Project Title: **Prospective study of optometry assimilation into primary care of the Unified Health System (SUS).**

1. INTRODUCTION

Since the French Revolution (1789-1799) inaugurated the Declaration of the Rights of Man and of the Citizen, in which the definition of men's individual and collective rights begins to gain strength and encourage paradigmatic changes on the perception of equality between individuals, the issue of citizenship is part of the social, cultural, and political aspects of contemporary States. The 20th century increased and formalized the Universal Declaration of Human Rights (1948), a response to the dramatic experiences of successive wars and genocides seeking to standardize and reaffirm the validity of universal rights from the perspective of citizens' rights and duties (HUNT, 2009).

A theme sensitive to citizenship maintenance policies is related to health. The concept of health proposed by the World Health Organization (WHO) suggests that it is "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity," which epistemologically leads to discussions about the health condition of citizens organized in societies by understanding health as a collective value and a common good.

Health technology issues relate to this health concept. According to the Brazilian Ministry of Health (MS, 2016), health technology refers to the application of knowledge to promote health, prevent and treat diseases, and rehabilitate people. Examples of health technologies are: medicines, health products, procedures, organizational, educational, information, and support systems, and the care programs and protocols providing the population with health care. Technologies are present in health from disease prevention to health treatment and recovery. The correct use of health technologies and the constant updating of their information are essential to better benefit patients, caregivers, and family members (MS, 2016).

In Brazil, with the promulgation of the so-called 1988 Citizen Constitution, health became a universal right and a duty of the State. The latter must arbitrate health policies whose specificities can provide citizens with health prevention, protection, and maintenance. The article 196 of the 1988 Constitution reads as follows: "Health is a right of all and a duty of the State and shall be guaranteed by means of social and economic policies aimed at reducing the risk of illness and other hazards and at the universal and equal access to actions and services for its promotion, protection and recovery" (BRASIL, 1988). In this context, the Unified Health System (SUS), the predominant health system in Brazil, was delineated. Laws no. 8,080 of September 19, 1990 and no. 8,142, of December 28, 1990 established a free health system accessible to all citizens, whether residents or in transit in the Brazilian territory. SUS is based on three basic principles: universalization, equity, and integrality, making health a right and a gateway to citizenship in Brazil.

One of the powers granted by the SUS laws (no. 8,080/90, art. 5, item III) includes in its practices the possibility to "III – assist people via health promotion, protection, and recovery actions, with the integrated

realization of care actions and preventive activities"; whereas art. 6, item I/D, states that: "I – execution of actions: d) of comprehensive therapeutic, including pharmaceutical, care;" (BRASIL, 1990). As a whole, these characteristics provide and encourage public health policies aimed at maturing several health priority sectors that can meet the population's health needs within the premises of SUS.

Among the priorities of SUS, eye and ocular health services achieve considerable efforts to maintain and improve eyesight, demanding constant improvement and including new technologies for the regular care of the population. An option that may be feasible for SUS to address primary eye health care is to incorporate, in its care, optometry procedures, activities, and social function. Since SUS is one of the largest free health systems in the world, it refers its users to primary, secondary, and tertiary/quaternary health care. The latter shows higher technological density and establishes actions for its self-maintenance. Among the actions of SUS, we evidence its decentralized management, operated by municipalities, states, and the federal government, enabling the expansion of incorporated care procedures identified with the health needs of each Brazilian region.

Over time, the Ministry of Health developed strategies to optimize the budget available for the development and maintenance of SUS. One of them refers to incorporating medicines, procedures, and equipment into health care, provided for the law no. 12,401 of April 28, 2011, which established new rules for incorporating health technologies into SUS. This law regulates the National Commission for Technology Incorporation at SUS (CONITEC) and the Health Technology Assessment (ATS). CONITEC is responsible for advising the Ministry of Health on the incorporation, alteration or exclusion of new health technologies, as well as on the constitution or alteration of clinical protocols and therapeutic guidelines, whereas the ATS subsidizes CONITEC.

Both operate to meet the population's health priorities, choosing the best healthcare option in light of economic limitations. CONITEC analyzes important information for the incorporation of technologies into SUS via: i. what SUS users expect from the new technology; ii. estimated benefits; iii. integration of these benefits into treatments already incorporated into care; iv. whether affected individuals will live better with the proposed technology; v. the importance of benefits; and vi. the budgetary and/or financial impact on health system users' lives. These items guide the evaluation of new SUS incorporation proposals. This experience space includes national, state, and municipal health councils which deliberate the incorporation of technologies and new care technologies based on the population's health needs.

According to the WHO and the Brazilian Ministry of Health's Virtual Health Library, providing effective and accessible eye health services is key to controlling visual impairment, including blindness. Preference should be given to strengthening vision care services by integrating them into health systems.

