

# Double Burden of Malnutrition Among Migrants and Refugees in Developed Countries: A Mixed-Methods Systematic Review Protocol

Blessing Akombi-Inyang<sup>1\*</sup>, Md. Nazmul Huda<sup>1,2</sup>, Judith Byaruhanga<sup>3</sup>, Andre Renzaho<sup>4</sup>

<sup>1</sup>School of Population Health, University of New South Wales, Sydney, Australia.

<sup>2</sup>Department of Sociology and Anthropology, Green University of Bangladesh, Dhaka, Bangladesh.

<sup>3</sup>School of Medicine and Public health, The University of Newcastle, Callaghan, Australia.

<sup>4</sup>School of Social Sciences, Translational Health Research Institute, Western Sydney University, Penrith, Australia.

## ABSTRACT

**Background:** The double burden of malnutrition (DBM) increases the risk of developing non-communicable diseases among migrant and refugee populations living in developed countries. This systematic review aims to examine the DBM among migrants and refugees in developed countries. It aims to appraise, synthesise, and summarise literature to create an evidence base that looks at multiple faces of DBM.

**Methods/Design:** This protocol is informed by the standard Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols (PRISMA-P) guidelines. A systematic review of peer-reviewed quantitative, qualitative and mixed-methods studies on DBM among migrants and refugees in developed countries will be undertaken. The review will include only studies published in English. Eight bibliographic databases will be searched: Ovid MEDLINE, EMBASE, PsycINFO, CINAHL, ProQuest, Scopus, PubMed, and web of science. Grey literature will also be searched. Studies that meet the inclusion criteria will be imported to Covidence. Screening for eligible studies will be conducted by two independent researchers. The quality of included studies will be appraised for risk of bias using validated tools. A narrative synthesis approach will be undertaken to report retrieved data.

**Discussion:** The protocol provides insight into the scope and parameters of the systematic review to be conducted.

**Systematic review registration:** The protocol was registered with the PROSPERO international prospective register of systematic reviews [CRD42020192416].

**Keywords:** Double burden of malnutrition, undernutrition, overnutrition, micro-nutrient deficiency, non-communicable diseases, migrants, refugees

\* Correspondence to Blessing Akombi-Inyang, School of Population Health, University of New South Wales, Sydney, Australia. Email: [b.akombi@unsw.edu.au](mailto:b.akombi@unsw.edu.au)

# 1. Background

## 1.1 Introduction to the literature

Globally, diet-related epidemiology has seen a significant shift in recent decades being largely influenced by the forces of globalisation, income and economic growth, urbanisation, and demographic change (WHO, 2017; Popkin et al., 2020). This dynamic nutrition landscape has witnessed the coexistence of undernutrition along overweight or obesity, micro- or macro-nutrient deficiency or diet-related non-communicable diseases (NCDs) emerging as a public health concern especially within migrant and refugee populations (Popkin et al., 2020; UNICEF, 2017). This double burden of malnutrition (DBM) amongst migrant and refugee population may be due to multiple socio-economic, environmental, and acculturative factors (Yu et al., 2014; WHO, 2020a) such as limited income, sub-optimal infant feeding practices, poor access to health services, clean water as well as limited food and humanitarian assistance (WHO, 2020b). The social, developmental, economic, and medical impacts of DBM are serious and lasting, for migrants and their families, as well as for the host countries (WHO, 2020b).

Globally, about one-third of people suffer from at least one form of malnutrition including stunting, wasting, underweight, micronutrient deficiency, overweight or obesity and diet-related NCDs (WHO, 2020a; WHO, 2020b). Nutrition-related factors mainly due to undernutrition contribute to approximately 45% of child mortality with most cases occurring in low- and middle-income countries (LMICs) (WHO, 2020a; WHO, 2020b). However, recent trend shows a simultaneous rise in childhood overweight and obesity in LMICs (WHO, 2020a; WHO, 2020b).

