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Cardiovascular risk in people living with HIV: concept analysis

Risco cardiovascular em pessoas vivendo com HIV: análise do conceito

Riesgo cardiovascular en personas con VIH: análisis conceptual

Mayara Nascimento de Vasconcelos[I]; George Jó Bezerra Sousa[II]; Sherida Karanini Paz de Oliveira[I]; Rhanna Emanuela Fontenele Lima de Carvalho[I]; Saiwori de Jesus Silva Bezerra dos Anjos[I]; Thereza Maria Magalhães Moreira[I]; Renata Eloah de Lucena Ferretti-Rebustini[III]; Maria Lúcia Duarte Pereira[I]

[I]Universidade Estadual do Ceará. Fortaleza, CE, Brazil; [II]Ministério da Saúde. Brasília, DF, Brazil; [III]Universidade de São Paulo. São Paulo, SP, Brazil

ABSTRACT

Objective: to analyze the concept of cardiovascular risk in people living with HIV. **Method:** a concept analysis performed according to the eight stages set forth in the Walker and Avant model, namely: Choosing the concept for analysis; Determining the concept analysis purposes; Identifying possible uses of the concept; Determining defining attributes; Preparing a model case; Preparing a contrary case; Identifying antecedents and consequences; and Defining empirical references. **Results:** cardiovascular risk in people living with HIV can be defined as a multifactorial condition characterized by traditional risk factors for cardiovascular diseases along with the chronic inflammatory state caused by HIV, adverse effects of antiretroviral therapy and presence of chronic co-infections. It also encompasses identifying biochemical and cardiovascular markers. **Conclusion:** based on the findings, professionals and managers will be able to have scientific grounds for health planning, guiding patients in adopting preventive measures, achieving healthy lifestyle habits and minimizing cardiovascular events prevalent in the HIV population.
Descriptors: Nursing; Cardiovascular Diseases; HIV; Risk; Concept Formation.

RESUMO

Objetivo: analisar o conceito risco cardiovascular em pessoas vivendo com HIV. **Método:** análise conceitual realizada conforme as oito etapas do modelo de Walker e Avant: escolha do conceito para análise, objetivos da análise conceitual, identificar possíveis usos do conceito, determinar atributos definidores, construção de um caso modelo, construção de um caso contrário, identificar antecedentes e consequentes e definição das referências empíricas. **Resultados:** risco cardiovascular em pessoas vivendo com HIV pode ser definido como condição multifatorial caracterizada por fatores de risco tradicionais para doenças cardiovasculares juntamente com o estado inflamatório crônico causado pelo HIV, efeitos adversos da terapia antirretroviral e presença de coinfecções crônicas. Compreende também a identificação de marcadores bioquímicos e cardiovasculares. **Conclusão:** a partir dos achados profissionais e gestores poderão ter embasamento científico para planejamento em saúde, conduzindo os pacientes na adoção de medidas preventivas, alcançando hábitos de vida saudáveis e minimizando eventos cardiovasculares prevalentes na população com HIV.
Descritores: Enfermagem; Doenças cardiovasculares; HIV; Risco; Formação de Conceito.

RESUMEN

Objetivo: analizar el concepto de riesgo cardiovascular en personas que viven con VIH. **Método:** análisis conceptual realizado según las ocho etapas del modelo de Walker y Avant: elección del concepto a analizar, objetivos del análisis conceptual, identificación de posibles usos del concepto, determinación de atributos definitorios, construcción de caso modelo, construcción de caso opuesto, identificación de antecedentes y consecuencias y definición de referencias empíricas. **Resultados:** el riesgo cardiovascular en personas que viven con VIH puede definirse como una condición multifactorial que se caracteriza por factores de riesgo tradicionales de enfermedades cardiovasculares junto a un estado inflamatorio crónico causado por el VIH, efectos adversos de la terapia antirretroviral y presencia de coinfecciones crónicas. Comprende también identificación de marcadores bioquímicos y cardiovasculares. **Conclusión:** a partir de los hallazgos, los profesionales y gestores podrán disponer de base científica para planificación en salud, y orientar los pacientes en la adopción de medidas preventivas que forjen hábitos de vida saludables y minimicen eventos cardiovasculares prevalentes en la población con VIH.
Descriptores: Enfermería; Enfermedades Cardiovasculares; VIH; Riesgo; Formación de Concepto.

INTRODUCTION

The epidemic caused by the Human Immunodeficiency Virus (HIV) has exerted an impact on public health worldwide since the 1980s, particularly in terms of morbidity and mortality. The global incidence-prevalence ratio of HIV infections decreased from 11.2% in 2000 to 4.4% in 2019, reinforcing progress against the epidemic[1]. This change in the epidemiological scenario of the infection also took place in Brazil[2], mainly due to Antiretroviral Therapy (ART) initiated in the country in 1996[3].