Recent and alarming data in the World report on vision (WHO, 2019), published on October 8, 2019, show that at least 2.2 billion people worldwide currently suffer from visual impairments, of which at least one billion show avoidable or uncorrected visual impairments. The report asserts that the world faces considerable

challenges in ophthalmological care, including coverage inequalities and quality of prevention, treatment, and rehabilitation services; a shortage of trained ophthalmologic service providers; poor integration of vision care services into health systems, among others (WHO, 2019). It also shows cases of "avoidable blindness": refractive errors (myopia, hyperopia, astigmatism, and presbyopia) are, admittedly, one of the most prevalent eye disease groups worldwide. In 2006, the WHO found 15^3 million people blinded by uncorrected refractive errors. According to the Brazilian Council of Ophthalmology (CBO, 2019), this number would exceed 300 million if cases of uncorrected presbyopia were summed.

Eye health is situated within public health, and data from the 2000 Census, conducted by the Brazilian Institute of Geography and Statistics (IBGE), indicate that the leading cause of disability among the 24.5 million disabled Brazilians, is visual, composing 48.1% of the total (IBGE, 2000). The main cause of low vision in elementary school students are uncorrected refractive errors (KARA; ALVES, 1994). The Brazilian Council of Optometry and Optics (CBOO) corroborates these data and includes in the discussion the need to expand the scope of primary diagnosis and treatment of refractive errors (CBOO, 2021), a phase in which prescribed glasses could positively impact visual problem complications and future outcomes, such as blindness (DANDONA; DANDONA, 2006).

According to the WHO, the provision of effective and affordable eye health services is key to controlling visual impairment, including blindness, and preference should be given to strengthening eye care services via their integration into health systems. Among several studies, we highlight the one by Yashadhana et al. (2021), which addresses aspects of the eye health sector in Latin American children, especially on Colombia. The study reinforces the need to potentiate eye health public policies which focus on the early stages of literacy, in which correcting refractive errors and prescribing glasses and/or contact lenses could avoid many future problems – such as blindness.

1.1 A problem to be addressed

In this context, optometry procedures linked to eye health services emerge. Optometry is the vision science which several countries in the world, including Brazil, recognize and apply, for 331,743 optometrists in 123 countries (STERN, 2021). One way to apply optometry knowledge is to promote people's quality of life. Thus, the role of the professionals called optometrists gains crucial importance (MATEUS, 2019). Optometry is widely adopted in health systems in Great Britain, Canada, the United States, Australia, Spain, and Colombia, among hundreds of other countries, decisively contributing to the improvement of the population's eye and visual health. This means that optometry could reduce the waiting for eye health care in SUS, alongside ophthalmologists, occupational therapists, physical therapists, and orthoptists. As widely reported, more than 80% of people who wait for appointments in SUS for some eye disease show refractive errors such as myopia and astigmatism, the main causes of preventable blindness. These are cases in which it is possible to still correct the problem in primary health care with the use of glasses or contact lenses, a function historically linked to optometry.

According to the CBOO, this contingent composes most of the demand for care in SUS, which optometrists could easily serve since it directly relates to their academic background. It is a consensus that optometrists are professionals trained to examine and evaluate visual function in the absence of pathological disorders, as is the case with refractive errors. They can identify refractive errors, prescribe solutions, and, if the problem is pathological in etymology, refer patients to ophthalmological care (CBOO, 2021; LINO, 2007 *Apud* MARINHO, 2014; SILVA, 2017).

It seems that optometrists could become the primary care force in eye healthcare, screening cases that necessarily require ophthalmological care. This dynamic could represent a decrease in waiting for care, an increase in the quality of life of the population affected by eye problems and, especially, an optimization of the resources available for this priority in SUS.

Based on the above, this research project aims to develop scientific work on the importance of optometry procedures in visual and ocular care. It intends to generate academic and scientific products that can contribute to elaborating and presenting optometry procedures to the Ministry of Health, including the analysis of health councils and CONITEC, aiming at primary eye health care.

1.2 Translational Research in Health and Transdisciplinarity in Biomedical Engineering

Currently, Brazil faces a growing interaction of different knowledge areas, such as medical sciences, health, humanities, social sciences, and engineering. This is a new academic perspective based on theoretical and methodological procedures which should adapt to this movement and create reflection objects. In Healthcare Engineering, this perspective contributed to constitute scientific knowledge related to the problems it raises, including aspects of public policies.

Especially in public health – understood as a space for the State to act in its various aspects to provide care for the population – it should be emphasized that constructing an object is not defined by restriction. Weil, D'Ambrosio, and Crema (1993) claim that, in disciplinarity, objects are fragmented in three different levels: matter (solid, liquid, igneous and gaseous forms), life (plant, animal, and human) and programming, with information identified both at the matter and life levels. Academic and scientific methodologies and practices, such as interdisciplinary and/or transdisciplinary research, assist in developing technologies, incorporating them into health systems, and involving an expressive variety of disciplinary matrices, enable interdisciplinarity in science, technology, and innovation (PHILIPPI; SILVA NETO, 2011).