DBM can exist at the individual level where two or more forms of malnutrition could occur simultaneously in the same individual, for instance both obesity and micronutrient deficiency occurring concurrently in an individual. DBM could also occur across the life-course and be temporally separated, due to changing nutrition environments which may result from a shift in economic or other circumstances including migration, for instance in situations where an individual who was stunted during childhood becomes overweight/obese in adulthood. Evidence has shown that undernutrition early in life – and even in utero – may predispose to overweight and NCDs such as diabetes and heart disease later in life (WHO, 2017). At the household level, DBM could be seen when a mother is overweight or anaemic and her child or grandparent is underweight or diabetic (type 2). This situation is commonly seen in low- and particularly middle- income countries (Tzioumis & Adair, 2014) as well as among migrants and refugees undergoing a rapid nutrition transition (Renzaho, 2007). DBM could also exist at the population level, where there is a prevalence of both undernutrition and overweight, obesity or NCDs in the same community, region, or nation (WHO, 2017). Research has shown that women are disproportionately affected by DBM at the population level (AO, 2006; Tanumihardjo et al., 2007). The intersectionality of being a woman and a migrant exacerbates the DBM among migrant women population (AO, 2006; Tanumihardjo et al., 2007; Renzaho et al., 2010). These biological mechanisms operating at different levels alongside social, behavioural, and environmental factors greatly influence individual weight status and act as important drivers of DBM across the life course.

Migrants and refugees undergo the complex and dynamic (Thomson & McFeeter, 2019) process of acculturation which denotes the process by which minority groups adopt the culture of their host country (Satia-Abouta, 2003). Consequently, lifestyle and dietary acculturation specifically the adoption of Western nutritional practice, dietary habits, and sedentary lifestyle, may result in adverse health effects such as obesity (Regev-Tobias et al., 2012) and NCDs (Kandula et al., 2008). This change is often associated with a shift from a predominance of undernutrition in home country to higher rates of overweight, obesity and NCDs in the host country. DBM brought about by a nutrition transition characterised by changes in diet and

lifestyle (Hasan et al., 2017; Grijalva-Eternod et al., 2012) could be due to socio-economic and environmental factors (Doak et al., 2005). Because of these factors, refugee and migrant populations living in developed countries face an increasingly high prevalence of both overnutrition and undernutrition (Kosaka et al., 2017), which poses unprecedented challenges to the migrant and refugee populations' health, including increased incidence of NCDs (Grijalva-Eternod et al., 2012, Menon & Peñalvo, 2020).

Some studies have solely reported undernutrition among migrant communities (Renzaho et al., 2006; Hashmi et al., 2019) while others have provided evidence for the growing burden of overnutrition (Sundquist et al., 1999; Ngongalah et al., 2018; Renzaho, 2004). However, limited studies have synthesised evidence on the DBM among migrant and refugee populations living in developed countries to guide targeted interventions given the potential negative impact it exerts on both the migrants and the health system of host countries. Therefore, this systematic review will be conducted to examine DBM among migrants and refugees living in developed countries.

## **1.2 Aim of the review and its public health importance**

The review is necessary to appraise, synthesise, and summarise the literature on the DBM among migrants and refugees in developed countries. To date, most studies have focused either on overnutrition or undernutrition or both in LMICs. However, no review has synthesised evidence on the DBM among migrants and refugees in developed countries. This proposed systematic review will look at overnutrition and various forms of undernutrition in the migrant and refugee populations. It will create an evidence base that looks at the multiple faces of DBM and findings will help inform policies and programs in host countries to invest in the prevention and management of all forms of malnutrition among migrant and refugee populations.