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Corresponding author: Mayara Nascimento de Vasconcelos. E-mail: mayaravasconcelos92@hotmail.com
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Furthermore, Brazil was one of the first nations in Latin America and the Caribbean to formally adopt the 90-90-90 goals, currently called 95-95-95, which include expanding access to ART among the stipulated goals. There was a 16% increase in use of the therapy between 2012 and 2019 in the country[4,5]. Thus, ART contributed benefits in reducing morbidity and mortality associated with HIV/AIDS, improving quality of life[3] and, consequently, life expectancy of these people[6].

As life expectancy increases for people living with HIV, Chronic Non-Communicable Diseases (CNCDs) are also becoming more common in this group. Cardiovascular diseases (CVDs) have emerged as one of the most common causes of death among these patients, resulting not only from the deleterious effects of the virus itself and prolonged ART use, but also from the effects of aging[7].

Therefore, the Brazilian Ministry of Health (*Ministério da Saúde*, MS) recommends that cardiovascular risk be assessed during the initial approach in all people diagnosed with HIV and at each change in ART, using the Framingham risk score[4]. However, the literature points to the possibility that this score does not perform as expected in this population segment, as the cardiovascular risk spectrum in people living with HIV differs from that of patients undergoing standard primary prevention[8].

In view of the above, it is worth noting that there are gaps in the scientific literature regarding the effects of HIV on the development of cardiovascular diseases[9]. This fact can be mainly justified by the need for clarity regarding definition of the concept of cardiovascular risk in people living with HIV, as it has not yet been analyzed for this specific population group.

Likewise, it is emphasized that cardiovascular risk is currently defined broadly and originally as a health and nursing care context that allows identifying risk factors for modifiable (cardiometabolic, behavioral, psychosocial, cultural and occupational) and non-modifiable (biological) cardiovascular diseases, which act as early and interrelated markers of multiple and heterogeneous etiology, predisposing to cardiovascular vulnerability[10]. However, there is a need to perform an analysis of the concept including characteristics of the HIV-positive population, as it is understood that there are specific important elements in the relationship between HIV and CVDs that need to be studied and included.

That said, it is important to qualify this definition and, thus, provide a concept that fills the gaps regarding the population with HIV, elucidating pertinent explanations about HIV and CVDs, therefore providing theoretical grounds for a qualified clinical practice, including Nursing care, as concept analysis is closely related to knowledge evolution and expansion in Nursing[11]. Consequently, understanding concept analysis as a fundamental exercise for knowledge construction in Nursing and Health, the study proves to be relevant since, based on clarification of the construct, it will be possible to provide data for understanding the relationship between HIV and CVDs, elucidating characteristics and collaborating with specific health promotion strategies, as well as instigating questions not yet addressed in the scientific literature.

Given the above, this study aimed at analyzing the concept of cardiovascular risk in people living with HIV.

METHOD

This is a concept analysis based on the Walker and Avant Model, which consists of eight stages: a) Choosing the concept for analysis; b) Determining the purposes of the concept analysis; c) Identifying possible uses of the concept; d) Determining defining attributes; e) Preparing a model case; f) Preparing a contrary case; g) Identifying antecedents and consequences; and h) Defining empirical references[11,12].

It is worth emphasizing that choice of the framework is especially justified for being a model that underpins the main objective of this analysis: Development of a research instrument, providing in its stages a description of the components and uses of the concept. Therefore, it is considered a robust method, as well as the most widely used in Nursing[11]. The authors of the model propose an interactive process throughout the research, with the objective of analyzing the structure and function of its basic elements of a given concept, with the purpose of distinguishing it, refining ambiguities and clarifying vague and relevant concepts for Nursing, with the perspective of contributing to developing its practice[12].

The study followed eight stages as recommended by the adopted framework, which can be carried out interactively and not sequentially[12]. The first stage recommends that choice of a concept be linked to the professional experience area (practice, research, teaching, administration) and that it has aroused attention and concern[11,12]. At this point, to select the concept of cardiovascular risk in people living with HIV, it was considered that the cardiovascular

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risk of this population group differs from that found in the general population[8]. Therefore, it is necessary to perform a thorough analysis to clarify its particularities, especially for being a phenomenon of interest to the Nursing science.

The second stage refers to the concept analysis objectives, which can be justified by the development of research instruments or an operational (real) definition, development of a Nursing diagnosis, clarification of vague or imprecise concepts used in the professional practice, refinement of a concept when it appears to have multiple meanings, or adjustment between definition of the concept and its practical application[11,12]. The purpose of this analysis is based on theoretical understanding for the future construction of a specific instrument to measure cardiovascular risk for the HIV population.