Integration between knowledge areas strengthens health research, development & innovation (RD&I), contributing to design the science, technology, and innovation sector (ST&I) by discussing, in its development, activities that consider not only hardware and software, preparation of protocols, and development of new molecules but also the incorporation of this set into public and private health systems. Moreover, translational research in health (TRH) has, in its methodological basis, the debate about the stages that make up the ecosystem of transformation of research projects into technologies (procedures, medicines, and equipment) whose economic and social characteristics can be assimilated by SUS, i.e., "from the bench

to SUS". According to Correia et al. (2019), the translational research spectrum represents the phases of biological-based research up to interventions that improve individuals' health, involving different times (T). T0 represents basic research; T1, preclinical research; T2, clinical research; T3, clinical implementation; and T4, public health implementation. However, appropriating the TRH method contributes toward the RD&I of health technologies, including discussions such as: i. production of a pilot lot with good manufacturing practices (GMP); ii. research and bench and clinical studies (brochures); iii. notification to ANVISA of the clinical research; iv. patent deposits; v. donations in the compassionate use model; vi. technology licensing and/or transfer; vii. regulation of regulatory bodies; viii. CONITEC; and ix. ATS.

Processes of interdisciplinary research in science, technology, and innovation, and health translational research are methodologies aiming to increase the impact of scientific and technological development conducted within universities for the common good. Integration of these methodologies aims to optimize the scientific effort in its aim to meet population's needs. In biomedical engineering, the object is constructed from the perspective of the encounter of disciplines. Thus, a biomedical engineering and health innovation problem involves looking at the biological body and at social, environmental, economic, and political issues. Moreover, the issues analyzed will be resolved by following the opposite movement that forced disciplinarity. Interdisciplinarity establishes new research possibilities, technology construction, and the formulation of public policies of incorporation into health systems. The interdisciplinary process, according to Alvarenga et al. (2013), "is part of the broad movement of critical reflection on the type of science and technology advance in the modern world" and biomedical engineering presents itself as a vector of this process.

The Graduate Program in Biomedical Engineering (PPG-EB/FGA/UnB) has as its mission, according to Art. 1 of its Internal Regulation, to

> […] develop innovation and advanced research related to engineering applications to biology and health while promoting the knowledge, methods, and academic training of undergraduates and graduates in biomedical engineering or related areas. In this mission, it must train teachers, researchers, and high-level professionals, developing their capacity for intellectual creation and their professional and academic competence, aiming at innovation, scientific, technological, and social advances.

Currently, PPG-EB, the first Graduate Program in Biomedical Engineering in the Brazilian Midwest, offers a master's degree and, in 2020, had approximately 49 registered students, 26 graduates, with around 20 permanent and collaborating professors linked to the program. The 2018 *Relatório de Conferência de Proposta – Plataforma Sucupira ENGENHARIA BIOMÉDICA* (Proposal Conference Report – Sucupira Platform, ENGENHARIA BIOMÉDICA) (53001010083P6) informs that the PPG-EB:

> [...] has an intense demand for Biomedical Engineering masters and doctors to strengthen the area in educational, research, and application institutions (hospitals, certification testing laboratories, medical equipment companies assisted by RD&I, the Ministry of Health (MoH), the National Health Surveillance Agency – Anvisa, and ATS.

These are important characteristics to promote the "quadruple helix" (State, university, private initiative, and society). In biomedical engineering, the interaction involves improving public health policies

and developing the industrial sector in the area of "health light, light-hard, and hard technologies"[1], fostering the translation[2] of scientific and technological knowledge developed inside and outside universities for practical use in society.

The PPGEB/FGA/UnB is connected to epistemological biomedical engineering advances. As one of its research lines shows, i.e.: "Health evaluation, education, and public policies" is divided into the following research topics: 1) epidemiological data analysis and modeling; 2) health systems analysis; 3) health technology management and evaluation; 4) studies on medical technology usability; 5) biomedical data safety evaluation; 6) characterization of the risks associated with medical-hospital equipment; 7) professional profiles; 8) teaching improvements; 11) active methodology application; 12) care and sustainability tools; 13) qualitative methods; 14) social participation; 15) economy; 16) real-world evidence; 17) incorporation of solutions into SUS; 18) metrology; 19) normalization; 20) testing and certification; 21) innovation, assistive technology, and therapeutic resources; 22) energy assessment in hospital environment and medical facilities; 23) hospital waste optimization; 24) hospital dynamics; 25) analysis of injury mechanisms related to users of motorized or non-motorized means of transport (vulnerable road users); 26) evaluation of the safety of transport vehicles (crashworthiness); 27) mechanism dynamics, gas emission, and health; 28) alternative energies; and 29) public health policies. The diversity of topics available for problematization in "Health evaluation, education, and public policies" includes the PPG-EB in the trends of the biomedical engineering industry 4.0 and assists in the processes of incorporating technologies into public and private health systems, aiming to reduce social and economic impacts on the portfolio.

