & Biddle, 2015).Numerous studies indicate an increase in the prevalence of diabetes associated with higher acculturation modes among migrants in Western countries (Deng et al., 2013; Montesi et al., 2016). Anderson (2015) finds that the strength of this association increases with the length that migrants spend in the host country(Anderson, 2015b)(Anderson, 2015b)(Anderson, 2015b)(Anderson, 2015b)(Anderson, 2015b)(Anderson, 2015b).

The integration mode of acculturation was found to be positively associated with EBGL or T2DM, while the traditional mode of acculturation was 80% less likely to associate with EBGL or T2DM in this study. This result is contrary to some previous findings (Kandula et al., 2008; Mainous et al., 2006; Zheng et al., 2012), where the traditional mode of acculturation correlated positively with EBGL or T2DM compared to higher levels of acculturation (integration and assimilation), but is consistent with the most recent studies (Domnich et al., 2012; Kennedy et al., 2015).

5.7 Acculturation and psychological impact

The acculturation process influences behavioural changes both positively and negatively. Negative influences may manifest in negative psychological episodes such as depression, anxiety and stress (Graves, 1967; Oppedal et al., 2005; Sam & Berry, 2010b). Migrants face challenges in economic and gender roles, financial strain, different climate and linguistic environments as they try to resettle in new physical and social environments (Butler et al., 2015; Henkin et al., 2011). One meta-analysis, in the US reveals that the assimilation mode of acculturation is inversely correlated with depression. Traditional and integration modes are also inversely correlated with depression, although this is not statistically significant (Gupta et al., 2013). However, it is contrary to observations in the present study where highly acculturated participants with higher socioeconomic status were more likely than those less acculturated and in lower socioeconomic status to have depression, anxiety and EBGL or T2DM. These differences may reflect the impact of PED and the higher acculturation (integrated) mode, since most participants with severe depression, anxiety, stress and EBGL or T2DM had a higher socioeconomic status and were found to be in the integration mode of acculturation with higher levels of PED.

In a separate study, a lower risk of depression and co-morbidities were found among the native-born participants in comparison to migrant participants (Ünlü Ince et al., 2014). Studies conducted among Mexican and Korean migrants in the US find that depression levels were higher among migrants in comparison to the main US population (Concha et al., 2016; Gonzalez et al., 2001; Oh et al., 2002). Similar effects of acculturation on anxiety and stress have been reported (Aspray et al., 2000; George et al., 2015; Hovey & Magaña, 2002; Kirmayer et al., 2011; Potochnick & Perreira, 2010). Stress also varies according to the length of stay in the host country (Hyung-Chul et al., 2015) and it has also been noted that stress levels vary according to the type of migrants (refugee or voluntary), with refugees having higher levels of stress than voluntary migrants (Colic-Peisker & Tilbury, 2007). However, in the present study, those with severe stress were not refugees, but skilled migrants, which is an important finding that needs further investigation to elucidate.

5.8 Impact of PED on EBGL or T2DM in this study

PED has been implicated in various illnesses in migrant populations worldwide (Paradies, Ben, et al., 2015; Todorova et al., 2010; Viruell-Fuentes et al., 2012; Whitaker et al., 2017). This thesis assesses discrimination based on ethnicity. Ethnic discrimination usually stems from racism, which frequently leads to the development of negative attitudes and beliefs toward racially prejudiced groups resulting in differential treatment of members of these groups by both individuals and social institutions (Jones, 2000).

In Australia, “one in ten Australians believe that some races are inferior or superior to others. Eighteen per cent (18%) of Australians surveyed said they had experienced

discrimination because of skin colour, ethnic origin or religion. The most often reported location of discrimination was the neighbourhood (58%), followed by shopping centres (42.8%) and at work (39%)" (Australian Human Rights Commission, 2014). Sub-Saharan Africans report a wide range of ethnic discrimination in Australia (Markus, 2016). In the present study, a total of 94.7% (80% moderate and 14.7% high level) of participants experienced PED, the prevalence of which was higher among the employed than the unemployed, and higher among those educated than uneducated. This manifested itself more among skilled migrants than humanitarian/refugees, student or family/spouse migrants. This may be due to 88.9% of skilled migrants being employed and 100% being well educated. This finding agrees with the findings of Markus (2016), that sub-Saharan Africans experience high levels of discrimination in Australia. Previous studies reveal that ethnic disparities in health are persistent and have worsened in recent years (Williams & Collins, 2001; Williams & Sternthal, 2010) and this could be associated with PED (Ensher et al., 2001; Pascoe & Smart Richman, 2009). Therefore, the significant correlation of PED with EBGL or T2DM in the present study is a signal that this population is likely to experience a rapid rise in NCDs, unless strategic public health policies are developed.

5.9 Implications for policy and practice

Sub-Saharan African migration to Australia has been a relatively recent phenomenon (Jakubowicz, 2010) and its population is rapidly increasing in Australia. The sub-Saharan African migrant population may increase through new arrivals from Africa and by new births. In Australia, recent fertility rates among women aged 30-34 indicate that 123 babies are born per 1,000 women (ABS, 2016). However, the exact

fertility rate for the sub-Saharan African migrant population in Australia is not known. The sub-Saharan African fertility rate in the African continent was 4.8 babies per woman in 2016 (Roser, 2017). So, if sub-Saharan African migrants in Australia are to reflect similar African fertility rates in Australia, the sub-Saharan African migrant population may increase rapidly. Given the magnitude of PED observed in this study and evidence of discrimination reported against this population in Australia (Markus, 2016), it is plausible to project significant public health issues such as increased EBGL or T2DM and mental health prevalence among this population as it grows and attains significant population size over the next decade. It is recommended that Australian governments at both federal and state levels develop social and health policies to reduce ethnic intolerance (both real or perceived) in public and work places and create programs to enhance sub-Saharan African interaction with the wider Australian society so that both cultural groups may learn to coexist positively and value each other's culture.