The third stage involves identifying possible uses of the concept in order to get an idea of how the concept in question is being approached or applied. The fourth stage determines the defining attributes, which represents a fundamental step in the concept analysis, as they constitute characteristics that express the concept and act as elements for differential diagnoses, that is, to discriminate what is an expression of the concept from what is not. The fifth stage involves preparing a model case, which involves elaborating an example (based on reality) of how the concept is used, which includes its essential attributes. The sixth stage involves developing other cases: borderline, related, invented contraries and illegitimate, and they serve to assist in the decision regarding the essential attributes of the concept. The literature draws the attention to two of these cases, as they best fulfill the goal herein set out: the contrary case and the borderline case. The concept's antecentes are identified in the seventh stage, which involves surveying incidents or events that take place before the phenomenon and consequences of the concept and are related to events or situations that occur *a posteriori*. Finally, the empirical references are defined in the eighth stage[11,12].

In view of the above, these steps were instrumentalized from a scoping review that was developed according to the Joanna Briggs Institute (JBI) method[13]. The protocol was reported as per the recommendations set forth in the PRISMA-ScR checklist (PRISMA extension for Scoping Reviews)[14], being registered in the Open Science Framework. The review was conducted from the following phases: Definition and alignment of the objectives and question; Development and alignment of inclusion criteria, with the objectives and question; Description of the planned approach for searching evidence; Selection, data extraction and presentation of evidence; Search for evidence; Selection of evidence; Extraction of evidence; Analysis of evidence; Presentation of the results; Summary of the evidence in relation to the review objective; Drawing conclusions and observing any implications of the results[13].

The Population, Concept and Context (PCC) strategy was used To define the question, namely: P) People living with HIV; C) Cardiovascular risk characteristics, antecedents and consequences; and C) Health area. Thus, the following research question was defined: What is the concept of cardiovascular risk, according to its characteristics, antecedents and consequences in people living with HIV?

Based on the definition of the elements comprising the concept under study (concept uses, attributes, antecedents and consequences), we proceeded with preparing fictitious case based on the evidence found in the review and in the authors' care experiences. The fictitious case developed represents a reality-based example of how the concept is used, which includes its essential attributes[11]. In the same way, an additional case was identified, in which it was decided to prepare a contrary fictitious case since, in addition to being one of the most recommended in the literature, it provides an example of the “non-concept” and is useful to assist in the decision regarding the essential attributes of the concept[11]. Subsequently, the last step was carried out by searching for empirical references. These references included methods for measuring cardiovascular risk in people living with HIV. Both clinical scores and biological markers could be part of these references in order to allow better identification of high-risk patients[15].

Online access to databases was adopted to search for the materials. The first step was a search in The Medical Literature Analysis and Retrieval System Online (MEDLINE via PubMed), followed by another one in the Latin American and Caribbean Literature on Health Sciences (*Literatura Latino-Americana e do Caribe em Ciências da Saúde*, LILACS), Scientific Electronic Library Online (SciELO) and, finally, in the Cumulative Index to Nursing and Allied Health Literature (CINAHL). These databases were chosen for being comprehensive, with broad coverage of publications in the health area.

The inclusion criteria were as follows: full-text articles on cardiovascular risk in people living with HIV, conducted with human beings. Articles not answering the guiding question, duplicates, editorials, letters to the editor, abstracts, reviews, commentaries and case studies were not included, even when tracked in the searches. The processes to search and select the articles followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guide[14].

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The search took place in September 2023. Titles, abstracts and descriptors of the evidence found in the review were studied. The studies selected that answered the guiding question were read in full. The search strategies and the number of articles selected can be seen in Figure 1.

Database	Search strategy	Studies leveraged (n)
MEDLINE/PubMed	"HIV"[Mesh] AND "Risk"[Mesh] AND "Cardiovascular Diseases"[Mesh]	23
LILACS	("HIV") AND ("Risco") AND ("Doenças Cardiovasculares")	12
SciELO	("HIV") AND ("Risco") AND ("Doenças Cardiovasculares")	05
CINAHL	("Human Immunodeficiency Virus") AND ("Cardiovascular Risk Factors")	02

Figure 1: Search strategies according to databases. Fortaleza, CE, Brazil, 2023.

A previously developed instrument was used for data collection, including the following: a) Characterization of the studies selected: authorship, year, database, title, study objective and type; and b) Elements of the concept analyzed: definition of the concept, essential attributes, antecedents and consequences.

For data processing and analysis, a floating reading of the material was performed, the study objective was revisited and the material was organized into a *corpus* for analysis. Subsequently, after extracting the data from the articles, they were grouped into categories based on similar ideas and concepts. Essential information was extracted to build the *corpus* for concept analysis, from which categories were created according to the theoretical framework stages. Thus, the concept use, attributes and antecedents/consequences were identified, which were presented in a conceptual structure, as well as the empirical references identified.

