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Complete List of Authors:	Frehner, Caroline; Universidade Federal do Paraná Hospital de Clínicas, Medicina Interna e Ciências da Saúde; Cunha, Natalia; Universidade Federal do Paraná Hospital de Clínicas, Medicina Interna e Ciências da Saúde Nagano, Francisca; Universidade Federal do Paraná Hospital de Clínicas, Medicina Interna e Ciências da Saúde Almeida, Claudia; Universidade Federal do Paraná Hospital de Clínicas, Medicina Interna e Ciências da Saúde Junior, Emilton; Universidade Federal do Paraná Hospital de Clínicas, Medicina Interna e Ciências da Saúde
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Protocol for a scoping review study to identify and classify Anthropometric indicator versus Coronary Artery Calcification for cardiovascular risk

Caroline Frehner[1], Natalia Morais Cunha[1], Francisca Eugenia Zaina Nagano[1], Claudia Choma Bettega Almeida[2] , Emilton Lima Júnior[1]

[1] Programa de Pós-Graduação em Medicina Interna e Ciências da Saúde – Complexo Hospital de Clínicas
[2] Departamento de Nutrição, Professora do Programa de Pós-Graduação em Segurança Alimentar e Nutricional (Mestrado) Professor Adjunto - Nutrição

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Correspondence to Caroline Frehner: carol.frehner@hotmail.com

Abstract

Introduction

Cardiovascular diseases (CVD) are the main cause of mortality and disability worldwide. In this sense, the prevention of cardiovascular disease becomes a priority in terms of public health, especially in those individuals considered to be at high cardiovascular risk (CVR). Therefore it is necessary to use validated strategies in order to adequately identify these patients in daily clinical practice. The objective of this scope review is to comprehend and comprehensively describe the anthropometric indicators used in studies that address its association with CAC to identify Cardiovascular Risk in the adult population.

Methods and Analysis

Using Arksey and O'Malley's scoping review methodology as a guide, our scoping review of published reviews begins by searching several databases: Cochrane Central Register of Controlled Trials (CENTRAL) in the Cochrane Library, Medline Complete (EbscoHost), Embase (Ovid SP), LILACS (BIREME) and Web of Science and Scielo. As well as, it will be searched in the International Platform of the Registry of Clinical Trials of the World Health Organization (www.who.int/ictrp); ClinicalTrials.gov; Transforming Research into Practice (TRIP). Our team has formulated search strategies and two reviewers will

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independently screen eligible studies for final study selection. Bibliographic data and abstract content will be collected and analysed using a tool developed iteratively by the research team.

Ethics and Dissemination

This protocol reports a comprehensive, rigorous and transparent methodology. This scoping review will be the first study to compare anthropometric measurements and CAC, and thereby will contribute to the design and comparison of future studies in this field. This protocol reports a comprehensive, rigorous and transparent methodology. The results will be disseminated through a peer-reviewed publication. By identifying gaps in the current body of literature, this study can guide future research.

Strengths and Limitations of this study

- This is a novel review approach to cover a vast volume of literature on a broad topic, thus offering a 'big picture' or map of research on the anthropometric indicators that address its association with CAC to identify Cardiovascular Risk.
- This protocol outlines a rigorous study design that includes the use of an established scoping review methodology, a multidisciplinary search strategy developed iteratively in consultation with an experienced medical librarian and a study selection and data extraction process that is carried out in tandem with validation from content experts.
- The synthesis of data will be limited to peer-reviewed published work.

Background

Cardiovascular diseases (CVD) are the main cause of mortality and disability worldwide. In this sense, the prevention of cardiovascular disease becomes a priority in terms of public health, especially in those individuals considered to be at high cardiovascular risk (CVR). Therefore it is necessary to use validated strategies in order to adequately identify these patients in daily clinical practice. The application of methods to determine body composition began in the 1940s, and was expanded to a variety of methods, being used as an indicator of health status, treatment evolution and functional condition (NAVARRO et al., 2000; VANNUCCHI et al. ,1984).

These factors make it interesting to investigate the use of anthropometry as a method of assessing the risk of cardiovascular disease, since it is easy to

apply in the clinic due to being operationally simple techniques, low cost and providing information about risk factors (BALL et al., 2004b) that can aid in the prevention and treatment of diseases. Anthropometry is one of the methods of assessing body composition and is defined as: "the science that studies the measurement of size, weight and proportions of the human body" (POLLOCK et al, 1986). Pesitinotto et al. (2002) found that non-pathological factors that may affect anthropometric characteristics should be taken into account, such as age, gender and geographical area. (PERISSINOTTO et al., 2002). Anthropometric measures have been the focus of many studies. However, some difficulties such as the possible redistribution of fat, the choice of the most appropriate equation and the best measurement technique are important issues that may limit the accuracy in the elderly populations (VISSER et al., 1994).

Through the various anthropometric measures, data such as weight, height, circumferences, lengths and skin folds can be obtained. The values obtained allow us to calculate secondary measures such as body mass index (BMI), arm muscle circumference (BMC), arm muscle area (AMB) and others (NAVARRO and MARCHINI, 2000). To estimate the body fat compartment, there are several formulas that use the value of the skin folds, each of which determines the number and location of the pleat to be used (TRITSCHLER, 2003). Each of these measures and their interrelations determine a specific body compartment, with a greater or lesser degree of precision (NAVARRO and MARCHINI, 2000). However, there are criticism concerning the estimation of body composition by anthropometry because it can present important changes in results by interindividual variability.

Some anthropometric indices are associated with chronic diseases. The World Health Organization (WHO,1995) defines obesity not only as an excess of fat per se but rather as a fat accumulation that is related to worsening health and uses BMI (kg / m2) to classify it. BMI is also used to predict the evolution and risk of disease, but it does not differentiate, for example, excess fat from excess lean mass / muscle or even edema. For example, a bodybuilder may have a BMI above 30 kg/m^2 and should not be characterized as excess fat but rather as weight (SVENDSEN, 2003). However, population studies have observed that the increase in BMI from 25kg/m^2 has a positive curvilinear correlation with cardiovascular diseases, hypertension, and some types of cancer, bladder

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diseases, diabetes and higher mortality (BRAY, 1985). In older men and women (65-74 years-old), BMI>27 kg/m^2 was associated with worsening of glycemia, triglycerides and HDL cholesterol (CABRERA and JACOB FILHO, 2001). In this study, patients were randomly assigned to either the intra-abdominal fat (KIM et al., 2004), or to the body mass index (BMI) (ROSENBAUN et al., 1997; MISRA et al., 2003). The AQI is correlated with intra-abdominal fat (KIM et al., 2004) and together with BMI, have a prognostic value for dyslipidemias and coronary diseases (ROSENBAUN et al., 1997; MISRA et al., 2003).

Among the many methods of cardiovascular risk evaluation, the Coronary Artery Calcification (CAC) deserves attention because it is a direct and non-invasive way of measuring calcium deposited in the coronary arteries (BISCHOFF, et al., 2011; TOTA-MAHARAJ et al., 2014, TOTA-MAHARAJ, et al, 2012). CAC proves to be a strong independent predictor of cardiovascular events, providing considerable, superior and additional prognostic information against clinical risk assessment methods (HECHT, 2015). The risk assessment offered by the CAC goes beyond that offered by the Framingham Risk Score, for example, and to populations of different ethnicities (GREENLAND, 2004), having overcome clinical risk factors and other non-invasive methods in the evaluation of CVR (PETERS, et al, 2012, YEBOAH, et al, 2012; BLAHA, et al, 2016). The use of CAC allows re-stratification of cardiovascular risk in patients classified as intermediate risk for low or high risks ranges (POLONSKY, et al, 2010), potentially modifying the profile and intensity of the approach to risk factors. In addition, international recommendations advocate the use of CAC as a tracking tool (NAGHAVI, et al, 2006). Therefore, the quantitative evaluation of coronary calcium with computed tomography has a definite role in the identification and stratification of coronary artery disease risk.