5.10 Limitations of this research

There are several limitations to this research: firstly, this research was conducted in only two cities of Australia and sampling was not intended to generalise to the entire sub-Saharan African population in Australia. Therefore, the finding of this study serves as preliminary information for further confirmatory studies. Secondly, the study was cross-sectional in design. Typically, a cross-sectional design only describes the prevalence of outcomes in a study but cannot determine causal effects. Thirdly, data were collected via face-to-face interviews and these can be susceptible to interviewer's effects and they are feasible only in small samples (Opdenakker, 2006). Fourthly, a purposive sampling framework was used for the recruitment of

participants, and purposive sampling is potentially subjective in nature and can lead to bias in selection. Lastly, the questionnaire used to collect data in this study was designed to collect only quantitative data thus the qualitative aspect of the research was not addressed. This process limited the information that could have been obtained using a questionnaire with more open-ended questions to give participants an opportunity to express themselves freely about their perception of ethnic discriminative experience or why they eat certain foods more than the others for example.

5.11 Unique contribution of this study to knowledge

To the best of my knowledge, this study is the first of its kind conducted among sub-Saharan African in Australia or elsewhere. This research was the first that assessed the impact of acculturation, PED, depression, anxiety and stress on the prevalence of EBGL or T2DM among sub-Saharan African migrants in an OECD country. No study to date stratifies immigrant groups into immigration visa types to assess an association with any kind of health determinant. Results of this study may open ways for future health promotion intervention strategies to target migrants worldwide. This thesis, therefore, provides preliminary data on the associations of EBGL or T2DM, PED, depression, anxiety and stress based on types of immigration visa among migrants. It could serve as a reference for further studies among migrant populations across the world. Previous evidence shows positive associations between BMI and EBGL or T2DM, but BMI in this study was not significantly associated with EBGL or T2DM. This implies that BMI may not be a significant contributing factor for EBGL or T2DM risk in this population. Also, although socioeconomic status is associated inversely with an array of NCDs, this research found positive correlations contrary to

this established evidence. This opens the way for further studies to confirm this finding. To some extent, the findings of this thesis are consistent with past studies that associate acculturation and PED with EBGL or T2DM. However, many past studies assess these variables separately and in different populations. This research was specially designed to consider all these factors (acculturation, PED, depression, anxiety and stress) at one time and in a single model to analyse the effects of these variables on each individual participant in both combined and separate models in multiple regression analysis while adjusting for each factor in the analysis process. It thus provides further insight on the impact of each factor on EBGL or T2DM. In other words, the individual effect of each factor was observed separately, thus giving a clearer perspective of the contribution to the occurrence of EBGL or T2DM.

5.12 Future research opportunities

Despite the potential contributions discussed, this study can be considered as a preliminary step as it was conducted in only two cities of Australia. It is, clearly not representative of the sub-Saharan African population in Australia. Thus, further robust studies with larger and more representative samples are encouraged in this population in Australia and elsewhere in the world. This future research may consider the following: firstly, a cross sectional survey across all states and territories with a representative sample of sub-Saharan African migrants in Australia; secondly, inclusion of qualitative data using a mixed-method approach to give both quantitative and qualitative information; and thirdly, longitudinal studies in the population to further investigate the impact of the factors on individuals more clearly in a given period to ascertain their impact over time for reliable conclusions.

5.13 Conclusion

This study was conducted to determine potential mechanisms by which acculturation and PED predict the prevalence of EBGL or T2DM in sub-Saharan African immigrants in Queensland and the Northern Territory, Australia. Although most findings of the research confirm previous studies of acculturation and PED conducted among migrants world-wide, some findings were contrary. The study finds positive associations between socioeconomic status and the prevalence of EBGL or T2DM, depression and anxiety. The most important result that emerges from this study is the variation in prevalence of EBGL or T2DM, depression and anxiety based on the categorisation of migrants according to their immigration visa types. The unique manifestation in this study is that migrants who migrated to Australia on humanitarian/refugee visa were less likely to have EBGL or T2DM, depression and anxiety. Generally, humanitarian/refugees are expected to be of lower socioeconomic status and psychologically unstable due to past traumatic experiences, therefore they are more likely to be susceptible to physical and mental health conditions as they resettle in a new environment. This study reveals findings contrary to this common concept and previous evidence (Bardenheier et al., 2019; Chandra, Duri, & Smith, 2019; Yun et al., 2012). Instead, those who moved to Australia voluntarily (skilled migrants), with jobs in their profession and higher incomes, were found to be more likely to have these various ailments than the humanitarian/refugee visa holders. This finding therefore gives new insight into migrant acculturation and morbidity research. More studies that stratify migrants into their migration visa types may validate the present study and provide tools for targeted health promotion strategies among migrants. However, the finding agrees with the conceptual framework that indicates

that there is a link between acculturation and T2DM and this has been mediated by PED, depression and anxiety in this population.

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APPENDIX 1: PARTICIPATION INFORMATION LETTER

PROJECT TITLE: Are the change of African lifestyle to Australian and perception of being discriminated contributing factors to becoming diabetic among sub-Saharan African migrants in Queensland?