RESULTS

The concept was analyzed from 42 articles identified in the databases, ranging from 2009 to 2023 (Figure 2), thus elucidating the conceptual structure of cardiovascular risk in people living with HIV (Figure 3).

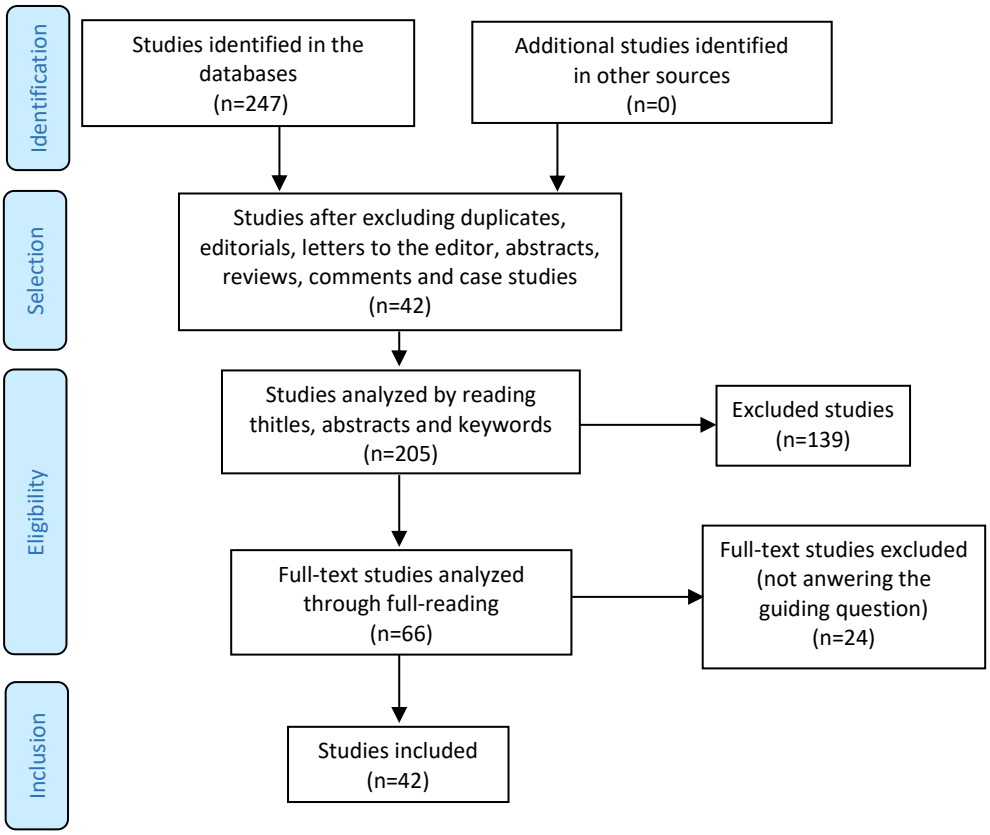

Figure 2: Flowchart showing the database search results, adapted from PRISMA-ScR[15]. Fortaleza, CE, Brazil, 2023.