STUDY RATIONALE

Currently, the coronary calcium score imaging test is considered the gold standard for identifying CVR in patients. And there is no consensus in the literature about the anthropometric measure that best indicates the CVR. As well as there is no literature review that analyzes the interrelation of the anthropometric measurements of CVR and imaging tests.

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This review is therefore important because it aims to identify the anthropometric measure that is closest to the results of exams in the identification of CVR. In this way it assists in the patients diagnoses, guaranteeing a better therapeutic result and a cost-effective approach to patient care.

In resource-limited settings, access to screening is limited and the risk of patients lost to follow-up is high. So, anthropometric indicator to be applied at Point of Care (POC), which detect CVR, have become popular in those settings due to their advantages: the quickness in giving results, the possibility of giving guidance immediately, are performed with minimal technical training in non-laboratory settings, and detect the risk for the disease at the clinical setting. In addition, as the test results are obtained on the same day, expressed in a qualitative way (detected or not detected) and guidance can be provided right away.

STUDY OBJECTIVE

The objective of this scope review is to comprehend and comprehensively describe the anthropometric indicators used in studies that address its association with CAC to identify Cardiovascular Risk in the adult population.

METHODS AND ANALYSIS

Protocol design

The methodology for this scoping review was based on the framework outlined by Arksey and O'Malley (2005), methodological enhancement made by Levac *et al*. (2010) and the Joanna Briggs Institute. The review will include the following five key phases: (1) identifying the research question, (2) identifying relevant studies, (3) study selection, (4) charting the data, and (5) collating, summarizing, and reporting the results.

In preparation for this review, a pilot scoping search for Anthropometric indicator versus Calcium Coronary Score was done, in order to identify the list of all eligible index tests. The pilot search was conducted in two steps: first, we searched for all anthropometric indicator and second we searched for test accuracy studies for each of the Anthropometric indicator found by our first search comparing to Calcium Coronary Score. The first search, concerning available

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Anthropometric indicator, was restricted to English and Portuguese articles. This pilot search (conducted in April/ May 2019) resulted in a list of 241 eligible articles at Pubmed research

This protocol was submitted to PROSPERO, but not accepted for registration as they do not currently take scoping review protocols.

Stage 1: Identifying the research question

This review was guided by the question, 'What is the diagnostic accuracy of Anthropometric methods associated with Coronary Artery Calcification (CAC) to measure cardiovascular risk in the adult population?' For the purposes of this study, a scoping review is defined as a type of research synthesis that aims to 'map the literature on a particular topic or research area and provide an opportunity to identify key concepts; gaps in the research; and types and sources of evidence to inform practice, policymaking, and research' (Daudt et al., 2013).

As scoping is an iterative process (Arksey and Malley, 2005) we might add additional questions based on our findings along the review process. While the eventual goal of this study is to contribute to the understanding of the process of nursing students' learning in practice, we will also synthesize results that are relevant to this topic.

Stage 2: Identifying relevant studies

SEARCH STRATEGY AND INFORMATION SOURCES

For the selection of the databases will be considered the coverage in the area of Health Sciences, and availability through the Portal of Periodicals of Capes and the Portal of the Library System of the Federal University of Paraná (UFPR). The selected databases will be: Cochrane Central Register of Controlled Trials (CENTRAL) in the Cochrane Library, Medline Complete (EbscoHost), Embase (Ovid SP), LILACS (BIREME), Web of Science, Scopus and SciELO. As well as, will be searched in the International Platform of the Registry of Clinical Trials of the World-wide Organization of the Health (www.who.int/ictrp); ClinicalTrials.gov; Transforming Research into Practice (TRIP);and will be

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updated. We will not apply language limits to the searches and we will seek translations where our resources permit. If translations cannot be obtained, studies will be listed as awaiting.

To ensure that all relevant information is retrieved we will also search a variety of grey literature sources. We will search relevant grey literature databases (eg, Grey Literature Report, OpenGrey, Web of Science Conference Proceedings) to identify studies, reports and conference abstracts of relevance to this review. We will also conduct a targeted search of the grey literature in local, provincial, national and international organizations' websites and related health or scientific organizations classification.

The search strategy for the scoping review will be as comprehensive as possible within the constraints of time and resources in order to identify both published and unpublished (grey literature) primary studies as well as reviews. As recommended in all JBI types of reviews, a four-step search strategy is to be utilized (Table 1)

Table 1 Four Step search strategy

Step	Strategy
1	Limited search of Pubmed , analysis of text words in titles and abstracts and of index terms used to describe the articles (241 articles in 28th May 2019)
2	Search using all identified keywords and index terms across all included databases: Cochrane Central Register of Controlled Trials (CENTRAL) in the Cochrane Library, Medline Complete (EbscoHost), Embase (Ovid SP), LILACS (BIREME) and Web of Science and Scielo. As well as, it will be searched in the International Platform of the Registry of Clinical Trials of the World Health Organization (www.who.int/ictrp); ClinicalTrials.gov; Transforming Research into Practice (TRIP); and will be updated.
3	Search of reference lists of all identified reports and articles for additional studies
4	Search of all relevant published systematic reviews and consultation with experts

Search terms will be determined with input from the research team, research collaborators and knowledge users. The search strategy will be developed by an experienced research librarian, and will be revised pending input from stakeholders. Database and other searches will combine terms from two thematic blocks were drawn: CAC (comparison), anthropometric indicators (intervention). Terms will be searched as both keywords in the title and/or abstract and subject headings (eg, MeSH, EMTREE) as appropriate. No language or date limits will be applied.

The search strategy is showed in Table 2.

Stage 3: Study selection

The review process will consist of two levels of screening: (1) a title and abstract review and (2) full-text review. For the first level of screening, two investigators will independently screen the title and abstract of all retrieved citations for inclusion against a set of minimum inclusion criteria. The criteria will be tested on a sample of abstracts prior to beginning the abstract review to ensure that they are robust enough to capture any articles that may relate to the theme. Any articles that are deemed relevant by either or both of the reviewers will be included in the full-text review. In the second step, the two investigators will then each independently assess the full-text articles to determine if they meet the inclusion/exclusion criteria. To determine inter-rater agreement, Cohen's κ statistic. will be calculated at both the title and abstract review stage and at the full article review stage. Any discordant full-text articles will be reviewed a second time and further disagreements about study eligibility at the full-text review stage will be resolved through discussion with a third investigator until full consensus is obtained.

We will include all study designs seeking to evaluate anthropometric measurements as CVR index, in which it was compared to an eligible reference standard (Coronary Calcium Score). We expect most studies to be cross-sectional (where individuals recruited with and without the target condition are included proportionally to their prevalence in the general sample, with a measure essentially competing with anthropometric measurements). The anthropometric measure may have been assessed alone or in conjunction with (and / or compared with) other measures. The studies should have measured Anthropometry and performed a Coronary Calcium Score simultaneously, or at least prior to any intervention to ensure that the comparative tests reflect the same status. However, we will include studies in which this is not explicitly stated. We will include prospective and retrospective studies in the analysis.

The inclusion criteria will be developed in an interative process in which the reviewers calibrate a threshold for inclusion and exclusion. The initial

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inclusion criteria will be: adults without any kind of intervention at pre-screening (surgeries, drug treatment, specific diseases).

Since we are interested in how learning CAC and anthopometric measurements are associated, we exclude adults with intervention at the time of pre-screening, or adolescents/children (< 18 years of age), or specialized populations.

The exposure of this review will be an individual's total and regional body composition. These measures may include, but are not limited to: height (m), mass (kg) and body mass index (kg/m^2), waist circumference (cm), total body fat (g), total body fat percentage (%), android fat (g), gynoid fat (g) and intra-abdominal body fat (g, cm^2, cm^3).