In this context, the PPG-EB aims to consolidate itself as a qualifying pole of specialized labor, a producer of actions and practices seeking to support the development of the national strategic sector of ST&I via the RD&I in health and to contribute so the Midwest region and Brazil can industrially produce technological-based health, conducted by public and/or private entities. This aspect includes the role of biomedical engineering in integrating public policies and processes of incorporation of technologies and new technologies in health systems.

1.3 Solidarity, Nucleation, and Internationalization

Universidade de Brasília is a higher education institution with intellectual, material, political, and cultural capital to accept the challenge of becoming a university that meets growing internationalization without losing regional insertion. It develops science and technology, but also culture, general training, knowledge, and the ability to understand what happens in the country and in the world; building communication bridges between knowledge and society. Since its foundation, it directs its activities and social

[1] According to Mehry (2014), it is possible to visualize three types of health technologies: light, light-hard, and hard. Hard technologies refer to those that target the biological body, i.e., equipment and machines, and deal with structured and materialized knowledge and practices. Light-hard technologies refer to grouped knowledge that organizes work, i.e., standards and protocols.

[2] "Due to internal influencing elements and various interinstitutional arenas, it is important for a country to know the elements that involve knowledge translation, as well as the multiple barriers to be overcome to develop elements of coping with the difficulties in effecting translational research" (SUSSMAN; BRAVE; ROHRBACH et al., 2006).

function to diversity, forming a reference standard in quality and relevance for the higher education sector and other essential sectors of the country, according to its *Projeto Político Pedagógico Institucional* (Institutional Pedagogical Political Project – PPPI) (UnB, 2017a).

Strengthening transversality – a principle seeking to approximate reality and science, materialized in the process of knowledge construction by inserting themes of everyday life into the curricular structure – is one of the important points of the PPPI/UnB. In addition to this principle, it is part of the strengthening of its internationalization actions, which, together, contribute to the founding pedagogical principles of the UnB in teaching, research, and extension. Its internationalization plan (2018/2022) aims at integrated innovation research by institutionalizing international cooperation actions developed by the initiative of UnB researchers, which, according to the plan, should be stimulated by the creation of thematic nuclei and/or international networks capable of federating initiatives from different areas of knowledge (UnB, 2018).

The Legal Optometry Project aims to enhance the solidarity, nucleation, and internationalization of the actions and practices linked to UnB-generated RD&I, as it seeks to institutionalize participation in building the proposed knowledge of national and international institutions, as described below:

- The World Council of Optometry (WCO) is an associative organization to internationally develop optometry. The WCO is the first and only optometric organization to have official relations with the WHO. It represents 250,000 optometrists from 75 member organizations in more than 40 countries. (need approval)
- University of Contestado (UnC) – Its optometry course empowers professionals to develop actions in visual and eye health, correct refractive errors and visual dysfunction, identify and rehabilitate oculomotor alterations, and detect and refer pathological changes to specialists in the area.
- SINDIÓPTICA/GO – *Sindicato do Comércio Varejista de Material Óptico, Joias, Relógios, Cine-Foto e Bijouterias de Goiás* – Optical Material, Jewelry, Watches, Cine-Photo and Retail Trade Union of Goiás.
- The Brazilian Council of Optometry and Optics (CBOO) – founded in 1997, it is a non-profit associative civil society.

Integration between the aforementioned institutions will have, as its main axis, the prospective study of the assimilation of optometry into the SUS primary care, connecting these institutions and UnB via debates and the co-authorship of the academic and scientific products currently designed; a cooperation to design part of the Brazilian optometric scenario and make available options that assertively meet the Brazilian population's health needs to national managers.

2. OBJECTIVES

2.1 General

The main objective of this research is to analyze evidence and impacts and seek to expand the possibility of incorporating optometry in visual and eye health aid into the SUS primary.

2.2 Specific

As secondary objectives, it also aims to:

I. Develop content and programs and hold two workshops on the role of optometry in Brazil with the participation of national and international institutions, health managers, political agents, regulatory agencies, and society representatives.

II. Develop a PICO systematic review on the field of interest: optometry.

III. Develop a PICO cost/economic review on optometry.

IV. Provide supplementary material (open source database) for future classification analyses with artificial intelligence techniques, m-Health, and build ontologies and tools to develop statistical information that support public policies.

3. LITERATURE REVIEW

This project aims, within the scenario of eye health, which is linked to the need for multidisciplinary actions in the national economic scenario, to provide health managers with robust scientific data to cope with incorporations in the SUS coverage to better develop the country and better allocate its resources; and to classify the application of optometry as a light technology – within the classification of the technologies involved in healthcare. Light technology refers to bond production, autonomization, admission, and relationship management technologies as a way to govern work processes and solve health problems. Optometry has a strong significance for the process of screening symptoms that can generate complications, which, if unmet, lead to cases of avoidable blindness.