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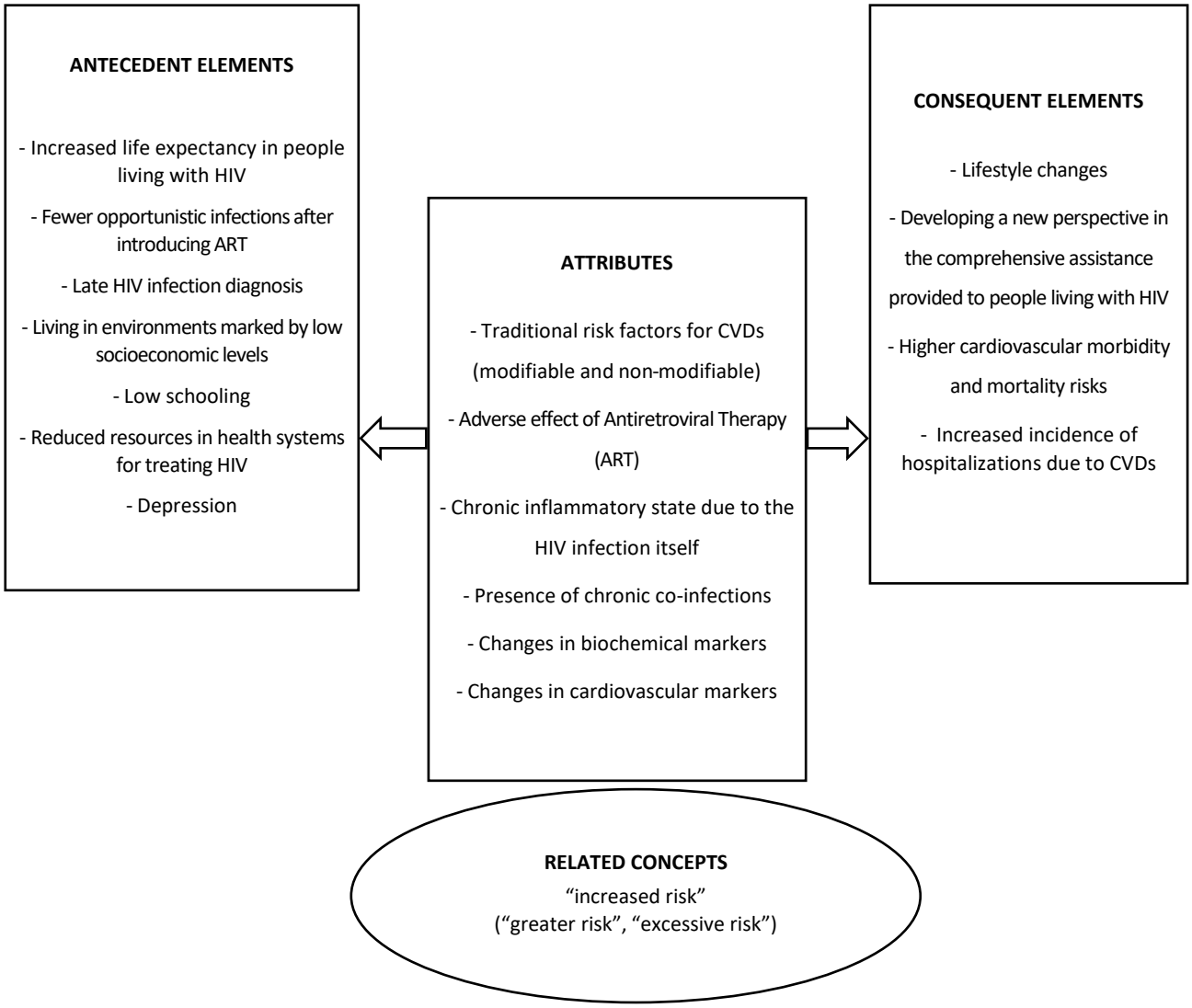

Figure 3: Conceptual framework for cardiovascular risk in people living with HIV. Fortaleza, CE, Brazil, 2023.

Regarding how the concept is used, it was identified that some authors present the expression "increased risk" and synonyms ("greater risk", "excessive risk") as the most frequent terms and closest to the possible definitions of the concept analyzed.

Subsequently, with the intention of listing the elements that characterize the concept, the defining attributes were determined, which include elements related to traditional risk factors (modifiable and non-modifiable) for cardiovascular diseases, as follows: a) modifiable: smoking, high blood pressure, high cholesterol, obesity, sedentary lifestyle, diabetes *mellitus*, inadequate diet, alcohol abuse, physical inactivity, stress and use of illicit drugs; and b) non-modifiable: gender, genetics, cultural factors, family history of early Coronary Artery Disease and age; the inflammation state caused by presence of the virus, adverse effects of ART, presence of chronic co-infections such as Hepatitis C; Herpes; Cytomegalovirus; Chronic Kidney Disease; and alteration of biochemical and cardiovascular markers, namely: interleukin 6 (IL-6), C-Reactive Protein (CRP), D-dimer, low lymphocyte count (mainly T-CD4+ lymphocytes), high viral load, low serum selenium level, low platelet levels, N-terminal fragment of B-type natriuretic peptide (NT-ProBNP), endothelial and vascular impairment, greater thickness of the intima-media layer of carotid arteries.

Regarding the concept's antecedents and consequences, most of the studies presented aging of this population and the effects of ART, such as possible toxicity and reduction of opportunistic infections, as antecedents to cardiovascular risk in people living with HIV. It is also related to less investment in health services for the care of people living with HIV. As consequences of this risk, the studies list cardiovascular morbidity/mortality and changes in the habits

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of this population segmtn. It was pointed out that comprehensive care for each individual is a consequence related to health professionals.

Subsequently, a model case was created as a support pattern, as well as a contrary one to present an example of "non-concept", both presented in Figure 4.