Stage 4: Data collection

Data will be extracted from full-text journal articles which meet the aforementioned inclusion criteria. A data collection instrument will be developed by the research team to confirm study relevance and to extract study characteristics. Study characteristics to be extracted will include, but not be limited to: publication year, publication type (eg, original research), study design, country, patient population characteristics, anthropometric measurements, CAC method, cut off points, outcomes, study quality). This form will be reviewed by the research team and pretested by all reviewers before implementation to ensure that the form is capturing the information accurately. Data abstraction will be conducted in duplicate with two reviewers independently (CF and NMC) extracting data from all included studies. To ensure accurate data collection, each reviewer's independent abstracted data will be compared and any discrepancies will be further discussed to ensure consistency between the reviewers. The search results will be imported into the EndNote (Thomson Reuters) citation manager and pooled into a single library.

Stage 5: Data summary and synthesis of results

Since a scoping review can be used to map the concepts underpinning a research area and the main sources and types of evidence available, the aggregated findings provide an overview of the research rather than an

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assessment of the quality of individual studies. Although formal assessment of study quality is generally not performed in scoping reviews, (Peters et al 2017) some claim it should be incorporated in the methodology (Daudt et al 2003). Assessing study quality will enable us to address not only quantitative, but also qualitative gaps in the literature (Levac et al, 2010). We will therefore assess the quality of included studies by a set of quality indicators for reviews developed by Buckley *et al*. The analytic frame will be piloted on 5–10 articles by the team and will allow us to analyse the selected articles through a common framework.

A PRISMA flow diagram will be used to report final numbers in the resulting study publication. As we expect a diverse body of knowledge, we will give a descriptive account of concepts and subsequent operationalisations. We will synthesise study findings using narrative descriptions based on themes that emerge from the extracted data. The results will be compared and consolidated through consensus between two of the reviewers CF and NMC. (Figure 1).

A narrative summary will accompany the diagram results and will describe how the results relate to the reviews objective and questions.

PATIENT AND PUBLIC INVOLVEMENT

No patient involved

DISSEMINATION AND ETHICS

This protocol reports a comprehensive, rigorous and transparent methodology. This scoping review will be the first study to compare anthropometric measurements and CAC, and thereby will contribute to the design and comparison of future studies in this field. This protocol reports a comprehensive, rigorous and transparent methodology. The results will be disseminated through a peer-reviewed publication. By identifying gaps in the current body of literature, this study can guide future research. Both the methodology and the results may be of interest for researchers, doctors, nutritionist and other health professions given the widely spread importance of learning in clinical practice. Since the methodology applied consists of reviewing and collecting data from publicly available materials, this study does not require an ethical approval.

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Table 2. Search terms

Search	Query
#1 Intervention	(anthropometry OR anthropometric OR "anthropometric indicator" OR "anthropometric marker" OR "anthropometric parameter" OR "anthropometric measurement")
#2 Comparator	("calcium coronary score" OR "calcium artery score" OR "calcium coronary artery score" OR "coronary artery calcium" OR "coronary calcification" OR "coronary artery calcium score" OR "computed tomographic angiography")
#3	#1 AND #2
Limits	Age +18

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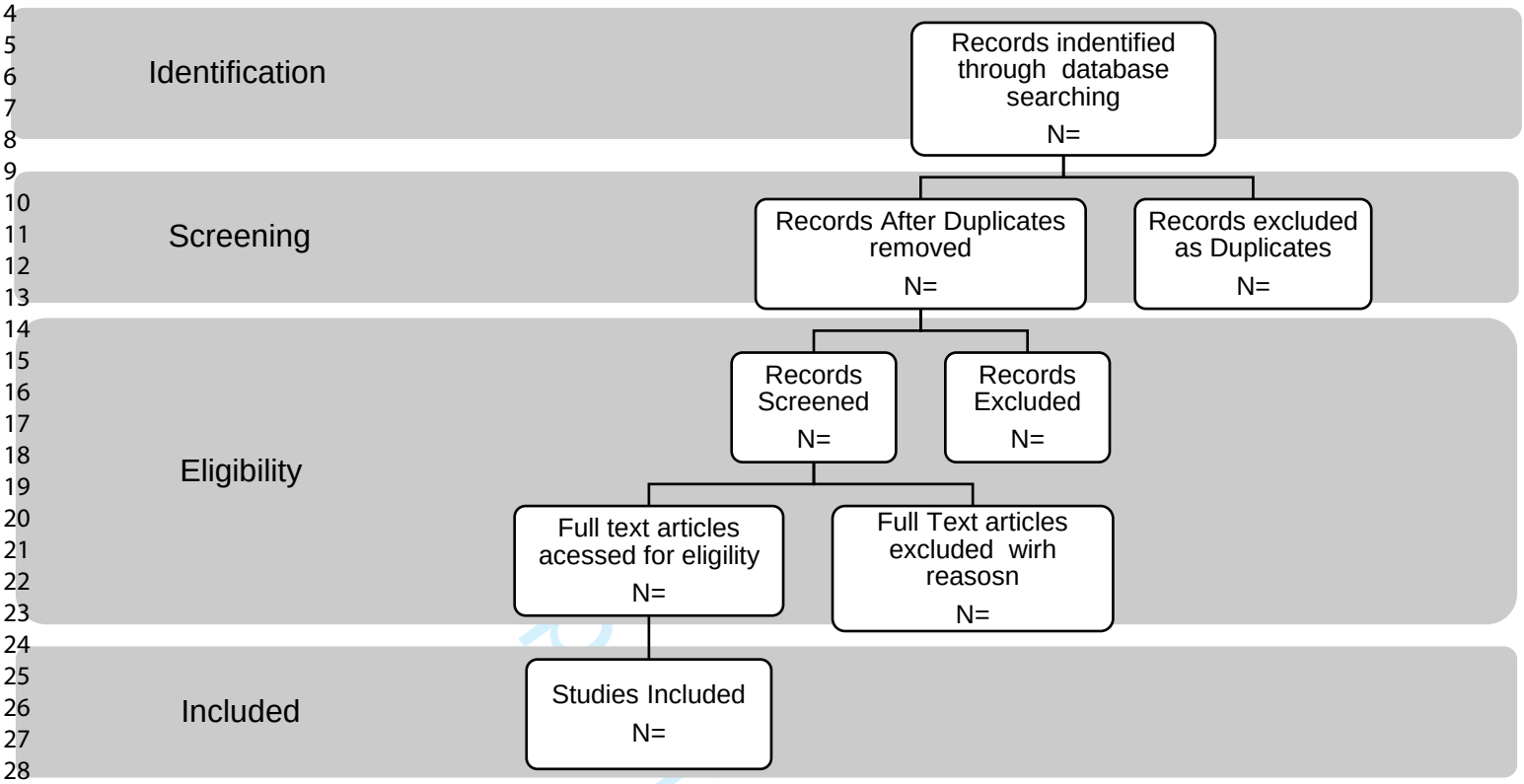

Figure 1 . Flow Diagram for the scoping review process adapted from the PRISMA statement by Moher and colleagues (2009)

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Caroline Frehner[1], Natalia Morais Cunha[1], Francisca Eugenia Zaina Nagano[1], Claudia Choma Bettega Almeida[2] , Emilton Lima Júnior[1]

[1] Programa de Pós-Graduação em Medicina Interna e Ciências da Saúde – Complexo Hospital de Clínicas
[2] Departamento de Nutrição, Professora do Programa de Pós-Graduação em Segurança Alimentar e Nutricional (Mestrado) Professor Adjunto - Nutrição

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Correspondence to Caroline Frehner: carol.frehner@hotmail.com

Abstract

Introduction

Cardiovascular diseases are the main cause of mortality and disability worldwide, so the prevention becomes a priority in terms of public health. Therefore, it is necessary to use validated strategies in order to adequately identify these patients in daily clinical practice. The objective of this scope review is to comprehend and comprehensively describe the anthropometric indicators used in studies, such as such as weight, height, circumferences, lengths and skin folds, that address its association with Coronary artery calcification to identify Cardiovascular Risk in the adult population.