According to Sonada et al. (2021), optometrists have been active in Brazil since the arrival of the Portuguese court to Brazil. At the time, they were titled "*mecânico oculista*" (oculist mechanic) and cared for the emperor. Optometrists are the primary agents of vision care, working in several countries around the world. This qualification was described in the first decree for the regulation of medicine in Brazil. However, several legal interpretations have been installed, some in favor and others contradictory to professional practice. The authors conclude that with the emergence of the medical act law in 2013, and after the interpretation of the Supreme Court (2021), various sentences are handed down and the population, punished without realizing what optometry can change in their lives.

The Portuguese Association of Optometrists issued, in 2017, its report on the proposal for law no. 34/XIII/2ª (Health Acts), asserting that the consensus among health organizations worldwide is to consider

optometrists as specialists in primary vision healthcare, practicing optometry and providing extensive care for vision and visual systems, including refraction and prescription, detection/diagnosis and monitoring/treatment of eye diseases, and rehabilitation/treatment of visual system conditions (APLO, 2017). The European Commission, following that report, has examined in detail the optometrist profession, together with opticians', from the point of view of the need for regulation represented in the report "Mutual evaluation of regulated professions. Overview of the regulatory framework in the retail sector by using the example of opticians." After evaluating the reasoning used by each Member State to regulate the optometrist profession, it declares, at the conclusion of its report, its understanding that such regulation can be seen as appropriate to protect public health.

Currently in Brazil, according to the *Classificação Brasileira de Ocupações* (Brazilian Classification of Job Occupations – CBO) of the Ministry of Labor (3223: TÉCNICOS, 2022), optometry fits into family 32.2305 – optics and optometry technicians, the result of a workforce established at the end of the 1990s that generated this framework, considered at the time an advance in the recognition of optometry in Brazil. However, there are several awareness processes in progress aimed at improving this framework, following international optometry standards, since, in Brazil, it is a higher education science, widespread in all regions of the country and in line with optometry functions in countries in which the profession operates in primary eye health care.

The World report on vision (2019) presents a picture of eye health and its perspectives in the world. It invariably shows that eye diseases are a real concern, and that endemic diseases require the union of all academic and scientific efforts, and public health policies, including private sectors, aiming to minimize the impact of these health problems on the population. The WHO understands that governmental and civil organizations need to cooperate in trying to reduce preventable blindness and that optometry is a driving force toward this outcome.

The WCO reports that there are about 358 optometry educational institutions and 250,000 optometrists worldwide, and that in India, the profession was established at least 60 years ago (VENUGOPAL et al., 2020). The global optometrist workforce is large and widely accepted in most countries making up the United Nations, a network of assistance in primary eye health care with great screening potential.

A study conducted in 2015 by Hartmann et al. justifies the development of an integrated data system to record vision exams and ophthalmologic examinations for preschool children. The *Painel Nacional de Especialistas ao Centro Nacional para a Visão e Saúde Ocular das Crianças* (National Panel of Experts at the National Center for Vision and Eye Health of Children) developed recommendations in Prevent Blindness, funded by Maternal and Child Health at the Department of Health & Human Services Health Resources & Services, U.S. Department of Health and Human Services (HARTMANN et al., 2015). The study offers guidance on specific elements to be included in eye health care to mainly maximize referral or screening of cases for regulation to establish an epidemiological picture of health system users.

Yashadhana et al. (2021), in a study titled “Access to school-based eye health programs: a qualitative case study, Bogotá, Colombia”, problematize, in general terms, the screening of ocular problems in a specific epidemiological scope. Their results suggest the need for a national school eye health plan and better cooperation between the Ministries of Health and Education. It recommends interventions to improve confidence in health services, combat the lack of human resources, respect professional qualifications, and raise awareness of the importance of health (YASHADHANA et al., 2021). The study focuses on Colombia, the South American country with the greatest application of optometric science, when compared to its continental neighbors.

In the United States, following a global trend, eye comorbidities increased alongside other comorbidities, such as obesity and diabetes, becoming a sure concern for health managers, especially on the economic impacts they cause in public and private societal areas. Among economic concerns, the Avalon Health Economics Institute (AHE, 2019) consequently included that public policy managers have, in recent years, increased their efforts to strengthen the supply of well-trained high-quality providers and create a more efficient system, capable of dealing with on-demand pressures for eye problems. The U.S. already considers optometrists as the primary contact for eye health care; but legislation between states is heterogeneous and many of them unnecessarily limit optometrists, despite their training to truly meet primary eye health needs.

In 2015, the Ophthalmic & Physiological Optics (OPO) editorial, under the title “A historical review of optometry research and its publication: are optometry journals finally catching up?”, innovated by studying the impact of optometry research and journals; reaffirming that optometry is a young discipline with roots in optical science rather than medicine (ELLIOT; HANDLEY, 2015). Moreover, according to the editorial, good-quality publications linked to optometry increased dramatically between 2007 and 2013.