STUDENT RESEARCHER: Paul Izaru Bilal

STUDENT'S DEGREE: PhD

SUPERVISOR:

Principle Supervisor: Associate Professor Shawn Somerset
National Public Health Discipline Leader

Associate supervisor: Associate Professor Paula Schultz
Deputy Head of School of Nursing, Midwifery and Para-medicine

Dear Participant,

You are invited to participate in the research project described below.

What is the project about?

The research will determine how many people have elevated blood glucose and type 2 diabetes as well as overweight and obesity among sub-Saharan Africans. It will also assess how much people have changed their lifestyle from the African way to that of Australian (acculturation) and how many will say they have experienced discriminative episodes and whether these have contributed to elevated blood glucose

and type 2 diabetes. The research will also try to understand relationships between acculturation modes, perceived discrimination, obesity and type 2 diabetes and determine whether perceived discrimination affects healthcare services among the diabetic members of the population.

This project is important as many studies conducted elsewhere show that acculturation process of migrants in the host countries plays an important role in causing various chronic diseases among migrants. In Australia, sub-Saharan African migrants are experiencing a rapid weight increase and prevalence of type 2 diabetes. This phenomenon may be linked to acculturation factors including perceived discrimination. Since data are scarce on this population, it would be very difficult for any level of government in Australia to plan effectively for healthcare services among the sub-Saharan population coupled with language and cultural barriers. This research, therefore, will provide information on the occurrence of type 2 diabetes among sub-Saharan Africans in Queensland and will lead to a better management of type 2 diabetes and other chronic diseases among the sub-Saharan Africans.

Who is undertaking the project?

This project is being conducted by Mr Paul Izaru Bilal and will form the basis for the Doctor of Philosophy (PhD) degree at Australian Catholic University under the supervision of Associate Professors Shawn Somerset and Professor Paula Schultz.

Are there any risks associated with participating in this project?

There are no foreseeable risks for you in participating in this research. The only process that may slightly be uncomfortable is the collection of a blood sample for a

fasting blood glucose test. The process will involve pricking of your finger by lancet to collect a small drop (0.3-1.3 μl) of blood for the test.

What will I be asked to do?

In the entire process of the research you will be asked to:

- take part in focus group discussion where participants will discuss some questions related to acculturation and perceived discrimination. The discussion will be audio-taped to help the researcher make detailed notes after the discussion and use the audiotape as a reference during analysis and report writing.
- take part in answering a survey that is intended to collect information on your day-to-day lifestyle, social preferences and experience of discriminative events that occurred to you and that you perceived to have happened due to your race/ethnicity.
- have your weight and height measured to estimate your Body Mass Index (BMI) that will be used to determine your risk of type 2 diabetes.
- have your blood sample tested for fasting glucose level to see whether it is elevated or not. The blood sample for the test will be taken and tested by the researcher who has received training under the guidance of the two experienced supervisors.
- go to African house to take part in focus group discussion. However, the survey interviews will take place in in your house or any appropriate place of your choice (at “a mutually convenient location”).

How much time will the project take?

- The focus group discussion and the face-to-face interviews will not take place on the same day. Focus group discussion will take place before the survey interviews.
- The focus group discussion will take one hour, while face-to-face interviews may take 20-30 minutes. There will not be any other activities where you will be asked to participate after the completion of the two processes.

What are the benefits of the research project?

At an individual level the blood sugar level testing will be beneficial to you as it will give you an idea about what your blood sugar level is; normal or elevated, and when slightly elevated, it will be an alert for you to start monitoring and receiving medical advice from your General Practitioner. Similarly, when levels are elevated (close to being diabetic) you will be advised to immediately seek medical attention for management.

On the general level of benefits, this study outcome will provide information to all levels of Australian government to plan effectively for healthcare services among sub-Saharan African migrants. This is because a few researches among sub-Saharan African migrants in Australia show that sub-Saharan Africans are experiencing rapid weight increase and prevalence of type 2 diabetes. This phenomenon may be linked to acculturation factors including perceived discrimination. There is scanty data on sub-Saharan Africans in Australia; it is therefore not easy for any government levels in Australia to plan for management of health problems among this emerging African

community. Language and cultural barriers add to these difficulties, therefore your participation in this research will be a milestone for future healthcare strategy development and planning for an effective health service for sub-Saharan African migrants in Australia.

Can I withdraw from the study?

Participation in this study is completely voluntary. You are not under any obligation to participate. Even after choosing to participate, you can withdraw from the study at any time without adverse consequences, however, you cannot withdraw the survey paper that you have submitted and that has been mixed with other survey papers from other participants. Possible withdrawal stage is when the survey interviews are still on process.

Will anyone else know the results of the project?

Data will be securely stored: audio-taped recording during the focus group discussions and the completed interview survey sheets will be kept in a locked cabinet accessible only to the research team (supervisors and the researcher). All data will be in a non-identifiable form; therefore, nobody can identify any participant after all survey papers are put together.

The result of the research, however, in its non-identifiable form be published in scientific journals or might be used by other future researchers. This will not indicate any personal information of participants.

Will I be able to find out the results of the project?

After completing the research, the result will be written into a report (thesis) for an award of Doctor of Philosophy (PhD) degree. After that the researcher will present the finding of the research to all participants in a general meeting of participants to be held immediately after Australian Catholic University approves the report and the degree is awarded.

Who do I contact if I have questions about the project?

Any participants who want to know about the process and the general findings of the research or want to ask any questions, he/she can contact the researcher (Mr. Paul Izaru Bilal) to ask questions about the project on the following contact:

Phone: [redacted]

Email: [redacted]

What if I have a complaint or any concerns?

The study has been approved by the Human Research Ethics Committee at Australian Catholic University. If you have any complaints or concerns about the conduct of the project, you may write to the Chair of the Human Research Ethics Committee care of the Office of the Deputy Vice Chancellor (Research).