Methods and Analysis

Using Arksey and O'Malley's scoping review methodology as a guide, our scoping review of published reviews begins by searching several databases: Cochrane Central Register of Controlled Trials (CENTRAL) in the Cochrane Library, Medline Complete (EbscoHost), Embase (Ovid SP), LILACS (BIREME) and Web of Science and Scielo. As well as, it will be searched in the International Platform of the Registry of Clinical Trials of the World Health Organization (www.who.int/ictrp); ClinicalTrials.gov; Transforming Research into Practice (TRIP). Our team has formulated search strategies and two reviewers will independently screen eligible studies for final study selection. Bibliographic data

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and abstract content will be collected and analysed using a tool developed iteratively by the research team.

Ethics and Dissemination

This protocol reports a comprehensive, rigorous and transparent methodology. This scoping review will be the first study to compare anthropometric measurements and Coronary artery calcification, and thereby will contribute to the design and comparison of future studies in this field. This protocol reports a comprehensive, rigorous and transparent methodology. The results will be disseminated through a peer-reviewed publication. By identifying gaps in the current body of literature, this study can guide future research.

Strengths and Limitations of this study

- This is a novel review approach to cover a vast volume of literature on a broad topic, thus offering a 'big picture' or map of research on the anthropometric indicators that address its association with Coronary artery calcification to identify Cardiovascular Risk.
- This protocol outlines a rigorous study design that includes the use of an established scoping review methodology, a multidisciplinary search strategy developed iteratively in consultation with an experienced medical librarian and a study selection and data extraction process that is carried out in tandem with validation from content experts.
- The synthesis of data will be limited to peer-reviewed published work.

Background

Cardiovascular diseases (CVD) are the main cause of mortality and disability worldwide. In this sense, the prevention of cardiovascular disease becomes a priority in terms of public health, especially in those individuals considered to be at high cardiovascular risk (CVR). Therefore it is necessary to use validated strategies in order to adequately identify these patients in daily clinical practice. The application of methods to determine body composition began in the 1940s, and was expanded to a variety of methods, being used as an indicator of health status, treatment evolution and functional condition[1].

These factors make it interesting to investigate the use of anthropometry as a method of assessing the risk of cardiovascular disease, since it is easy to apply in the clinic due to being operationally simple techniques, low cost and providing information about risk factors[2] that can aid in the prevention and

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treatment of diseases. Anthropometry is one of the methods of assessing body composition and is defined as: "the science that studies the measurement of size, weight and proportions of the human body"[3]. Perissinotto et al. (2002) found that non-pathological factors that may affect anthropometric characteristics should be taken into account, such as age, gender and geographical area[4]. Anthropometric measures have been the focus of many studies. However, some difficulties such as the possible redistribution of fat, the choice of the most appropriate equation and the best measurement technique are important issues that may limit the accuracy in the elderly populations [5].

Through the various anthropometric measures, data such as weight, height, circumferences, lengths and skin folds can be obtained. The values obtained allow us to calculate secondary measures such as body mass index (BMI), arm muscle circumference (BMC), arm muscle area (AMB) and others[1]. To estimate the body fat compartment, there are several formulas that use the value of the skin folds, each of which determines the number and location of the pleat to be used[6]. Each of these measures and their interrelations determine a specific body compartment, with a greater or lesser degree of precision[1]. However, there are criticism concerning the estimation of body composition by anthropometry because it can present important changes in results by interindividual variability.

Some anthropometric indices are associated with chronic diseases. The World Health Organization defines obesity not only as an excess of fat per se but rather as a fat accumulation that is related to worsening health and uses BMI (kg / m2) to classify it[7]. BMI is also used to predict the evolution and risk of disease, but it does not differentiate, for example, excess fat from excess lean mass / muscle or even edema. For example, a bodybuilder may have a BMI above 30 kg/m^2 and should not be characterized as excess fat but rather as weight[8]. However, population studies have observed that the increase in BMI from 25kg/m^2 has a positive curvilinear correlation with cardiovascular diseases, hypertension, and some types of cancer, bladder diseases, diabetes and higher mortality[9]. In older men and women (65-74 years-old), BMI>27 kg/m^2 was associated with worsening of glycemia, triglycerides and HDL cholesterol[10]. In this study, patients were randomly assigned to either the intra-abdominal fat [11], or to the body mass index (BMI)[12;13]. The AQI is correlated with intra-abdominal

fat[11] and together with BMI, have a prognostic value for dyslipidemias and coronary diseases [12;13].

Among the many methods of cardiovascular risk evaluation, the Coronary Artery Calcification (CAC) deserves attention because it is a direct and non-invasive way of measuring calcium deposited in the coronary arteries [14;15;16]. Coronary artery calcification proves to be a strong independent predictor of cardiovascular events, providing considerable, superior and additional prognostic information against clinical risk assessment methods[17]. The risk assessment offered by the Coronary artery calcification goes beyond that offered by the Framingham Risk Score, for example, and to populations of different ethnicities[18], having overcome clinical risk factors and other non-invasive methods in the evaluation of cardiovascular risk [19;20;21]. The use of Coronary artery calcification allows re-stratification of cardiovascular risk in patients classified as intermediate risk for low or high risks ranges[22], potentially modifying the profile and intensity of the approach to risk factors. In addition, international recommendations advocate the use of Coronary artery calcification as a tracking tool[23]. Therefore, the quantitative evaluation of coronary calcium with computed tomography has a definite role in the identification and stratification of coronary artery disease risk.

STUDY RATIONALE

Currently, the coronary calcium score imaging test is considered the gold standard for identifying cardiovascular risk in patients. And there is no consensus in the literature about the anthropometric measure that best indicates the cardiovascular risk. As well as there is no literature review that analyzes the interrelation of the anthropometric measurements of cardiovascular risk and imaging tests.

This review is therefore important because it aims to identify the anthropometric measure that is closest to the results of exams in the identification of cardiovascular risk. In this way, it assists in the patients diagnoses, guaranteeing a better therapeutic result and a cost-effective approach to patient care.

In resource-limited settings, access to screening is limited and the risk of patients lost to follow-up is high. So, anthropometric indicator to be applied at

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Point of Care (POC), which detect cardiovascular risk, have become popular in those settings due to their advantages: the quickness in giving results, the possibility of giving guidance immediately, are performed with minimal technical training in non-laboratory settings, and detect the risk for the disease at the clinical setting. In addition, as the test results are obtained on the same day, expressed in a qualitative way (detected or not detected) and guidance can be provided right away.

STUDY OBJECTIVE

The objective of this scope review is to comprehend and comprehensively describe the anthropometric indicators used in studies that address its association with CAC to identify Cardiovascular Risk in the adult population.

METHODS AND ANALYSIS

Protocol design

The methodology for this scoping review was based on the framework outlined by Arksey and O'Malley (2005), methodological enhancement made by Levac *et al*. (2010) and the Joanna Briggs Institute [24;25]. The review will include the following five key phases: (1) identifying the research question, (2) identifying relevant studies, (3) study selection, (4) charting the data, and (5) collating, summarizing, and reporting the results.

In preparation for this review, a pilot scoping search for Anthropometric indicator versus Calcium Coronary Score was done, in order to identify the list of all eligible index tests. The pilot search was conducted in two steps: first, we searched for all anthropometric indicator and second we searched for test accuracy studies for each of the Anthropometric indicator found by our first search comparing to Calcium Coronary Score. The first search, concerning available Anthropometric indicator, was restricted to English and Portuguese articles. This pilot search (conducted in April/ May 2019) resulted in a list of 241 eligible articles at Pubmed research

Stage 1: Identifying the research question

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This review was guided by the question, 'What is the diagnostic accuracy of Anthropometric methods associated with Coronary Artery Calcification (CAC) to measure cardiovascular risk in the adult population?' For the purposes of this study, a scoping review is defined as a type of research synthesis that aims to 'map the literature on a particular topic or research area and provide an opportunity to identify key concepts; gaps in the research; and types and sources of evidence to inform practice, policymaking, and research'[26].