Our brief bibliographic survey shows the visible tendency to include optometry in primary eye health care, especially in more advanced countries. The WHO believes that stimulating the institutionalization of multidisciplinary and/or interdisciplinary efforts, including optometry, in primary health care, especially in less economically developed countries, strengthens the efforts of civil and state social organizations to reduce preventable blindness.

4. METHODOLOGY

The main motivation for achieving this project is to support the practice of biomedical engineering systematic reviews (SRs) as a way to investigate studies addressing the development of health technologies, in its broad concept, whose main objective is health prevention and promotion, mediated by the SUS, promoting social and economic improvements. Thus, by applying the systematic review method, evaluating what has already been developed on the subject and observing previous studies, it is possible to generate articulated and republished results which will become tools stakeholders linked to the theme can apply. We aim to provide a comprehensive and impartial synthesis of relevant studies to produce international evidence

and confirm the current practice of primary care optometry and produce a scientific document for decision-making in eye health care focused on the Brazilian reality.

The methodology used in developing this solution will be the Design Science method, which seeks to understand the essential points of research problems as a way to solve them via the general research question (GRQ): How to promote the best visual aid in the SUS primary care? From the formulation of the GRQ, and according to Design Science, research questions can be decomposed into knowledge issues (KI), design questions (DQ), and prediction questions (PQ), which will direct the problem set to the solution set. In configuring the problem set, two systematic review models will be used: PICO textual syntheses to review and synthesize experts' opinion, and narratives and policy; and PICO cost/economic reviews to determine the costs associated with the outcome linked to the context so that, from this problem set, solution sets are achieved, i.e., literature review, prototyping applicability/incorporation scenarios; case study; and interview+survey.

The generated data will be made available as supplementary material (open-source database) for future classification analyses with artificial intelligence techniques, m-Health, build ontologies, and tools to develop statistical information that support public policies. We intend, within the national economic scenario, linked to the need for actions of multidisciplinary areas based on biomedical engineering, to provide managers and/or legislators with robust scientific data in coping with incorporation of technologies into primary care to better develop Brazil and allocate its resources. The literature shows that systematic reviews commonly produce the best available evidence to assess the effectiveness, efficacy, and safety of technologies, supporting clinical decision-making and health policies (COOK et al., 1997).

In summary, we would deliver the following products:

Product	Description	Impacts
Consolidate a research team with skills to develop biomedical engineering systematic reviews and meta-analyses.	Form a group to develop and apply methodological guidelines to prepare Engineering IV systematic reviews and meta-analyses.	Provide bases to elaborate clinical protocols and therapeutic guidelines for the SUS. Increase article publications using secondary data.
Register systematic review protocols on the PROSPERO database.	We should consider publishing the protocol even before preparing the research, effecting it at the time of searches or selection of studies. These steps will help to better define the scope of the review.	Establish linearity in scientific confirmation procedures via systematic reviews.
Organize two workshops.	Lasting for eight hours and taking place on a single day, these workshops will promote theme exhibition, group debates, practical exercises, and the conclusion of all participants on the addressed theme. The workshops will take place at the international level – with the participation of the collaborators listed in this document and who have signed a letter of intent.	Education and Health: Biomedical engineers use their knowledge in partnership with optometrists to improve visual and eye health. Impacts on Capes (Coordination for the Improvement of Higher Education Personnel) Collection in Solidarity and Nucleation:

	Workshop 1: "Biomedical engineering and optometry in eye health PHC (Unified Health System)" Workshop 2: "Goiás Legislature and basic and applied research in different areas of optometry and biomedical engineering"	consistent with criteria characterizing the formation of human resources trained to identify, formulate, analyze, and search for solutions in visual and eye health. Support the dissemination, research, and promotion of biomedical engineering and Brazilian optometry.
Book - Organize a book with Qualis Capes, linked to the UnB/UERN collection series: Research Ecosystem, Development, Innovation, and Technological Practices in Health: Visual care and its areas.	The book will feature publications by invited authors – from the public, private, and national and international scientific sectors (WCO; CBOO; IAPB).	Academic production of chapters and a book with Qualis Capes classification.
Systematic review - PICO textual syntheses to review and synthesize experts' opinion, and narratives and policy.	Write the scientific article with a group of academics with multidisciplinary training who should develop a review protocol. Critically assess the partner entities involved in this project.[3]	Indexed article - published; internationalization; networking.
PICO cost/economic review to estimate the costs associated with the outcome, linked to the context, of this problem set.	Write and submit the article. In particular, that document will have characteristics such as: transparency, systematic process, and reproducibility since it generated evidence for legislative constructions.	Deliver evidence for decision making. Implications for practice and future research. Impact of the Coleta Capes.
Apply an interview+survey based on CNS Resolution no. 510/2016.	Prepare a questionnaire, approved by CNS Resolution no. 510/2016, to determine specific ethical guidelines for human and social sciences.	Generate a database with the results collected in the application of the questionnaire.