## **1.3 The review question**

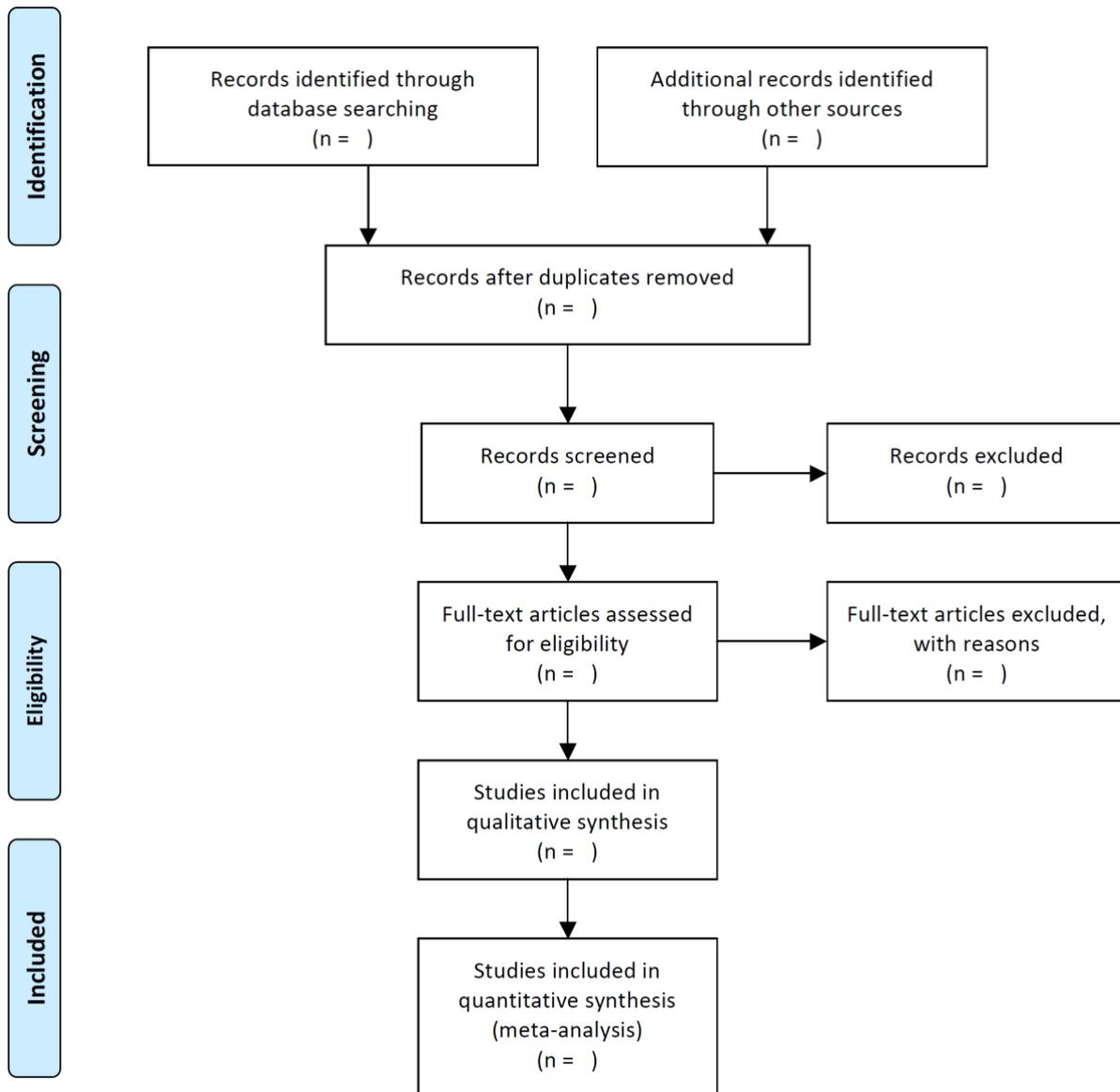
The systematic review will be guided by the following question: What is the DBM among migrants and refugees in developed countries?

## **2. Methods/Design**

### **2.1 Study design**

This protocol is informed by the standard Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols (PRISMA-P) statement (Moher et al., 2015) which consist of a checklist (Supplementary file 1) and the PRISMA flowchart (Figure 1).

**Figure 1.** PRISMA flowchart.



## 2.2 Outcomes of interest

The primary outcome is the DBM characterised by the coexistence of undernutrition along with overweight and obesity, micronutrient deficiency or diet-related noncommunicable diseases, within individuals, households, and populations, and across the life course (WHO, 2017). According to World Health Organization (WHO), undernutrition has four broad sub-forms which include wasting (low weight-for-height), stunting (low height-for-age), underweight (low weight-for-age), and the deficiencies of macronutrient (fats, protein, and carbohydrate) and micronutrient (minerals and vitamins) (WHO, 2020c). Overnutrition, on the other hand, develops from an abundant intake of nutrients, leading to excessive weight and obesity (high weight-for-height) (Mathur & Pillai, 2019). Diet-related NCDs include cardiovascular diseases (such as heart attacks and stroke, and often linked with high blood pressure), certain cancers, and diabetes.