As scoping is an iterative process we might add additional questions based on our findings along the review process[24]. While the eventual goal of this study is to contribute to the understanding of the process of nursing students' learning in practice, we will also synthesize results that are relevant to this topic.

Stage 2: Identifying relevant studies

SEARCH STRATEGY AND INFORMATION SOURCES

For the selection of the databases will be considered the coverage in the area of Health Sciences, and availability through the Portal of Periodicals of Capes and the Portal of the Library System of the Federal University of Paraná (UFPR). The selected databases will be: Cochrane Central Register of Controlled Trials (CENTRAL) in the Cochrane Library, Medline Complete (EbscoHost), Embase (Ovid SP), LILACS (BIREME), Web of Science, Scopus and SciELO. As well as, will be searched in the International Platform of the Registry of Clinical Trials of the World-wide Organization of the Health (www.who.int/ictrp); ClinicalTrials.gov; Transforming Research into Practice (TRIP); and will be updated. We will apply language limits to the searches (Portuguese, English, Spanish).

To ensure that all relevant information is retrieved we will also search a variety of grey literature sources. We will search relevant grey literature databases (eg, Grey Literature Report, OpenGrey, Web of Science Conference Proceedings) to identify studies, reports and conference abstracts of relevance to this review. We will also conduct a targeted search of the grey literature in local, provincial, national and international organizations' websites and related health or scientific organizations classification.

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The search strategy for the scoping review will be as comprehensive as possible within the constraints of time and resources in order to identify both published and unpublished (grey literature) primary studies as well as reviews. As recommended in all JBI types of reviews, a four-step search strategy is to be utilized (Table 1)

Search terms will be determined with input from the research team, research collaborators and knowledge users. The search strategy was developed by an experienced research librarian, and was revised pending input from stakeholders. Database and other searches will combine terms from two thematic blocks were drawn: anthropometric indicators (comparator 1) and CAC (comparator 2). Terms will be searched as both keywords in the title and/or abstract and subject headings (eg, MeSH, EMTREE) as appropriate. No language or date limits will be applied.

The search strategy example is showed in Table 2.

Stage 3: Study selection

The review process will consist of two levels of screening: (1) a title and abstract review and (2) full-text review. For the first level of screening, two investigators will independently screen the title and abstract of all retrieved citations for inclusion against a set of minimum inclusion criteria. The criteria will be tested on a sample of abstracts prior to beginning the abstract review to ensure that they are robust enough to capture any articles that may relate to the theme. Any articles that are deemed relevant by either or both of the reviewers will be included in the full-text review. In the second step, the two investigators will then each independently assess the full-text articles to determine if they meet the inclusion/exclusion criteria. To determine inter-rater agreement, Cohen's κ statistic. will be calculated at both the title and abstract review stage and at the full article review stage[27]. Any discordant full-text articles will be reviewed a second time and further disagreements about study eligibility at the full-text review stage will be resolved through discussion with a third investigator until full consensus is obtained.

We will include all study designs seeking to evaluate anthropometric measurements as cardiovascular risk index, in which it was compared to an

eligible reference standard (Coronary Calcium Score). The anthropometric measure may have been assessed alone or in conjunction with (and / or compared with) other measures. The studies should have measured Anthropometry and performed a Coronary Calcium Score simultaneously, or at least prior to any intervention to ensure that, the comparative tests reflect the same status. However, we will include studies in which this is not explicitly stated. We will include prospective and retrospective studies in the analysis.

The inclusion criteria will be developed in an interative process in which the reviewers calibrate a threshold for inclusion and exclusion. The initial inclusion criteria will be: adults without any kind of intervention at pre-screening (surgeries, drug treatment, specific diseases).

Since we are interested in learning how CAC and anthropometric measurements are associated, we exclude adults with intervention at the time of pre-screening, or adolescents/children (< 18 years of age), or specialized populations (specific diseases; drug treatment).

The exposure of this review will be an individual's total and regional body composition. These measures may include, but are not limited to: height (m), mass (kg) and body mass index (kg/m^2), waist circumference (cm), total body fat (g), total body fat percentage (%), android fat (g), gynoid fat (g) and intra-abdominal body fat (g, cm^2, cm^3).

Stage 4: Data collection

Data will be extracted from full-text journal articles which meet the aforementioned inclusion criteria. A data collection instrument will be developed by the research team to confirm study relevance and to extract study characteristics. Study characteristics to be extracted will include, but not be limited to: publication year, publication type (eg, original research), study design, country, patient population characteristics, anthropometric measurements, calcium artery calcification method, cut off points, outcomes, study quality). This form will be reviewed by the research team and pretested by all reviewers before implementation to ensure that the form is capturing the information accurately. Data abstraction will be conducted in duplicate with two reviewers independently (CF and NMC) extracting data from all included studies. To ensure accurate data

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collection, each reviewer's independent abstracted data will be compared and any discrepancies will be further discussed to ensure consistency between the reviewers. The search results will be imported into the EndNote (Thomson Reuters) citation manager and pooled into a single library.

Stage 5: Data summary and synthesis of results

Since a scoping review can be used to map the concepts underpinning a research area and the main sources and types of evidence available, the aggregated findings provide an overview of the research rather than an assessment of the quality of individual studies. Although formal assessment of study quality is generally not performed in scoping reviews, some claim it should be incorporated in the methodology[26;28]. Assessing study quality will enable us to address not only quantitative, but also qualitative gaps in the literature[25]. We will therefore assess the quality of included studies by a set of quality indicators for reviews developed by Buckley *et al*[29]. The analytic frame will be piloted on 5–10 articles by the team and will allow us to analyse the selected articles through a common framework.

A PRISMA flow diagram will be used to report final numbers in the resulting study publication. As we expect a diverse body of knowledge, we will give a descriptive account of concepts and subsequent operationalisations. We will synthesise study findings using narrative descriptions based on themes that emerge from the extracted data. The results will be compared and consolidated through consensus between two of the reviewers CF and NMC (Figure 1)[30].

A narrative summary will accompany the diagram results and will describe how the results relate to the reviews objective and questions.

PATIENT AND PUBLIC INVOLVEMENT

No patient involved

DISSEMINATION AND ETHICS

This protocol reports a comprehensive, rigorous and transparent methodology. This scoping review will be the first study to compare anthropometric measurements and CAC, and thereby will contribute to the design

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and comparison of future studies in this field. This protocol reports a comprehensive, rigorous and transparent methodology. The results will be disseminated through a peer-reviewed publication. By identifying gaps in the current body of literature, this study can guide future research. Both the methodology and the results may be of interest for researchers, doctors, nutritionist and other health professions given the widely spread importance of learning in clinical practice. Since the methodology applied consists of reviewing and collecting data from publicly available materials, this study does not require an ethical approval.

Contributors: CF conceived the idea, developed the research question and study methods and contributed meaningfully to the drafting and editing. NMC, FEZN, Claudia CBA, ELJ aided in developing the research question and study methodsm contributed meaningfully to the drafting and editing.