Chair, HREC

c/o Office of the Deputy Vice Chancellor (Research)

Australian Catholic University, Melbourne Campus

Locked Bag 4115, FITZROY, VIC, 3065

Phone: 03 9953 3150, Fax: 03 9953 3315

Email: res.ethics@acu.edu.au

Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

I want to participate! How do I sign up?

On agreeing to participate in the research, you will be issued with two copies of the participants' consent form. You will sign both copies, keep one and return a copy to the researcher immediately before completing the survey.

Yours sincerely,

Paul Izaru Bilal

APPENDIX 2: CONSENT FORM

TITLE OF PROJECT: Are the change of African lifestyle to Australian and perception of being discriminated contributing factors to becoming diabetic among Sub-Saharan African migrants in Queensland?

STUDENT RESEARCHER: Mr Paul Izaru Bilal

SUPERVISOR: Associate Professor Shawn Somerset and Associate Professor Paula Schultz

I ..... have read/have had read to me and understood the information provided in the letter to Participants. Any questions I asked have been answered to my satisfaction. I agree to participate in this research process which involves focus group discussion where audiotaping will take place, as well as a survey interviews and blood sugar level testing for diabetes, realising that I can withdraw my consent at any time without adverse consequences. I agree that research data collected for the study may be published or may be provided to other researchers in a form that does not identify me in any way. I will participate in the following research process (Check applicable to you):

☐ Participate in survey interviews only

☐ Participate in both survey interviews and focus group discussions

☐ Participate in focus group discussions only

Name of participant: _____

Signature_____

Date_____

Signature of supervisor_____

Date_____

Signature of student researcher_____

Date_____

APPENDIX 3: RESEARCH QUESTIONNAIRE

Acculturation, Perceived discrimination, Depression, Anxiety and Stress Scale

Background Information:

This survey is anonymous and confidential. It is designed to assess acculturation process, perceived discrimination and Depression, Anxiety and Stress of the Sub-Saharan African migrants in Queensland.

Part 1: Socio-demographic information

Sex: ☐ Male ☐ Female

Marital status: ☐ Married ☐ Single ☐ Divorce ☐ Never Married

Age: ____ years

Education level: ☐ Primary level

☐ High school

☐ Vocational Trade Certificate

☐ Diploma

☐ Bachelor's degree

☐ Postgraduate

Annual household income (approx.): (indicate your Parent/Guardian's income if you don't work)

_____

Your country of origin _____

Method of migration to Australia:

How did you migrate to Australia (check only one of the following options)

☐ Refugee and Humanitarian migration ☐ Student ☐ Skilled Migration.

Anthropometry and Blood glucose

Weight_____Hight_____waistline_____Glucose level_____

Part 2: Measure of acculturation status

Please circle *one* of the numbers to the right of each question to indicate your degree of agreement or disagreement.

Many of these questions will refer to your *heritage culture*, meaning the original culture of your family (other than Australian). It may be the culture of your birth, the culture in which you have been raised, or any culture in your family background.

	Disagree								**Agree**
1. I often participate in my *heritage* cultural traditions.	1	2	3	4	5	6	7	8	9
2. I often participate in mainstream Australian cultural traditions.	1	2	3	4	5	6	7	8	9
3. I would be willing to marry a person from my *heritage-culture*.	1	2	3	4	5	6	7	8	9
4. I would be willing to marry a white Australian person.	1	2	3	4	5	6	7	8	9
5. I enjoy social activities with people from the same *heritage culture* as myself.	1	2	3	4	5	6	7	8	9

6. I enjoy social activities with typical Australian people. 1 2 3 4 5 6 7 8 9

7. I am comfortable interacting with people of t

he same *heritage culture* as myself. 1 2 3 4 5 6 7 8 9

8. I am comfortable interacting with typical Australian people. 1 2 3 4 5 6 7 8

9

9. I enjoy entertainment (e.g. movies, music) from

my *heritage cultures*. 1 2 3 4 5 6 7 8 9

10. I enjoy Australian or American entertainment

(e.g. movies, music). 1 2 3 4 5 6 7 8 9

11. I often behave in ways that are typical of

my *heritage-culture*. 1 2 3 4 5 6 7 8

9

12. I often behave in ways that are typically Australian. 1 2 3 4 5 6 7 8 9

13. It is important for me to maintain or develop the practices of

my *heritage-culture*. 1 2 3 4 5 6 7 8 9

14. It is important for me to maintain or develop

Australian cultural practices. 1 2 3 4 5 6 7 8 9

15. I believe in the values of my *heritage culture*. 1 2 3 4 5 6 7 8 9

16. I believe in mainstream Australian values. 1 2 3 4 5 6 7 8 9

17. I enjoy the jokes and humour of my *heritage culture*. 1 2 3 4 5 6 7 8 9

18. I enjoy white Australian jokes and humour. 1 2 3 4 5 6 7 8 9

19. I am interested in having friends from

my *heritage-culture*. 1 2 3 4 5 6 7 8 9

20. I am interested in having white Australian friends. 1 2 3 4 5 6 7 8 9

21. Rate yourself on how much you believe in African values (e.g. about marriage, families, education, work, etc):

1 2 3 4 5

(Do not believe) (Strongly believe)

22. Rate yourself on how much you believe in Australian (Western) values:

1 2 3 4 5

(Do not believe) (Strongly believe)

23. Rate yourself on how well you fit when with other African of the same ethnicity:

1 2 3 4 5

(Do not fit) (Strongly fit)

24. Rate yourself on how well you fit when with other Australian who are non-African

1 2 3 4 5

(Do not fit) (Strongly fit)

25. There are many ways in which people think of themselves. Which ONE of the following most closely describes how you view yourself?