### 2.3 Participants

The target population will be migrants and refugees residing in high income countries. According to the International Organization for Migration (IOM), a migrant is defined as a person who moves away from his or her place of usual residence, whether within a country or across an international border, temporarily or permanently, and for a variety of reasons (IOM, 2020). Under Article 1A (2) of the 1951 Refugee Convention, a 'refugee' is defined as a person who is outside his country of nationality or habitual residence based on a well-founded fear of persecution because of his race, religion, nationality, membership in a particular social group or political opinion, and is unable or unwilling to avail himself of the protection of that country, or to return there, for fear of persecution (UNHCR, n.d.). There will be no limits to the age, gender, social status, or ethnicity of participants.

### 2.4 Inclusion and exclusion criteria

Studies will be included in the review if they are peer-reviewed observational studies (cross-sectional studies, cohort studies and case-control studies) which reported DBM among migrant and refugee populations. In addition to searching peer reviewed literature, a search of grey literature including publications from key institutions, organisations and government websites will also be conducted. Studies will also be included in the review if they focus on undernutrition (stunting, wasting, underweight and micronutrient deficiencies of iron, vitamin A, and zinc), over nutrition, obesity, or overweight in refugee or migrant populations. Furthermore, the review will include studies that are written in English and whose full texts are available and accessible. The research team does not have the financial and logistical capacity to retrieve and translate articles published in languages other than English. Studies will be excluded if they (i) do not report on undernutrition; (ii) do not focus on refugee or migrant populations living in developed countries; (iii) are study protocols, reviews, editorials, letters to editors, commentaries, and opinion pieces; (iv) are not published in English.

### 2.5 Search strategy

The search will apply appropriate search terms and subject heading truncations (\*), and Boolean operators ("AND", "OR" and "NOT") depending on the specifications of databases to be searched. The following combination of keywords will be used in the search:

Migrant\* OR immigrant\* OR emigrant\* OR expat\* OR refugee\* OR asylum seeker\* OR displaced person\*

**AND**

Malnutrition OR Undernutrition OR Undernourish\* OR Stunting OR Wasting OR Underweight OR Overnutrition OR Obesity OR Overweight OR Micronutrient deficiency OR Vitamin A deficiency OR Vitamin D deficiency OR Iodine deficiency OR Iron deficiency OR Anaemia OR Non-communicable diseases OR NCD OR Diabetes OR Cancer OR Hypertension OR Cardiovascular diseases.

**AND**

Developed countries OR High-income countries OR Host countries OR United States OR United Kingdom OR Europe OR Australia OR OECD countries.

Eight databases including Ovid MEDLINE, EMBASE, PsycINFO, CINAHL, ProQuest, Scopus, PubMed, and web of science) for peer-reviewed studies will be searched using subject heading truncations and search terms. Authors will review the reference lists of studies

included for relevant articles that meet the inclusion criteria. A search log will be kept for accountability and transparency. Database searches will be re-run prior to the final analysis.

## **2.6 Study selection**

Studies generated in the search will be imported into Covidence and duplicates will be removed. The screening for eligible studies will follow a two-step process. First, titles and abstracts will be screened for eligibility and relevance. This will be followed by the screening of full texts for relevance. The screening process will be undertaken independently by two researchers and any disagreements will be resolved through discussion and consensus. In cases where a consensus could not be reached, a third researcher will adjudicate.

## **2.7 Data extraction**

Data extraction will be based on a modified Cochrane Public Health Group Data Extraction and Assessment Template. The data to be extracted will include study details (such as author's name, year of publication, country of study, study objective, study design and setting, intervention type, study characteristics, data collection methods, primary outcome measures (DBM) and comments section. This process will be undertaken independently by two researchers and any disagreements will be resolved through discussion and consensus. Where a consensus could not be reached, a third researcher will adjudicate.