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Acknowlegments: This Review will contribute to a Master of Internal Medicine and Health Sciences degree for CF

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Table 1

Table showing the Four Step search strategy

Step	Strategy
1	Limited search of Pubmed , analysis of text words in titles and abstracts and of index terms used to describe the articles (241 articles in 28th May 2019)
2	Search using all identified keywords and index terms across all included databases: Cochrane Central Register of Controlled Trials (CENTRAL) in the Cochrane Library, Medline Complete (EbscoHost), Embase (Ovid SP), LILACS (BIREME) and Web of Science and Scielo. As well as, it will be searched in the International Platform of the Registry of Clinical Trials of the World Health Organization (www.who.int/ictrp); ClinicalTrials.gov; Transforming Research into Practice (TRIP); and will be updated.
3	Search of reference lists of all identified reports and articles for additional studies
4	Search of all relevant published systematic reviews and consultation with experts

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Table 2

Table showing Search strategy example for Pubmed

Search	Query
#1 Comparator 1	(anthropometry OR anthropometric OR "anthropometric indicator" OR "anthropometric marker" OR "anthropometric parameter" OR "anthropometric measurement")
#2 Comparator 2	("calcium coronary score" OR "calcium artery score" OR "calcium coronary artery score" OR "coronary artery calcium" OR "coronary calcification" OR "coronary artery calcium score" OR "computed tomographic angiography")
#3	#1 AND #2
Limits	Age +18, Language (Portuguese, Spanish, English), Human Studies

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Figure 1 Flow Diagram for the scoping review process adapted from the PRISMA statement by Moher and colleagues (2009)[30]

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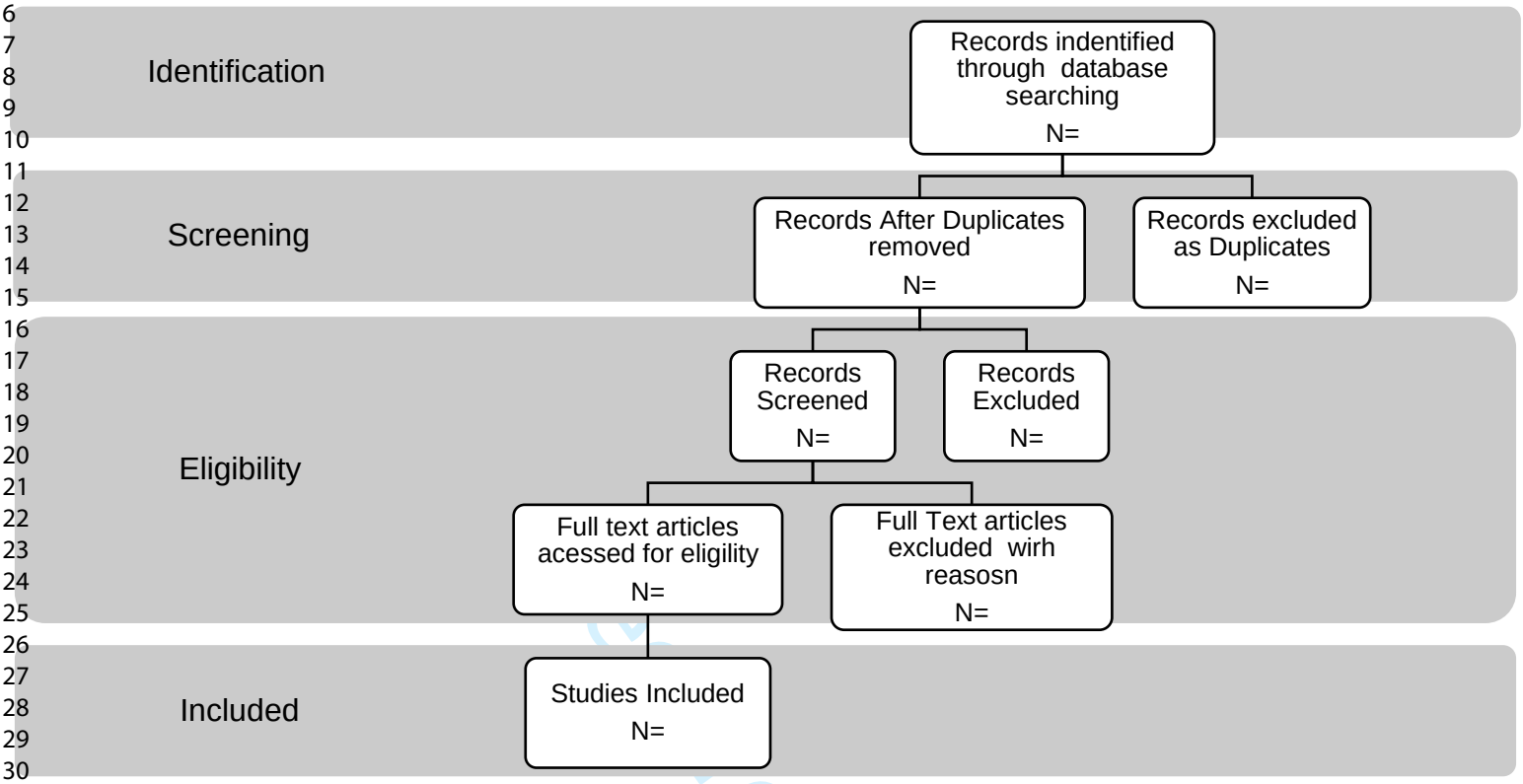

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Protocol for a scoping review study to identify and classify Anthropometric indicator for cardiovascular risk and Coronary Artery Calcification

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Protocol for a scoping review study to identify and classify Anthropometric indicator for cardiovascular risk and Coronary Artery Calcification

Caroline Frehner[1], Natalia Morais Cunha[1], Francisca Eugenia Zaina Nagano[1], Claudia Choma Bettega Almeida[2] , Emilton Lima Júnior[1]

[1] Programa de Pós-Graduação em Medicina Interna e Ciências da Saúde – Complexo Hospital de Clínicas
[2] Departamento de Nutrição, Professora do Programa de Pós-Graduação em Segurança Alimentar e Nutricional (Mestrado) Professor Adjunto - Nutrição

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Correspondence to Caroline Frehner: carol.frehner@hotmail.com

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These factors make it interesting to investigate the use of anthropometry as a method of assessing the risk of cardiovascular disease, since it is easy to apply in the clinic due to being operationally simple techniques, low cost and providing information about risk factors[2] that can aid in the prevention and

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treatment of diseases. Anthropometry is one of the methods of assessing body composition and is defined as: "the science that studies the measurement of size, weight and proportions of the human body"[3]. Perissinotto et al. (2002) found that non-pathological factors that may affect anthropometric characteristics should be taken into account, such as age, gender and geographical area[4]. Anthropometric measures have been the focus of many studies. However, some difficulties such as the possible redistribution of fat, the choice of the most appropriate equation and the best measurement technique are important issues that may limit the accuracy in the elderly populations [5].

Through the various anthropometric measures, data such as weight, height, circumferences, lengths and skin folds can be obtained. The values obtained allow us to calculate secondary measures such as body mass index (BMI), arm muscle circumference (BMC), arm muscle area (AMB) and others[1]. To estimate the body fat compartment, there are several formulas that use the value of the skin folds, each of which determines the number and location of the pleat to be used[6]. Each of these measures and their interrelations determine a specific body compartment, with a greater or lesser degree of precision[1]. However, there are criticism concerning the estimation of body composition by anthropometry because it can present important changes in results by interindividual variability.

Some anthropometric indices are associated with chronic diseases. The World Health Organization defines obesity not only as an excess of fat per se but rather as a fat accumulation that is related to worsening health and uses BMI (kg / m2) to classify it[7]. BMI is also used to predict the evolution and risk of disease, but it does not differentiate, for example, excess fat from excess lean mass / muscle or even edema. For example, a bodybuilder may have a BMI above 30 kg/m^2 and should not be characterized as excess fat but rather as weight[8]. However, population studies have observed that the increase in BMI from 25kg/m^2 has a positive curvilinear correlation with cardiovascular diseases, hypertension, and some types of cancer, bladder diseases, diabetes and higher mortality[9]. In older men and women (65-74 years-old), BMI>27 kg/m^2 was associated with worsening of glycemia, triglycerides and HDL cholesterol[10]. In this study, patients were randomly assigned to either the intra-abdominal fat [11], or to the body mass index (BMI)[12;13]. The AQI is correlated with intra-abdominal

fat[11] and together with BMI, have a prognostic value for dyslipidemias and coronary diseases [12;13].