Model case
"A.P.C., 56 years old, Brazilian, male, brown-skinned, single, born and raised in inland Ceará, fisherman, 1.65 m tall and 85 kg, living with HIV for eight years. A sedentary patient, he does not have healthy eating habits, as he claims to spend a lot of time at sea and is unable to follow an adequate diet, but he has tried to follow his antiretroviral treatment since his diagnosis. A fisherman, he has been a smoker for over ten years, is hypertensive and diabetic and has a family history of Acute Myocardial Infarction (AMI). When attending his routine appointment, A.P.C. presents the results of tests requested by his physician, as the professional had already warned him about the toxicity of antiretroviral drugs, which can cause a chronic inflammatory state and, consequently, compromise endothelial and vascular function. The test results were not satisfactory, as he had a low CD4 lymphocyte count and low platelet levels, as well as low serum selenium levels and thickening of the carotid intima-media layer (1.2 mm)".
Contrary case
"C.A.P., 32 years old, Brazilian, male, brown-skinned, single, born and raised in the capital of Ceará, student, 1.70 m tall and 72 kg, living with HIV for two years. The patient has been following an adequate diet and antiretroviral treatment since his diagnosis. The student has no comorbidities or family history. When attending his routine appointment, C.A.P. presents the results of the tests requested by his physician at the last appointment, as the professional had already warned him about the toxicity of antiretroviral drugs, which can cause a chronic inflammatory state and, consequently, compromise endothelial and vascular function. The test results were satisfactory, as he presented undetectable viral load, adequate levels of CD4 lymphocytes and adequate platelet and serum selenium levels, with no compromise in the carotid arteries".

Figure 4: Model case, and contrary case developed to present the "non-concept". Fortaleza, CE, Brazil, 2023.

Finally, in the last stage it was pertinent to search empirical references for this concept analysis, which were related to tools for predicting cardiovascular risk in people living with HIV. The literature proved to be diverse, as different empirical references were evidenced: Framingham Risk Score (FRS); Systematic Coronary Risk Evaluation (SCORE); Prospective Cardiovascular Munster (PROCAM); Data Collection on Adverse Events of Anti-HIV Drugs (DAD); Atherosclerotic Cardiovascular Disease (ASCVD) Risk Score and Pooled Cohort Equation (PCE).

In view of the above, this analysis allowed operationalizing the following definition of the concept of cardiovascular risk in people living with HIV: "A multifactorial condition characterized by traditional risk factors for cardiovascular diseases along with the chronic inflammatory state caused by HIV, adverse effects of antiretroviral therapy and presence of chronic co-infections. It also comprises identifying biochemical and cardiovascular markers".

DISCUSSION

This analysis identified that the definition of the concept of cardiovascular risk in people living with HIV is presented in a fragmented manner in the scientific literature. In fact, it is not addressed as a concept but, rather, HIV is presented as just another risk factor[16]. At this point, it is worth noting that the literature currently shows that perception and exposure to risk are differentiated according to the vulnerability conditions that are experienced, as well as the health actions/behaviors that people perform individually are in line with the meaning and significance that the disease represents for them[17]. In addition, it is known that the cardiovascular risk concept is broad and current[10]; thus, the authors of this study chose to maintain the term "cardiovascular risk" to define it specifically for the population with HIV, especially because it is believed that the analysis highlighted antecedents, attributes and consequences that can characterize the cardiovascular vulnerability of the population under study.

Therefore, the attributes elucidated are directly related to specific traits of the relationship between HIV and CVDs, in which it was possible to know the specificities of a person living with HIV with regard to their predisposition to a cardiovascular event.

Among the ideas discussed in the scientific field about the concept, most of the studies emphasized the presence of traditional risk factors for CVDs in the population researched, both non-modifiable: gender (men have a higher CVD risk) , genetics, cultural, family history of early Coronary Artery Disease (in first-degree relatives, before the age of 55 for men, or before 65 years old for women), age (men ≥45 years old; women ≥55 years old or early menopause without

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hormone replacement therapy); and the most significant modifiable risk factors: smoking, high blood pressure, high cholesterol, obesity, sedentary lifestyle, diabetes *mellitus*, inadequate diet, alcohol abuse, physical inactivity, stress and use of illicit drugs such as marijuana and other injectable drugs[18-30].

Thus, the aforementioned elements favor an increase in the inflammatory state in the individual. A recent cohort study conducted in the United Kingdom confirmed the importance of traditional CVD risk factors in screening patients with HIV; however, the results added that these factors exerted little impact on the overall CVD risk; therefore, a validated risk assessment tool for HIV and further investigation into who should be subjected to regular assessments would be beneficial[31].

Furthermore, the effects of HIV itself were considered as an attribute, as they present persistent immunological and inflammatory activation, in which the virus infection time can be considered a risk factor for CVDs[18]. It is worth noting that, although uncertain, diverse evidence indicates that ART also contributes to increased CVD risk[32]. This increased risk may occur in different ways depending on the antiretroviral used and the person's viral load. In this analysis, the studies especially highlighted the class of protease inhibitors as risk factors for CVDs[16,20,23,26,28,33-37]. Furthermore, the presence of chronic coinfections, such as coinfection by the Hepatitis C virus (HCV), coinfection and replication of viruses from the herpes family, infection by Cytomegalovirus (CMV) or development of chronic kidney disease, is also a determining factor for increased cardiovascular risk in the population with HIV[38].