## **2.8 Data synthesis**

It is expected that the included studies will be highly heterogeneous in their study methods, measurements, and outcomes. Hence, a statistical aggregation of the data may not be appropriate. However, to develop a robust understanding of the DBM among migrants and refugees in developed countries, a narrative synthesis approach will be undertaken to report results of the eligible studies. This approach involves identifying and extracting common threads from quantitative narratives and modifying the format to provide more understanding of the DBM among migrants and refugees in developed countries (Popay et al., 2006). The study findings will be summarised, emerging themes narrated and reviewed for the appropriateness of the content as well as the consistency of the emerging themes. All study results will be aggregated to provide a holistic analysis.

## **2.9 Quality assessment**

The Critical Appraisal Skills Programme (CASP) will be applied to assess the methodological quality of observational studies, including cohort studies (CASP 2018a) and case-control studies (CASP 2018b). Mixed-methods studies will be assessed based on the MMAT (mixed-methods appraisal tool) by Pluye and colleagues (Pluye et al., 2009). Grey literature will be appraised using the AACODS tool (Tyndall, 2018) which focuses on reviews' authority, accuracy, coverage, objectivity, date, and significance. All studies will be appraised as high, medium, or low quality and the overall quality of the body of evidence will be examined applying the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach (Guyatt et al., 2008). The methodological quality assessment of included studies will be independently undertaken by two independent researchers. Differences in the quality assessment will be resolved by discussion between all the authors.

## **3. Discussion**

Globally, there is growing interest among governments, donor community, the philanthropic and community development planners to understand and promote DBM-related interventions

to minimise the risk of NCDs among migrants and refugees in developed countries. A considerable body of literature exists on the subject matter but remains un-synthesised. The substantial body of literature supports the necessity for a review to provide a robust summary of evidence that could be drawn upon to influence policies and planning related to DBM among migrants and refugees in developed countries. Notably, assessing the DBM and risk of developing NCDs among migrants and refugees in developed countries will add to the knowledge base in diaspora and nutrition studies and direct future research. This study will inform future research efforts by identifying gaps and strengths in effective interventions targeting the needs of migrants and refugees in developed countries. In addition, findings from this review could further inform settlement and health policies and practice for migrants and refugees. The findings from the review will be shared at conferences, seminars, workshops, and other public forums. The target audiences for the review are public health researchers, practitioners, and policy-makers. The lead author (BAI) will also share these study findings with an advisory group of migrant and refugee populations to inform future research directions.

## List of Abbreviations

AACODS	Authority, Accuracy, Coverage, Objectivity, Date, Significance
CASP	Critical Appraisal Skills Programme
CINAHL	Cumulative Index to Nursing and Allied Health Literature
DBM	Double burden of malnutrition
EMBASE	Excerpta Medica dataBASE
GRADE	Grading of Recommendations Assessment, Development and Evaluation
IOM	International Organisation for Migration
MMAT	Mixed Methods Appraisal Tool
MEDLINE	Medical Literature and Retrieval System Online
NCDs	Non-Communicable Diseases
PRISMA	Preferred Reporting Items for Systematic Review
PROSPERO	International Prospective Register of Systematic Reviews
SSA	Sub-Saharan Africa

## Declarations

**Ethics approval and consent to participate:** Not applicable.

**Consent for publication:** Not applicable.

**Availability of data and materials:** Not applicable.

**Competing interests:** The authors declare that they have no competing interests.

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## References

Agriculture Organization. (2006). *The double burden of malnutrition: Case studies from six developing countries (Vol. 84)*. Food & Agriculture Organization.  
<http://www.fao.org/3/a0442e/a0442e00.pdf>.