Among the many methods of cardiovascular risk evaluation, the Coronary Artery Calcification (CAC) deserves attention because it is a direct and non-invasive way of measuring calcium deposited in the coronary arteries [14;15;16]. Coronary artery calcification proves to be a strong independent predictor of cardiovascular events, providing considerable, superior and additional prognostic information against clinical risk assessment methods[17]. The risk assessment offered by the Coronary artery calcification goes beyond that offered by the Framingham Risk Score, for example, and to populations of different ethnicities[18], having overcome clinical risk factors and other non-invasive methods in the evaluation of cardiovascular risk [19;20;21]. The use of Coronary artery calcification allows re-stratification of cardiovascular risk in patients classified as intermediate risk for low or high risks ranges[22], potentially modifying the profile and intensity of the approach to risk factors. In addition, international recommendations advocate the use of Coronary artery calcification as a tracking tool[23]. Therefore, the quantitative evaluation of coronary calcium with computed tomography has a definite role in the identification and stratification of coronary artery disease risk.

STUDY RATIONALE

Currently, the coronary calcium score imaging test is considered the gold standard for identifying cardiovascular risk in patients. And there is no consensus in the literature about the anthropometric measure that best indicates the cardiovascular risk. As well as there is no literature review that analyzes the interrelation of the anthropometric measurements of cardiovascular risk and imaging tests.

This review is therefore important because it aims to identify the anthropometric measure that is closest to the results of exams in the identification of cardiovascular risk. In this way, it assists in the patients diagnoses, guaranteeing a better therapeutic result and a cost-effective approach to patient care.

In resource-limited settings, access to screening is limited and the risk of patients lost to follow-up is high. So, anthropometric indicator to be applied at

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Point of Care (POC), which detect cardiovascular risk, have become popular in those settings due to their advantages: the quickness in giving results, the possibility of giving guidance immediately, are performed with minimal technical training in non-laboratory settings, and detect the risk for the disease at the clinical setting. In addition, as the test results are obtained on the same day, expressed in a qualitative way (detected or not detected) and guidance can be provided right away.

STUDY OBJECTIVE

The objective of this scope review is to comprehend and comprehensively describe the anthropometric indicators used in studies that address its association with CAC to identify Cardiovascular Risk in the adult population.

METHODS AND ANALYSIS

Protocol design

The methodology for this scoping review was based on the framework outlined by Arksey and O'Malley (2005), methodological enhancement made by Levac *et al*. (2010) and the Joanna Briggs Institute [24;25]. The review will include the following five key phases: (1) identifying the research question, (2) identifying relevant studies, (3) study selection, (4) charting the data, and (5) collating, summarizing, and reporting the results.

In preparation for this review, a pilot scoping search for Anthropometric indicator versus Calcium Coronary Score was done, in order to identify the list of all eligible index tests. The pilot search was conducted in two steps: first, we searched for all anthropometric indicator and second we searched for test accuracy studies for each of the Anthropometric indicator found by our first search comparing to Calcium Coronary Score. The first search, concerning available Anthropometric indicator, was restricted to English and Portuguese articles. This pilot search (conducted in April/ May 2019) resulted in a list of 241 eligible articles at Pubmed research

Stage 1: Identifying the research question

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This review was guided by the question, 'What is the diagnostic accuracy of Anthropometric methods associated with Coronary Artery Calcification (CAC) to measure cardiovascular risk in the adult population?' For the purposes of this study, a scoping review is defined as a type of research synthesis that aims to 'map the literature on a particular topic or research area and provide an opportunity to identify key concepts; gaps in the research; and types and sources of evidence to inform practice, policymaking, and research'[26].

As scoping is an iterative process we might add additional questions based on our findings along the review process[24]. While the eventual goal of this study is to contribute to the understanding of the process of nursing students' learning in practice, we will also synthesize results that are relevant to this topic.

Stage 2: Identifying relevant studies

SEARCH STRATEGY AND INFORMATION SOURCES

For the selection of the databases will be considered the coverage in the area of Health Sciences, and availability through the Portal of Periodicals of Capes and the Portal of the Library System of the Federal University of Paraná (UFPR). The selected databases will be: Cochrane Central Register of Controlled Trials (CENTRAL) in the Cochrane Library, Medline Complete (EbscoHost), Embase (Ovid SP), LILACS (BIREME), Web of Science, Scopus and SciELO. As well as, will be searched in the International Platform of the Registry of Clinical Trials of the World-wide Organization of the Health (www.who.int/ictrp); ClinicalTrials.gov; Transforming Research into Practice (TRIP); and will be updated. We will apply language limits to the searches (Portuguese, English, Spanish).

To ensure that all relevant information is retrieved we will also search a variety of grey literature sources. We will search relevant grey literature databases (eg, Grey Literature Report, OpenGrey, Web of Science Conference Proceedings) to identify studies, reports and conference abstracts of relevance to this review. We will also conduct a targeted search of the grey literature in local, provincial, national and international organizations' websites and related health or scientific organizations classification.

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The search strategy for the scoping review will be as comprehensive as possible within the constraints of time and resources in order to identify both published and unpublished (grey literature) primary studies as well as reviews. As recommended in all JBI types of reviews, a four-step search strategy is to be utilized (Table 1)

Search terms will be determined with input from the research team, research collaborators and knowledge users. The search strategy was developed by an experienced research librarian, and was revised pending input from stakeholders. Database and other searches will combine terms from two thematic blocks were drawn: anthropometric indicators (comparator 1) and CAC (comparator 2). Terms will be searched as both keywords in the title and/or abstract and subject headings (eg, MeSH, EMTREE) as appropriate. No language or date limits will be applied.

The search strategy example is showed in Table 2.

Stage 3: Study selection

The review process will consist of two levels of screening: (1) a title and abstract review and (2) full-text review. For the first level of screening, two investigators will independently screen the title and abstract of all retrieved citations for inclusion against a set of minimum inclusion criteria. The criteria will be tested on a sample of abstracts prior to beginning the abstract review to ensure that they are robust enough to capture any articles that may relate to the theme. Any articles that are deemed relevant by either or both of the reviewers will be included in the full-text review. In the second step, the two investigators will then each independently assess the full-text articles to determine if they meet the inclusion/exclusion criteria. To determine inter-rater agreement, Cohen's κ statistic. will be calculated at both the title and abstract review stage and at the full article review stage[27]. Any discordant full-text articles will be reviewed a second time and further disagreements about study eligibility at the full-text review stage will be resolved through discussion with a third investigator until full consensus is obtained.

We will include all study designs seeking to evaluate anthropometric measurements as cardiovascular risk index, in which it was compared to an

eligible reference standard (Coronary Calcium Score). The anthropometric measure may have been assessed alone or in conjunction with (and / or compared with) other measures. The studies should have measured Anthropometry and performed a Coronary Calcium Score simultaneously, or at least prior to any intervention to ensure that, the comparative tests reflect the same status. However, we will include studies in which this is not explicitly stated. We will include prospective and retrospective studies in the analysis.

The inclusion criteria will be developed in an interative process in which the reviewers calibrate a threshold for inclusion and exclusion. The initial inclusion criteria will be: adults without any kind of intervention at pre-screening (surgeries, drug treatment, specific diseases).

Since we are interested in learning how CAC and anthropometric measurements are associated, we exclude adults with intervention at the time of pre-screening, or adolescents/children (< 18 years of age), or specialized populations (specific diseases; drug treatment).

The exposure of this review will be an individual's total and regional body composition. These measures may include, but are not limited to: height (m), mass (kg) and body mass index (kg/m^2), waist circumference (cm), hip circumference (cm), total body fat (g), total body fat percentage (%), android fat (g), gynoid fat (g) and intra-abdominal body fat (g, cm^2, cm^3).