4.1 Goals and activities

Below is a description of the objectives and activities, linked to each goal, to generate and execute the project on screen.

Goal 1: Train the team involved in the research project; prepare workshop programs, and organize impacts.

Activity 1: Hold a workshop to train and create the core work of the project – collaborative environments of data storage, generated documents, partial reports, minutes of meetings, backup, and other evidential development materials.

[3] The project has the acceptance of the national entities, universities, and international partners involved in the research project.

Activity 2: Prepare a questionnaire, validate its ethics, and apply it to detail the aspects related to the general research question: How to promote the best visual assistance in the SUS primary care?

Activity 3: Prepare research questions that include efforts of defining the question and prepare the search pilot. The search includes elaborating and testing the search strategy, choosing bibliographic sources, searching in databases, exporting results, and manually searching (e.g., reference tracking of important studies in the area, unindexed congress annals).

Activity 4: Collect, compile, and organize data to be made available in open-source databases. This bank will also include the strings for each base to ensure that this research project will generate good-quality, reproducible, and impartial evidence.

Activity 5: Prepare the documentation regarding the effect of conflicts of interest in reporting systematic reviews, and register these documents on the supporting foundation to minimize the impact of conflicts of interest on the results of systematic reviews.

GOAL 2: Record two protocols on the database of systematic reviews PROSPERO (International Prospective Register of Systematic Reviews) and assemble initial documents based on PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis), a writing guide.

Activity 1: Forward the two proposed protocols for systematic reviews (SRs) to the PROSPERO database: systematic review - PICO textual syntheses and cost/economic reviews. Each protocol has a total of 38 mandatory items; from the revision title; expected end date of the review; conflicts of interest; guiding question of the systematic review; searches; address to access strategies; to plans to disseminate the review results.

Activity 2: Prospectively register systematic review protocols (SRs) to rate the progress of the study and the quality of its results, increasing transparency and reproducibility, and obtaining the number.

Activity 3: Write the first version of the SR reports, following the recommendations of the writing guide PRISMA, which has 27 items for a complete and transparent report, and prepare a flowchart of the study selection process.

Activity 4: Select, purchase, and install essential software to conduct the SR – such as: Grammaly; InstaText; general statistical programs such as STATA and specific ones, such as Review Manager (RevMan); Robot Reviewer, the entire process of searching, identifying, extracting, and even analyzing risk of bias can already be automated; picture digitizer, and WebPlotDigitizer.

Goal 3: Systematic Review – PICO textual synthesis to synthesize experts' opinions, and narratives and policies applied in the field of interest. In this case, PICO is: Population; Intervention or Phenomenon of Interest and Context.

Activity 1: Identify and formulate research questions. Apply search strategies; select the studies identified in reference managers, and search for evidence of non-indexed studies in technical disciplines.

Activity 2: Evaluate the eligibility of studies and extract data; rate the methodological quality of clinical trials (assessment of the risk of bias); evaluate the methodological quality of selected articles; extract data from the studies included: techniques, forms, and database by extracting data from the included studies; choose measures of effect.

Activity 3: Meta-analyze data by defining the statistical tool with robust software for statistical analysis and graphs.

Activity 4: Map the heterogeneity in fixed and random effect models, inconsistency, sensitivity analysis, and meta-regression; perform bias assessment and conduct meta-analyses in Review Manager (RevMan).

Activity 5: Evaluate the quality of evidence via the GRADE approach; publish a PRISMA statement; and report the study as recommended by the CONSORT Statement.

Activity 6: Write and publish our results.

Goal 4: PICO cost/economic review

Activity 1: Identify and formulate research questions. Record and develop a systematic review protocol via our search strategies; select the studies identified in reference managers, and search for evidence of non-indexed studies via technical disciplines.

Activity 2: Evaluate the eligibility of studies; extract data; rate the methodological quality of clinical trials (assessment of the risk of bias); evaluate the methodological quality of selected articles; extract data from the studies included: techniques, forms, and database by extracting data from included studies; choose measures of effect.

Activity 3: Meta-analyze data by defining the statistical tool "R" – a robust software for statistical analysis and graphs.

Activity 4: Map the heterogeneity in fixed and random effect models, inconsistency, sensitivity analysis, and meta-regression, perform bias assessment and conduct meta-analyses in Review Manager (RevMan).

Activity 5: Evaluate evidence quality via the GRADE approach; publish a PRISMA statement, and report the study as recommended by the CONSORT Statement.

Activity 6: Write and publish our results.