- Critical Appraisal Skills Programme. (2018). *CASP checklist: 12 questions to help you make sense of a cohort study*. [https://casp-uk.net/wp-content/uploads/2018/01/CASP-Cohort-Study-Checklist\\_2018.pdf](https://casp-uk.net/wp-content/uploads/2018/01/CASP-Cohort-Study-Checklist_2018.pdf)
- Critical Appraisal Skills Programme. (2018). *CASP checklist: 11 questions to help you make sense of a case control study*. <https://casp-uk.net/wp-content/uploads/2018/01/CASP-Case-Control-Study-Checklist-2018.pdf>
- Doak, C. M., Adair, L. S., Bentley, M., Monteiro, C., & Popkin, B. M. (2004). The dual burden household and the nutrition transition paradox. *International Journal of Obesity*, 29(1), 129-136. <https://doi.org/10.1038/sj.ijo.0802824>
- Grijalva-Eternod, C. S., Wells, J. C., Cortina-Borja, M., Salse-Ubach, N., Tondeur, M. C., Dolan, C., Meziani, C., Wilkinson, C., Spiegel, P., & Seal, A. J. (2012). The double burden of obesity and malnutrition in a protracted emergency setting: A cross-sectional study of Western Sahara refugees. *PLoS Medicine*, 9(10), e1001320. <https://doi.org/10.1371/journal.pmed.1001320>
- Guyatt, G. H., Oxman, A. D., Vist, G. E., Kunz, R., Falck-Ytter, Y., Alonso-Coello, P., & Schünemann, H. J. (2008). GRADE: An emerging consensus on rating quality of evidence and strength of recommendations. *BMJ*, 336(7650), 924-926. <https://doi.org/10.1136/bmj.39489.470347.ad>
- Hasan, M., Sutradhar, I., Shahabuddin, A., & Sarker, M. (2017). Double burden of malnutrition among Bangladeshi women: A literature review. *Cureus*, 9(12). <https://doi.org/10.7759/cureus.1986>
- Hashmi, A. H., Nyein, P. B., Pilaseng, K., Paw, M. K., Darakamon, M. C., Min, A. M., Charunwatthana, P., Nosten, F., McGready, R., & Carrara, V. I. (2019). Feeding practices and risk factors for chronic infant undernutrition among refugees and migrants along the Thailand-Myanmar border: A mixed-methods study. *BMC Public Health*, 19(1), 1-16. <https://doi.org/10.1186/s12889-019-7825-7>
- International Organization for Migration. (2019, June 27). Who is a migrant? <https://www.iom.int/who-is-a-migrant>
- Kandula, N. R., Diez-Roux, A. V., Chan, C., Daviglius, M. L., Jackson, S. A., Ni, H., & Schreiner, P. J. (2008). Association of acculturation levels and prevalence of diabetes in the multi-ethnic study of atherosclerosis (MESA). *Diabetes Care*, 31(8), 1621-1628. <https://doi.org/10.2337/dc07-2182>
- Kosaka, S., & Umezaki, M. (2017). A systematic review of the prevalence and predictors of the double burden of malnutrition within households. *British Journal of Nutrition*, 117(8), 1118-1127. <https://doi.org/10.1017/s0007114517000812>
- Mathur, P., & Pillai, R. (2019). Overnutrition: Current scenario & combat strategies. *Indian Journal of Medical Research*, 149(6), 695. [https://doi.org/10.4103/ijmr.ijmr\\_1703\\_18](https://doi.org/10.4103/ijmr.ijmr_1703_18)
- Menon, S., & Peñalvo, J. L. (2019). Actions targeting the double burden of malnutrition: A scoping review. *Nutrients*, 12(1), 81. <https://doi.org/10.3390/nu12010081>
- Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P., & Stewart, L. A. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Systematic Reviews*, 4(1). <https://doi.org/10.1186/2046-4053-4-1>
- Ngongalah, L., Rankin, J., Rapley, T., Odeniyi, A., Akhter, Z., & Heslehurst, N. (2018). Dietary and physical activity behaviours in African migrant women living in high income countries: A systematic review and framework synthesis. *Nutrients*, 10(8), 1017. <https://doi.org/10.3390/nu10081017>