1. I consider myself basically an African person (e.g. Sudanese, South Sudanese, Liberian, Sierra Leonean, etc.). Even though I live and work in Australia, I still view myself basically as an African person.
2. I consider myself basically as an Australian. Even though I have an African background and characteristics, I still view myself basically as an Australian.
3. I consider myself as an African-Australian, although deep down I always know I am an African.

4. I consider myself as an African-Australian, although deep down, I view myself as an Australian first.

5. I consider myself as an African-Australian. I have both African and Australian characteristics, and I view myself as a blend of both.

The below questions try to identify what food preference you have at home and at restaurants. Choose one answer that applies to you from the listed multiple answers.

26. What is your food preference at home?

1. Exclusively African food
2. Mostly African food and some Australian
3. About equally African and Australian
4. Mostly Australian food
5. Exclusively Australian food

27. What is your food preference in restaurants?

1. Exclusively African food
2. Mostly African food and some Australian
3. About equally African and Australian
4. Mostly Australian food
5. Exclusively Australian food

Part 3: Measure of perceived discrimination

This section is to assess your experience in your interaction with others who are not Africans and that you feel their undesirable action to you was done because of your ethnicity/race.

Circle one digit that is applicable to you in each question. The order of frequency of occurrence starts from 1 (Never) to 5 (Very often).

How often have any of the things listed below happened to you**,** because of your ethnicity/race?

Action (How often)	**Never**		**Sometimes**		**Very often**
PD1. Has someone said something disrespectful, either to your face or behind your back?	1	2	3	4	5
PD2. Have you been kept out of a public place or group?	1	2	3	4	5
PD3. Have you been treated unfairly by teachers, principals, or other staff at school or at workplace?	1	2	3	4	5
PD4. Have others thought you couldn't do things or handle a job?	1	2	3	4	5
PD5. Have others **threatened** to hurt you (e.g. they would threaten to hit you)?	1	2	3	4	5
PD6. Have others **actually** hurt you or tried to hurt you (e.g. kicked or hit you)?	1	2	3	4	5
PD7. Have others avoided talking to you or answering you?	1	2	3	4	5
PD8. Have you felt that you were kept out of certain places?	1	2	3	4	5
PD9. Have policemen or security officers treated you unfairly?	1	2	3	4	5
PD10. Have others hinted that you are stupid?	1	2	3	4	5
PD11. Have others **threatened** to damage your property?	1	2	3	4	5
PD12. Have others **actually** damaged your property?	1	2	3	4	5

PD13. Have people called you bad names related to your ethnicity?	1	2	3	4	5
PD14. Have others made you feel like an outsider who doesn't fit in because of your dress, speech, or other characteristics related to your ethnicity?	1	2	3	4	5
PD15. Were you left out when others were planning a party or get-together?	1	2	3	4	5
PD16. Have you been treated unfairly by co-workers or classmates?	1	2	3	4	5
PD17. Have others hinted that you are dishonest or can't be trusted?	1	2	3	4	5
PD18. Has someone made rude gestures?	1	2	3	4	5
PD19. Have others avoided shaking hands with you or sitting next to you (e.g. in class or workplace or on a bus)?	1	2	3	4	5
PD20. Have you been left out of social gatherings or get-togethers (e.g. going to lunch or to a bar)?	1	2	3	4	5
PD21. Have people like waiters, bank tellers, or secretaries and teachers been unfair or treated you badly?	1	2	3	4	5
PD22. Has a clerk or waiter ignored you or made you wait longer than others to be served?	1	2	3	4	5
PD23. Have people been nice to you to your face, but said bad things about you behind your back?	1	2	3	4	5
PD24. Have people who speak a different language made you feel like an outsider?	1	2	3	4	5

PD25. Have people on the street been unwilling to help you or give you directions?	1	2	3	4	5
PD26. Has a taxi driver passed you by or refused you service?	1	2	3	4	5
PD27. Have others hinted that you must be violent or dangerous?	1	2	3	4	5
PD28. Have others physically harmed members of your family?	1	2	3	4	5
PD29. Have others ignored you or not paid attention to you?	1	2	3	4	5
PD30. Has your boss or supervisor or teacher been unfair to you?	1	2	3	4	5
PD31. Have others hinted that you must not be clean?	1	2	3	4	5
PD32. Have people not trusted you?	1	2	3	4	5
PD33. Have people not taken you seriously or not wanted to give you responsibility?	1	2	3	4	5
PD34. Has it been hinted that you must be lazy?	1	2	3	4	5
PD35. Have you been the target of obvious and direct in-your-face' discrimination?	1	2	3	4	5
PD36. Have you been the target of subtle, indirect not-so-obvious 'deniable' discrimination?	1	2	3	4	5
PD37. Have you seen newspapers or magazines that make your ethnic group look bad?	1	2	3	4	5
PD38. Have you heard disrespectful comments about your ethnic group on talk radio or in song lyrics?	1	2	3	4	5

PD39. Have you seen people of your ethnic group made to look bad on TV or in the movies? 1 2 3 4 5

PD40. Have you heard outsiders say bad things about other members of your ethnic group? 1 2 3 4 5

PD41. Have you heard disrespectful comments about your ethnic group said to your face or behind your back? 1 2 3 4 5

PD42. If you have experienced episodes of discrimination:

Which group has given you **the most** difficulty? (Circle one.)