Stage 4: Data collection

Data will be extracted from full-text journal articles which meet the aforementioned inclusion criteria. A data collection instrument will be developed by the research team to confirm study relevance and to extract study characteristics. Study characteristics to be extracted will include, but not be limited to: publication year, publication type (eg, original research), study design, country, patient population characteristics, anthropometric measurements, calcium artery calcification method, cut off points, outcomes, study quality). This form will be reviewed by the research team and pretested by all reviewers before implementation to ensure that the form is capturing the information accurately. Data abstraction will be conducted in duplicate with two reviewers independently (CF and NMC) extracting data from all included studies. To ensure accurate data

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collection, each reviewer's independent abstracted data will be compared and any discrepancies will be further discussed to ensure consistency between the reviewers. The search results will be imported into the EndNote (Thomson Reuters) citation manager and pooled into a single library.

Stage 5: Data summary and synthesis of results

Since a scoping review can be used to map the concepts underpinning a research area and the main sources and types of evidence available, the aggregated findings provide an overview of the research rather than an assessment of the quality of individual studies. Although formal assessment of study quality is generally not performed in scoping reviews, some claim it should be incorporated in the methodology[26;28]. Assessing study quality will enable us to address not only quantitative, but also qualitative gaps in the literature[25]. We will therefore assess the quality of included studies by a set of quality indicators for reviews developed by Buckley *et al*[29]. The analytic frame will be piloted on 5–10 articles by the team and will allow us to analyse the selected articles through a common framework.

A PRISMA flow diagram will be used to report final numbers in the resulting study publication. As we expect a diverse body of knowledge, we will give a descriptive account of concepts and subsequent operationalisations. We will synthesise study findings using narrative descriptions based on themes that emerge from the extracted data. The results will be compared and consolidated through consensus between two of the reviewers CF and NMC (Figure 1)[30].

A narrative summary will accompany the diagram results and will describe how the results relate to the reviews objective and questions.

PATIENT AND PUBLIC INVOLVEMENT

No patient involved

DISSEMINATION AND ETHICS

This protocol reports a comprehensive, rigorous and transparent methodology. This scoping review will be the first study to compare anthropometric measurements and CAC, and thereby will contribute to the design

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and comparison of future studies in this field. This protocol reports a comprehensive, rigorous and transparent methodology. The results will be disseminated through a peer-reviewed publication. By identifying gaps in the current body of literature, this study can guide future research. Both the methodology and the results may be of interest for researchers, doctors, nutritionist and other health professions given the widely spread importance of learning in clinical practice. Since the methodology applied consists of reviewing and collecting data from publicly available materials, this study does not require an ethical approval.

Contributors: CF conceived the idea, developed the research question and study methods and contributed meaningfully to the drafting and editing. NMC, FEZN, Claudia CBA, ELJ aided in developing the research question and study methodsm contributed meaningfully to the drafting and editing.

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Table 1

Table showing the Four Step search strategy

Step	Strategy
1	Limited search of Pubmed , analysis of text words in titles and abstracts and of index terms used to describe the articles (241 articles in 28th May 2019)
2	Search using all identified keywords and index terms across all included databases: Cochrane Central Register of Controlled Trials (CENTRAL) in the Cochrane Library, Medline Complete (EbscoHost), Embase (Ovid SP), LILACS (BIREME) and Web of Science and Scielo. As well as, it will be searched in the International Platform of the Registry of Clinical Trials of the World Health Organization (www.who.int/ictrp); ClinicalTrials.gov; Transforming Research into Practice (TRIP); and will be updated.
3	Search of reference lists of all identified reports and articles for additional studies
4	Search of all relevant published systematic reviews and consultation with experts

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Table 2

Table showing Search strategy example for Pubmed

Search	Query
#1 Comparator 1	(anthropometry OR anthropometric OR "anthropometric indicator" OR "anthropometric marker" OR "anthropometric parameter" OR "anthropometric measurement")
#2 Comparator 2	("calcium coronary score" OR "calcium artery score" OR "calcium coronary artery score" OR "coronary artery calcium" OR "coronary calcification" OR "coronary artery calcium score" OR "computed tomographic angiography")
#3	#1 AND #2
Limits	Age +18, Language (Portuguese, Spanish, English), Human Studies

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Figure 1 Flow Diagram for the scoping review process adapted from the PRISMA statement by Moher and colleagues (2009)[30]

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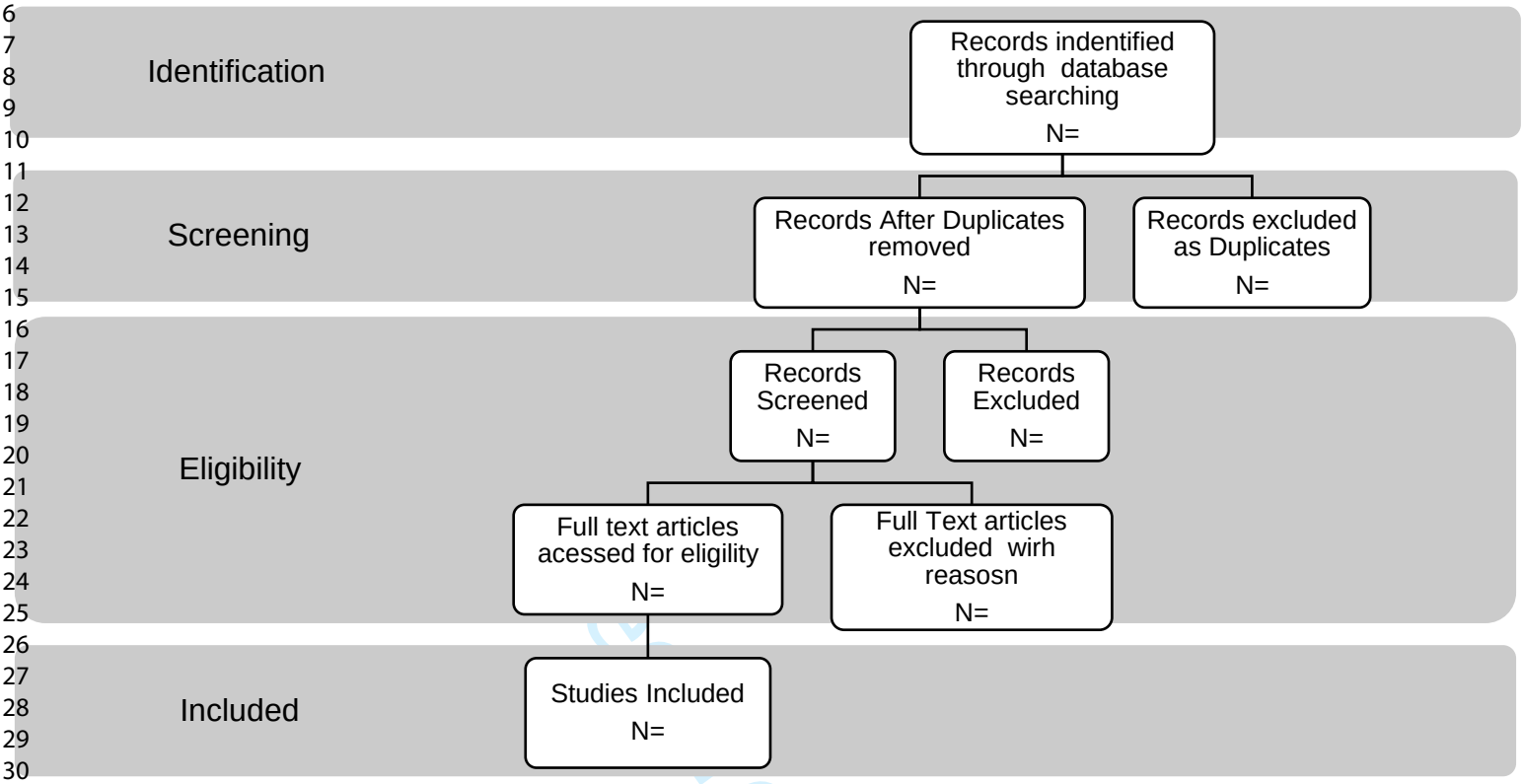

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