It was found that, in addition to the factors previously presented and the effects of the virus itself, biochemical and cardiovascular markers are also important characteristics present in the concept. Thus, some laboratory criteria can be considered in the care provided to the population under study, such as selenium[33], interleukin 6 (IL-6), C-Reactive Protein (CRP) and D-dimer levels since, to assess cardiovascular risk, it is necessary to evaluate unconventional inflammatory biomarkers, with proven high values in people living with HIV[9].

In addition, knowing that both HIV and ART can induce premature endothelium activation, the literature indicates that ultrasound measurement of the carotid intima-media layer should be included in the cardiovascular risk assessment in this population[9,39]. It is also worth noting that low levels of CD4+ T lymphocytes *and* **continuous** HIV replication damage platelets and contribute to the development of atherosclerosis[19,20]. A publication was also identified on the relationship between levels of N-terminal fragment of B-type natriuretic peptide (NT-ProBNP) and CVD risk in patients with HIV, in which it was inferred that elevated NT-ProBNP is associated with higher CVD risk, and this increased risk persisted after adjusting for other cardiovascular risk factors, although without considering the ART effects[9].

Regarding the background of the concept under study, it was identified that much evidence elucidated an increase in the survival of people living with HIV[9,16,18,29,28,38-44], that is, the improvement in the life expectancy of these people can be considered a previous event to CVDs, as advanced age can result in more comorbidities. This aging process is mainly related to ART, resulting in a lower proportion of opportunistic infections[26,34,45-46] and in the emergence of previously non-existent or unnoticed complications, until then considered adverse effects of the medications. Such complications included body fat redistribution, increased fat mass and changes in circulating lipids and glucose metabolism, all contributing to an increase in cardiovascular risk[46].

Other antecedent components identified were low socioeconomic status[33,47], low schooling level[18], reduced resources in health systems for HIV treatment[33,35,38,40,47], late HIV infection diagnosis[46] and depression[48]. Frail socioeconomic environments stand out in this context, as economic inequality is conducive to worsening quality of life because it limits the opportunity to access services and goods[18], which can lead to late diagnosis[49] and barriers to accessing treatments[40], contributing to the onset of cardiovascular complications[18]. Furthermore, low health literacy is associated with challenges for those living with HIV, including non-adherence to medications and worse health outcomes[50]. Thus, the factors presented weaken the care offered to people living with HIV, representing important characteristics due to their significant repercussions on each person's systems, with the cardiovascular system standing out.

Regarding the results identified in the “consequences” category, higher risks of cardiovascular morbidity and mortality were observed in the population under study[19,26-28,33,35,40-41,46-47]. In this context, there is a need for changes in lifestyle habits[9,18,36,43], as well as to develop a new perspective on comprehensive care for people living with HIV/AIDS[18,21,33,39], especially given the fact that AIDS has become a chronic disease[15]. One of the studies included in the review infers that specific characteristics of patients with HIV were more strongly associated with CVD morbidity and mortality than traditional CVD risk factors[20] and, consequently, can lead to increased hospitalization[16,22]. Therefore, it is suggested to develop a new perspective on clinical nursing and health care for

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these patients, also providing an interprofessional approach, achieving integration between actions and more contextualized assistance to achieve better health conditions.

Therefore, it is clear that this study population needs interventions addressing lifestyle habits as risk factors for the development of CVDs. It is essential to encourage them to change their eating habits, perforom physical exercise and stop smoking and drinking, as well as to support them in maintaining these changes. Likewise, it is essential to provide guidance on controlling weight, blood glucose levels, blood pressure and dyslipidemia in a clear and appropriate manner according to each person's reality, so that they reflect on their everyday actions, placing themselves as protagonists of their health-disease process[18,25,37,46,51].

Furthermore, the role of health services in reducing stigma also stands out, as comprehensive health care is not limited to testing and treatment and stigma also has repercussions on these individuals' family, social, emotional, work and health care relationships. Consequently, health services need to value listening to the patients' dilemmas and anxieties due to stigmas, helping them to reframe them, as they are a source of significant distress. Despite advances in prevention and treatment, joint intersectoral actions between Non-Governmental Organizations and the Brazilian government are likely to fall short of what is desired if stigma and discrimination remain at the current levels. In this regard, health care provision and ongoing education for health professionals represent a privileged *locus*[52].