7. Asian 8. Native Australian, 9. White, 10. Pacific Islander

PD43. *Have you had more difficulty from men or women?*

1. Men 2. Women

How often have you been discriminated against in the following places?

How often	**Never**		**Sometimes**		**Very Often**
PD44. In the criminal justice system (ex: police, judge, etc.)?	1	2	3	4	5
PD45. When looking for housing?	1	2	3	4	5
PD46. In medical services?	1	2	3	4	5
PD47. In school?	1	2	3	4	5

PD48. At work? 1 2 3 4

5

PD49 At a religious institution:

(e.g. church, mosque, etc?) 1 2 3 4

5

PD50. In public places: (e.g. a restaurant, store, bank,

government offices, supermarket, airport?) 1 2 3 4

5

PD51. On the street, in a park? 1 2 3 4

5

PD52. At private functions: (e.g. someone's home,

a party, wedding?) 1 2 3 4

5

PD53. Somewhere else

(please specify) _____? 1 2 3 4 5

PD54 If you are already diabetic,

how does the discrimination you experience

affect your treatment? 1 2 3 4

5

Part 4: Measure of depression, anxiety and stress (DAS)

Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:

0 = Did not apply to me at all

1 = Applied to me to some degree, or some of the time

2 = Applied to me to a considerable degree, or a good part of the time

3 = Applied to me very much, or most of the time

1	I found myself getting upset by quite trivial things	0	1	2	3
2	I was aware of dryness of my mouth	0	1	2	3
3	I couldn't seem to experience any positive feeling at all	0	1	2	3
4	I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1	2	3
5	I just couldn't seem to get going	0	1	2	3
6	I tended to over-react to situations	0	1	2	3
7	I had a feeling of shakiness (e.g. legs going to give way)	0	1	2	3
8	I found it difficult to relax	0	1	2	3
9	I found myself in situations that made me so anxious I was most relieved when they ended	0	1	2	3
10	I felt that I had nothing to look forward to	0	1	2	3

11	I found myself getting upset rather easily	0	1	2	3
12	I felt that I was using a lot of nervous energy	0	1	2	3
13	I felt sad and depressed	0	1	2	3
14	I found myself getting impatient when I was delayed in any way (e.g. lifts, traffic lights, being kept waiting)	0	1	2	3
15	I had a feeling of faintness	0	1	2	3
16	I felt that I had lost interest in just about everything	0	1	2	3
17	I felt I wasn't worth much as a person	0	1	2	3
18	I felt that I was rather touchy	0	1	2	3
19	I perspired noticeably (e.g. hands sweaty) in the absence of high temperatures or physical exertion	0	1	2	3
20	I felt scared without any good reason	0	1	2	3
21	I felt that life wasn't worthwhile	0	1	2	3
22	I found it hard to wind down	0	1	2	3
23	I had difficulty in swallowing	0	1	2	3
24	I couldn't seem to get any enjoyment out of the things I did	0	1	2	3
25	I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat)	0	1	2	3
26	I felt downhearted and blue	0	1	2	3
27	I found that I was very irritable	0	1	2	3
28	I felt I was close to panic	0	1	2	3

29	I found it hard to calm down after something upset me	0	1	2	3
30	I feared that I would be 'thrown' by some trivial but unfamiliar task	0	1	2	3
31	I was unable to become enthusiastic about anything	0	1	2	3
32	I found it difficult to tolerate interruptions to what I was doing	0	1	2	3
33	I was in a state of nervous tension	0	1	2	3
34	I felt I was pretty worthless	0	1	2	3
35	I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3
36	I felt terrified	0	1	2	3
37	I could see nothing in the future to be hopeful about	0	1	2	3
38	I felt that life was meaningless	0	1	2	3
39	I found myself getting agitated	0	1	2	3
40	I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
41	I experienced trembling (e.g. in the hands)	0	1	2	3
42	I found it difficult to work up the initiative to do things	0	1	2	3

APPENDIX 4: FOOD FREQUENCY AND PHYSICAL ACTIVITIES QUESTIONNAIRE

This questionnaire is about your usual eating habits over the past 12 months; where possible give only one answer per question for the type of food you eat most often.

1. Eating tradition and Australian vegetable

How much and often do you eat the following tradition and Australian vegetables per week (including frozen)?

Vegetable	**Quantity (size)**	**Frequency of consumption**						
		Never	1 time per week	2- 3 times per week	4- 5 times per week	6- 7 times per week	Once per day	More than once a day
TRADITIONAL								
Amaranth								
Arrow Root leaves								
Eggplant leaves								
Bean leaves								
Green Beans								
Dry Beans								
Cassava leaves								

Hute mellow								
Peas								
Potato leaves								
Pumpkin leaves								
Sweet Potato leaves								
Taro leaves								
Others found in supermarkets in Australia								
AUSTRALIAN								
Brussel Sprouts								
Cabbage – red								
Cabbage - white								
Cauliflower								
Celery								
Edive								
Keles								
Lettuce (Common)								
Lettuce (Iceberg								
Rhubarb								
Silver beet								
Spinach								

Sweet Corn								

2. Milk

   a. What type of milk do you usually use? (Mark only one of the listed possible answers)

   ◯ none

   ◯ full cream milk

   ◯ reduced fat milk

   ◯ skim milk

   ◯ soya milk

   b. How much milk do you usually use per day?

   ◯ none

   ◯ less than 250 ml (1 large cup or mug)

   ◯ between 250 and 500 ml (1-2 cups)

   ◯ between 500 and 750 ml (2-3 cups)

   ◯ 750 ml (3 cups or more)

3. Quantity of bread or traditional porridge consumed per day

   a. What type of bread do you usually eat (Traditional or Australian)?