- Popay, J., Roberts, H., Sowden, A., Petticrew, M., Arai, L., Rodgers, M., Britten, N., Roen, K., & Duffy, S. (2006). *Guidance on the conduct of narrative synthesis in systematic reviews. A product from the ESRC methods programme Version, 1, b92.* <https://www.lancaster.ac.uk/media/lancaster-university/content-assets/documents/fhm/dhr/chir/NSsynthesisguidanceVersion1-April2006.pdf>
- Pluye, P., Gagnon, M., Griffiths, F., & Johnson-Lafleur, J. (2009). A scoring system for appraising mixed methods research, and concomitantly appraising qualitative, quantitative and mixed methods primary studies in mixed studies reviews. *International Journal of Nursing Studies*, 46(4), 529-546. <https://doi.org/10.1016/j.ijnurstu.2009.01.009>
- Popkin, B. M., Corvalan, C., & Grummer-Strawn, L. M. (2020). Dynamics of the double burden of malnutrition and the changing nutrition reality. *The Lancet*, 395(10217), 65-74. [https://doi.org/10.1016/s0140-6736\(19\)32497-3](https://doi.org/10.1016/s0140-6736(19)32497-3)
- Regev-Tobias, H., Reifen, R., Endevelt, R., Havkin, O., Cohen, E., Stern, G., & Stark, A. (2012). Dietary acculturation and increasing rates of obesity in ethiopian women living in Israel. *Nutrition*, 28(1), 30-34. <https://doi.org/10.1016/j.nut.2011.02.010>
- Renzaho, A. M. (2004). Fat, rich and beautiful: Changing socio-cultural paradigms associated with obesity risk, nutritional status and refugee children from sub-Saharan Africa. *Health & Place*, 10(1), 105-113. [https://doi.org/10.1016/s1353-8292\(03\)00051-0](https://doi.org/10.1016/s1353-8292(03)00051-0)
- Renzaho, A., Gibbons, C., Swinburn, B., Jolley, D., & Burns, C. (2006). Obesity and undernutrition in sub-Saharan African immigrant and refugee children in Victoria, Australia: *Healthy Eating Club*. <https://pubmed.ncbi.nlm.nih.gov/17077063/>
- Renzaho, A. (2007). Migrants getting fat in Australia: acculturation and its effects on the nutrition and physical activity of African migrants to developed countries. *Nova Science Publishers, Hauppauge, New York*. <https://dro.deakin.edu.au/view/DU:30006817>
- Renzaho, A. M., Skouteris, H., & Oldroyd, J. (2010). Preventing gestational diabetes mellitus among migrant women and reducing obesity and type 2 diabetes in their offspring: A call for culturally competent lifestyle interventions in pregnancy. *Journal of the American Dietetic Association*, 110(12), 1814-1817. <https://doi.org/10.1016/j.jada.2010.09.017>
- Satia-Abouta, J. (2003). Dietary acculturation: definition, process, assessment, and implications. *International Journal of Human Ecology*, 4(1), 71-86.
- Sundquist, J., Cmelic-Eng, M., & Johansson, S. E. (1999). Body mass index and distribution of body fat in female Bosnian refugees—a study in primary health care. *Public Health*, 113(2), 89-93. [https://doi.org/10.1016/s0033-3506\(99\)00124-9](https://doi.org/10.1016/s0033-3506(99)00124-9)
- Tanumihardjo, S. A., Anderson, C., Kaufer-Horwitz, M., Bode, L., Emenaker, N. J., Haqq, A. M., Satia, J. A., Silver, H. J., & Stadler, D. D. (2007). Poverty, obesity, and malnutrition: An international perspective recognizing the paradox. *Journal of the American Dietetic Association*, 107(11), 1966-1972. <https://doi.org/10.1016/j.jada.2007.08.007>
- Thomson, L., & McFeeter, J. (2019). *What's for Dinner? An Exploration of Changes in Eating Habits and Dietary Acculturation among Migrants New to Australia*. AMES Australia; Melbourne, Australia. <https://www.ames.net.au/-/media/files/research/ames-australia-migrants-and-food-survey.pdf?la=en>
- Tyndall, J. (2018). *AACODS checklist*. Flinders University. [https://dspace.flinders.edu.au/xmlui/bitstream/handle/2328/3326/AACODS\\_Checklist.pdf](https://dspace.flinders.edu.au/xmlui/bitstream/handle/2328/3326/AACODS_Checklist.pdf)
- Tzioumis, E., & Adair, L. S. (2014). Childhood dual burden of under- and Overnutrition in low- and middle-income countries: A critical review. *Food and Nutrition Bulletin*, 35(2), 230-243. <https://doi.org/10.1177/156482651403500210>
- United Nations High Commissioner for Refugees. (n.d.). *Convention and protocol relating to the status of refugees*. <https://www.unhcr.org/en-au/3b66c2aa10>