In view of this, health professionals need to be aware of the evidence presented on cardiovascular risk in people living with HIV, so as to qualify care and practice reflected in science. At this point, it is emphasized that nurses have as their core competence and responsibility care at all health care levels, oftentimes determining the monitoring and guidance process. Thus, it is essential to measure the phenomenon under study in order to enable detection of future cardiovascular events. Therefore, from the last stage of this analysis, different tools for measuring cardiovascular risk used around the world were identified as empirical references; however, most of them were not specifically developed for HIV-positive people.

Proposed by the American Heart Association and American College of Cardiology and according to results from the Framingham Heart Study, the Framingham Risk Score (FRS) is one of the most widely used methods worldwide[21,43]. However, it is important to note that FRS may erroneously estimate the risk in this population segment, a situation that may be due to the type of population in which the study was developed, as well as the definition of events and follow-up time of the cohorts[21,25]. Therefore, use of other instruments should be considered.

This analysis emphasizes the DAD score, based on the multicenter study entitled “The Data Collection on Adverse Events of Anti-HIV Drugs (DAD) Study Group”, a collaboration of 11 cohorts comprised by HIV-positive patients treated in 212 clinics in the United States, Europe, Argentina and Australia, with algorithms specifically developed for this population. The DAD score was first published in 2010 and considered CD4 count, Abacavir use and exposure time to protease inhibitors and nucleoside reverse transcriptase inhibitors, in addition to the classic cardiovascular risk factors[53]. Subsequently, in order to simplify the risk stratification of HIV-positive patients and due to the difficulty evaluating previous ART regimes such as information retrieval, a modification of the DAD score was proposed and published in 2016, evaluating the same clinical outcomes in five years, but not using the classes and exposure time to ART[54].

On the other hand, it is worth noting that, although the DAD score was specifically developed for the HIV population, it was implemented in developed countries and not in Latin America, with the exception of Argentina. Thus, there is a scientific gap regarding the need for an instrument that measures cardiovascular risk in people with HIV who live in different realities. A Brazilian instrument is justified given the continental dimensions of the country, as well as its sociodemographic, economic, cultural and political characteristics that govern the care providd to people living with HIV.

The results of this study contribute to research and clinical practice, especially for the Nursing category, as understanding the concept under study will contribute to identifying cases that may present increased CVD risk, strengthening specific care to change this scenario. In this sense, it is believed that concept analysis is a method that should be strengthened as a foundation for the Nursing science, clarifying concepts that still require discussion.

Thus, elucidating this concept adds novelty to the Nursing science and may support new research studies to confirm which elements are important for cardiovascular risk in people living with HIV. Furthermore, the main purpose of this analysis was to contribute to adequate applicability of the concept in different care settings[11], as

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well as it will provide theoretical support in the development of a national measuring instrument focused on the Brazilian reality and may help to better understand the characteristics of this population group.

Regarding limitations, it is worth highlighting the fact that this concept analysis only used open-access databases specialized in health sciences, mainly medical and nursing literature. In addition, it is believed that it is important to use other descriptors and cross-references in a new literature search, rendering it more sensitive and broad, thus filling existing gaps.

CONCLUSION

Cardiovascular risk in people living with HIV can be defined as a multifactorial condition characterized by traditional risk factors for cardiovascular diseases along with the chronic inflammatory state caused by HIV, adverse effects of antiretroviral therapy, presence of chronic co-infections and identification of biochemical and cardiovascular markers. This study represents a contribution to Nursing and Health, as professionals and managers will be able to have scientific grounds to effectively plan health, guiding patients in the adoption of preventive measures, providing autonomy in the health-disease process, achieving healthy lifestyle habits and minimizing cardiovascular events prevalent in the population with HIV.

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Author's contributions

Conceptualization, M.N.V.; methodology, M.N.V. and G.J.B.S.; validation, M.N.V. and G.J.B.S.; formal analysis, M.N.V. and G.J.B.S.; investigation, M.N.V.; resources, M.N.V., T.M.M.M. and M.L.D.P.; data curation, M.N.V. and G.J.B.S; manuscript writing, M.N.V.; review and editing, M.N.V., G.J.B.S., S.K.P.O., R.E.F.L.C., S.J.S.B.A., T.M.M.M., R.E.L.F.R. and M.L.D.P.; visualization, M.N.V., G.J.B.S., S.K.P.O., R.E.F.L.C., S.J.S.B.A., T.M.M.M., R.E.L.F.R. and M.L.D.P; supervision, S.K.P.O., R.E.F.L.C., S.J.S.B.A., T.M.M.M. and M.L.D.P. project administration, M.N.V., T.M.M.M. and M.L.D.P.; financing acquisition, T.M.M.M. and M.L.D.P. All authors read and agreed with the published version of the manuscript.

Use of artificial intelligence tools

The authors declare that no artificial intelligence tools were used in the composition of the manuscript "*Cardiovascular risk in people living with HIV: concept analysis*".