   ◯ I do not eat any type of bread

   ◯ Traditional porridge (maize mill, millet or cassava)

   ◯ Australian (high fibre white bread)

   ◯ Australian (white bread)

   ◯ Australian (wholemeal bread)

◯ Australian (rye bread)

◯ Australian (multigrain bread)

b. How many slices of bread or quantity of traditional bread do you usually eat per day?

◯ Traditional porridge (250g)

◯ Traditional porridge (500g)

◯ Traditional porridge (750g)

◯ Traditional porridge (1000g)

◯ Australian (1 slice)

◯ Australian (2 slices)

◯ Australian (3 slices)

◯ Australian (4 slices)

◯ Australian (5-7 slices)

◯ Australian (8 or more slices)

c. Which spread do you usually put on bread?

◯ I don’t usually use any fat spread

◯ Margarine of any kind

◯ Polyunsaturated margarine

◯ Monounsaturated margarine

◯ Butter and margarine blends

◯ Butter

4. Type of cheese consumed

What type of cheese do you usually eat?

◯ I don't eat cheese

◯ Hard cheese (e.g. parmesan or Romano)

◯ Firm cheese (e.g. cheddar or edam)

◯ Soft cheese (e.g. camembert or brie)

◯ Ricotta or cottage cheese

◯ Cream cheese

◯ Low-fat cheese

5. Frequency of eating cereal foods, sweets and snacks, dairy products, meat and fish

Over the last 12 months, on average, how often did you eat the following foods?

Times you have eaten	**NEVER**	**Less than once**	**1 to3 TIMES**	**1 TIME**	**2 TIMES**	**3 to 4 T' IMESs**	**5 to 6 times**	**1 TIME**	**2 TIMESs**	**3 or more times**
		Per month		**Per week**				**Per day**		
CEREAL FOODS, SWEETS & SNACKS										
Sweet biscuits	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Cakes, sweet pies, tarts and other sweet pastries	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Meat pies, pastries, quiches and other savoury pastries	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Pizza	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Hamburger with a bun	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Chocolate	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Corn chips, potato crisps, Twisties, etc	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
DAIRY PRODUCTS, MEAT AND FISH										
Cheese	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Ice-cream	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Yoghurt	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Beef	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Veal	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Chicken	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Lamb	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Pork	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Bacon	)	)	)	)	)	)	)	)	)	)
Ham	)	)	)	)	)	)	)	)	)	)
Corn beef, luncheon meats or salami	)	)	)	)	)	)	)	)	)	)
Sausages or frankfurters	)	)	)	)	)	)	)	)	)	)
Fish (steamed, grilled or baked)	)	)	)	)	)	)	)	)	)	)
Fish fried (include takeaway)	)	)	)	)	)	)	)	)	)	)
Fish tinned (salmon, tuna sardines, etc)	)	)	)	)	)	)	)	)	)	)

APPENDIX 5: PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** and **moderate** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal.

PART 1: JOB-RELATED PHYSICAL ACTIVITY

The first section is about your work. This includes paid jobs, farming, volunteer work, course work, and any other unpaid work that you did outside your home. Do not include unpaid work you might do around your home, like housework, yard work, general maintenance, and caring for your family. These are asked in Part 3.

1. Do you currently have a job or do any unpaid work outside your home?

☐ Yes

☐ No → ***Skip to PART 2: TRANSPORTATION***

The next questions are about all the physical activity you did in the **last 7 days** as part of your paid or unpaid work. This does not include traveling to and from work.

2. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, heavy construction, or climbing upstairs **as part of your work**? Think about only those physical activities that you did for at least 10 minutes at a time.

_____ **days per week**

☐ No vigorous job-related physical activity → ***Skip to question 4***

3. How much time did you usually spend on one of those days doing **vigorous** physical activities as part of your work?

_____ **hours per day**

_____ **minutes per day**

4. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads **as part of your work**? Please do not include walking.

_____ **days per week**

☐ No moderate job-related physical activity → ***Skip to question 6***

5. How much time did you usually spend on one of those days doing **moderate** physical activities as part of your work?

_____ **hours per day**

_____ **minutes per day**

6. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time **as part of your work**? Please do not count any walking you did to travel to or from work.

_____ **days per week**

☐ No job-related walking → ***Skip to PART 2: TRANSPORTATION***

7. How much time did you usually spend on one of those days **walking** as part of your work?

_____ **hours per day**

_____ **minutes per day**

PART 2: TRANSPORTATION PHYSICAL ACTIVITY

These questions are about how you travelled from place to place, including to places like work, stores, movies, and so on.

8. During the **last 7 days**, on how many days did you **travel in a motor vehicle** like a train, bus, car, or tram?

_____ **days per week**

☐ No traveling in a motor vehicle → ***Skip to question 10***

9. How much time did you usually spend on one of those days **traveling** in a train, bus, car, tram, or other kind of motor vehicle?

_____ **hours per day**

_____ **minutes per day**

Now think only about the **bicycling** and **walking** you might have done to travel to and from work, to do errands, or to go from place to place.

10. During the **last 7 days**, on how many days did you **bicycle** for at least 10 minutes at a time to go **from place to place**?

_____ **days per week**

☐ No bicycling from place to place → ***Skip to question 12***

11. How much time did you usually spend on one of those days to **bicycle** from place to place?

_____ **hours per day**

_____ **minutes per day**

12. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time to go **from place to place**?