- United Nations International Children's Emergency Fund. (2017). *Levels and trends in child malnutrition. UNICEF-WHO-World Bank Group joint child malnutrition estimates: key findings of the 2017 edition*. New York: UNICEF, WHO, World Bank Group.  
[https://www.who.int/nutgrowthdb/jme\\_brochure2017.pdf](https://www.who.int/nutgrowthdb/jme_brochure2017.pdf)
- World Health Organization (2017). *The double burden of malnutrition: policy brief*. World Health Organization.  
<https://www.who.int/nutrition/publications/doubleburdenmalnutrition-policybrief/en/>
- World Health Organization. (2020a, April 1). *Children: improving survival and well-being*.  
<https://www.who.int/news-room/fact-sheets/detail/children-reducing-mortality>
- World Health Organization. (2020b, April 1). *Obesity and overweight*.  
<https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>
- World Health Organisation. (2020c, April 1) *Malnutrition*. <https://www.who.int/news-room/fact-sheets/detail/malnutrition>
- Yu, B., Chen, X., Li, S., Liu, Y., Jacques-Tiura, A. J., & Yan, H. (2014). Acculturative stress and influential factors among international students in China: A structural dynamic perspective. *PLoS ONE*, 9(4), e96322. <https://doi.org/10.1371/journal.pone.0096322>

## Supplementary File 1: PRISMA-P Checklist

Section/topic	#	Checklist item	Information reported		Reported on pg. #
			Yes	No	
<b>ADMINISTRATIVE INFORMATION</b>					
<b>Title</b>					
Identification	1a	Identify the report as a protocol of a systematic review	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Title
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A
<b>Registration</b>	2	If registered, provide the name of the registry (e.g., PROSPERO) and registration number in the Abstract	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Page 2
<b>Authors</b>					
Contact	3a	Provide name, institutional affiliation, and e-mail address of all protocol authors; provide physical mailing address of corresponding author	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Page 1
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<b>Amendments</b>	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A
<b>Support</b>					
Sources	5a	Indicate sources of financial or other support for the review	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Page 9
Sponsor	5b	Provide name for the review funder and/or sponsor	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A
Role of sponsor/funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A
<b>INTRODUCTION</b>					
<b>Rationale</b>	6	Describe the rationale for the review in the context of what is already known	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Page 3-4
<b>Objectives</b>	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Page 4
<b>METHODS</b>					
<b>Eligibility criteria</b>	8	Specify the study characteristics (e.g., PICO, study design, setting, time frame) and report characteristics (e.g., years considered, language, publication status)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Page 6

Section/topic	#	Checklist item	Information reported		Reported on pg. #
			Yes	No	
		to be used as criteria for eligibility for the review			
<b>Information sources</b>	9	Describe all intended information sources (e.g., electronic databases, contact with study authors, trial registers, or other grey literature sources) with planned dates of coverage	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Page 6-7
<b>Search strategy</b>	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Page 6
<b>STUDY RECORDS</b>					
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Page 7
Selection process	11b	State the process that will be used for selecting studies (e.g., two independent reviewers) through each phase of the review (i.e., screening, eligibility, and inclusion in meta-analysis)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Page 7
Data collection process	11c	Describe planned method of extracting data from reports (e.g., piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Page 7
Data items	12	List and define all variables for which data will be sought (e.g., PICO items, funding sources), any pre-planned data assumptions and simplifications	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Page 7
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Page 7
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Page 7
<b>DATA</b>					
<b>Synthesis</b>	15a	Describe criteria under which study data will be quantitatively synthesized	<input type="checkbox"/>	<input checked="" type="checkbox"/>	NA
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data, and methods of combining data from studies, including any planned exploration of consistency (e.g., $I^2$ , Kendall's tau)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	NA

Section/topic	#	Checklist item	Information reported		Reported on pg. #
			Yes	No	
	15c	Describe any proposed additional analyses (e.g., sensitivity or subgroup analyses, meta-regression)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	NA
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Page 7
<b>Meta-bias(es)</b>	16	Specify any planned assessment of meta-bias(es) (e.g., publication bias across studies, selective reporting within studies)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Page 7
<b>Confidence in cumulative evidence</b>	17	Describe how the strength of the body of evidence will be assessed (e.g., GRADE)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Page 7