_____ **days per week**

☐ No walking from place to place → ***Skip to PART 3: HOUSEWORK, HOUSE MAINTENANCE, AND CARING FOR FAMILY***

13. How much time did you usually spend on one of those days **walking** from place to place?

_____ **hours per day**

_____ **minutes per day**

PART 3: HOUSEWORK, HOUSE MAINTENANCE, AND CARING FOR FAMILY

This section is about some of the physical activities you might have done in the **last 7 days** in and around your home, like housework, gardening, yard work, general maintenance work, and caring for your family.

14. Think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, chopping wood, shovelling snow, or digging **in the garden or yard**?

_____ **days per week**

☐ No vigorous activity in garden or yard → ***Skip to question 16***

15. How much time did you usually spend on one of those days doing **vigorous** physical activities in the garden or yard?

_____ **hours per day**

_____ **minutes per day**

16. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** activities like carrying light loads, sweeping, washing windows, and raking **in the garden or yard**?

_____ **days per week**

☐ No moderate activity in garden or yard → ***Skip to question 18***

17. How much time did you usually spend on one of those days doing **moderate** physical activities in the garden or yard?

_____ **hours per day**

_____ **minutes per day**

18. Once again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate**

activities like carrying light loads, washing windows, scrubbing floors and sweeping **inside your home**?

_____ **days per week**

☐ No moderate activity inside home → ***Skip to PART 4: RECREATION, SPORT AND LEISURE-TIME PHYSICAL ACTIVITY***

19. How much time did you usually spend on one of those days doing **moderate** physical activities inside your home?

_____ **hours per day**

_____ **minutes per day**

PART 4: RECREATION, SPORT, AND LEISURE-TIME PHYSICAL ACTIVITY

This section is about all the physical activities that you did in the **last 7 days** solely for recreation, sport, exercise or leisure. Please do not include any activities you have already mentioned.

20. Not counting any walking, you have already mentioned, during the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time **in your leisure time**?

_____ **days per week**

☐ No walking in leisure time → ***Skip to question 22***

21. How much time did you usually spend on one of those days **walking** in your leisure time?

_____ **hours per day**

_____ **minutes per day**

22. Think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **vigorous** physical activities like aerobics, running, fast bicycling, or fast swimming **in your leisure time**?

_____ **days per week**

☐ No vigorous activity in leisure time → ***Skip to question 24***

23. How much time did you usually spend on one of those days doing **vigorous** physical activities in your leisure time?

_____ **hours per day**

_____ **minutes per day**

24. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** physical activities like bicycling at a regular pace, swimming at a regular pace, and doubles tennis **in your leisure time**?

_____ **days per week**

☐ No moderate activity in leisure time → ***Skip to PART 5: TIME SPENT SITTING***

25. How much time did you usually spend on one of those days doing **moderate** physical activities in your leisure time?

_____ **hours per day**

_____ **minutes per day**

PART 5: TIME SPENT SITTING

The last questions are about the time you spend sitting while at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading or sitting or lying down to watch television. Do not include any time spent sitting in a motor vehicle that you have already told me about.

26. During the **last 7 days**, how much time did you usually spend **sitting** on a **weekday**?

_____ **hours per day**

_____ **minutes per day**

27. During the **last 7 days**, how much time did you usually spend **sitting** on a **weekend day**?

_____ **hours per day**

_____ **minutes per day**

This is the end of the questionnaire, thank you for participating.

APPENDIX 6: PERMISSION LETTER TO CONDUCT STUDY IN THE SUB-SAHARAN AFRICAN COMMUNITY

Queensland African Community Council,

GPO Box 2154, Brisbane QLD 4001
Mobile – 0411 330 382, Email – qacc@qacc.com.au
Website - www.qacc.com.au, ABN 20 833 580 090
"A united voice for community wellbeing"

August 8, 2013

To whom it may concern,

RE: Letter for endorsement to conduct a research among African Communities in

Queensland on Type 2 Diabetes

On behalf of Queensland African Communities Council (QACC) I would like to pledge our endorsement to the student of Australian Catholic University Paul Izaru Bilal, for conducting a research titled; 'Acculturation and Perceived Discrimination as Risk factors for Type 2 Diabetes and Their Effect on the Medical Care of Diabetic Patients among sub-Saharan African Migrants in Queensland'. QACC was established over 8 years ago as a peak body for African communities and individuals in Queensland. QACC works towards uniting African communities irrespective of their ethnic or regional backgrounds, identifying and addressing common issues and promoting their capacity and strengths to ensure full participation in the wider Australian community.

I understand that this research is a high degree research (PhD) and aims to determine prevalence of type 2 diabetes Mellitus and type 2 diabetes risk factors such as overweight and obesity among sub-Saharan Africans. It will also assess how much people have changed their lifestyle from African way to that of Australian (acculturation) and how many will say they have experienced discriminative episodes and whether these have contributed to type 2 diabetes. The research will also try to understand relationships between acculturation modes, perceived discrimination, obesity and type 2 diabetes and determine whether perceived discrimination affects healthcare services among the diabetic members of the population.

This project is important as many research studies conducted elsewhere show that the acculturation process of migrants in the host countries plays an important role in causing various chronic diseases among migrants. This will provide information on the occurrence of type 2 diabetes among sub-Saharan Africans in Queensland and will lead to a better management of type 2 diabetes and other chronic diseases among the sub-Saharan Africans.

Acknowledging the significance of such research which will lead to a better understanding of the reasons for the increased occurrence of type 2 diabetes among African communities and will inform the management of such a debilitating chronic disease.

On behalf of QACC, I fully endorse this proposal which will enable this important research to commence. Please contact me on 0411 330 382 if I can offer any further information that will assist you in your decision-making process.

Your sincerely,

Sharon Orapeleng

President