Health technologies act to minimize and manage the political, social, and financial impacts caused by various types of health problems. Monitoring and idealizing health services encompass public and private health systems and their management and maintenance strategies. Partnerships built with the State, constituted by federal, state, and municipal governments, the private initiative and, mainly, research centers and public universities, seek ways to increase the efficient application of health management by researching, developing and innovating (RD&I) protocols, models, inputs, medicines, and equipment capable of meeting the population's health needs. The methodology shown aims to guide the understanding of the incorporation of optometry into the SUS coverage of primary care in Brazil.

5. MAIN SCIENTIFIC OR TECHNOLOGICAL CONTRIBUTIONS OF THE PROPOSAL

We will measure the project by developing and producing technological technical products (TTP) divided into workshops, a collection book, and systematic reviews, as detailed below:

- Workshops: Organization of two events in this modality.

Lasting for eight hours and taking place on a single day, the workshops will promote theme exhibition, group debates, practical exercises, and the conclusion of all participants on the addressed theme. The workshops will take place at the international level – with the participation of the collaborators listed in this document and who have signed a letter of intent.
Workshop 1: "Biomedical engineering and optometry in eye health PHC (Unified Health System)"
Workshop 2: "Goiás Legislature and basic and applied research in different areas of optometry and biomedical engineering"

- Book – Organize a book with Qualis Capes, linked to the UnB/UERN collection series: Research Ecosystem, Development, Innovation, and Technological Practices in Health: Visual care and its areas.

The book will feature publications by invited authors from the public, private, and national and international scientific sectors (WCO; CBOO; IAPB).

- Scientific article linked to the Systematic Review – PICO textual syntheses to review and synthesize experts' opinion, and narratives and policy. Draft the scientific article with a group of academics with multidisciplinary training to develop a review protocol. Critical assessment of the partner entities involved in this project.

- PICO cost/economic review to estimate the costs associated with the outcome, linked to the context, from this problem set. Write and submit the article. In particular, this document will have characteristics such as: transparency, systematic process, and reproducibility since it generated evidence for legislative constructions.

The following Table shows the development of TTP to better organize product delivery and planning:

Product	Description	Linked Goals
Workshops 01 and 02	01. “Biomedical engineering and optometry in eye health PHC (Unified Health System)” 02. “Goiás Legislature and basic and applied research in different areas of optometry and biomedical engineering	01, 02, 03, and 04.
Book - Organize a book with Qualis Capes - linked to the UnB/UERN collection series: Research Ecosystem, Development, Innovation, and Technological Practices in Health: Visual care and its areas.	The book will feature publications by invited authors from the public, private, and national and international scientific sectors (WCO; CBOO; IAPB).	01, 02, 03, and 04.
Systematic Review - PICO textual syntheses to review and synthesize experts’ opinion, and narratives and policy	Draft a scientific article with a group of academics with multidisciplinary training to develop a review protocol and critically assess the partner entities involved in this project.	01, 02, and 03.
PICO cost/economic review to estimate the costs associated with the outcome, linked to the context, from this problem set.	Write and submit the article. In particular, this document will have characteristics such as: transparency, systematic process, and reproducibility since it generated evidence for legislative constructions.	01, 02, and 04.

The scientific contributions listed above are linked to the applicability scope of our results to the SUS. They represent steps to provide academic and scientific elements which instruct the incorporation of optometry into the SUS coverage, in addition to other elements necessary for analysis by the National Health Council (CNS) and CONITEC, and may represent an outcome of increased screening and referral quality to regulate primary eye health care in Brazil.

6. CONTRIBUTIONS TO UNB UNDERGRADUATE AND/OR GRADUATE COURSES.

Our research is linked to the Biomedical Engineering graduate program at the Faculdade do Gama (PPGEB/FGA/UnB). The research line studies “Health evaluation, education, and public policies.” The scheduled TTP will support indicators for the graduate program, such as: 1) epidemiological data analysis and modeling; 2) health systems analysis; 3) health technology management and evaluation; 4) medical technologies usability; 5) professional profiles; 6) qualitative methods; 7) social participation; 8) economy; 9) real-world evidence; 10) incorporation of solutions to the SUS; 11) innovation, assistive technology, and therapeutic resources; and 12) public health policies.

Technical and technological products will support more than the publication of articles in a systematic review model, the organization of scientific events, and the publication of a collection book. It will provide exchanges with program professors and students, including the participation of the academic undergraduate community, assisting the training of specialized labor to meet the social and economic needs of the Midwest and the rest of Brazil.

6. SCHEDULE

GOALS		ACTIVITIES		PHYSICAL INDICATORS	DURATION (MONTHS)	
#	Description	#	Description	Physical Indicator	Beginning	End
G1	Train the team involved in the research project; prepare workshop programs, and organize impacts.	**A01**	Create work cores and collaborative data storage environments.	Professors, students, and participants' names. Work environment. Backup and cloud (archive) location.	**Month 01**	**Month 01**
G1		**A02**	Prepare a questionnaire to detail aspects related to the general research question (GRQ).	GRQ questionnaire.	**Month 01**	**Month 02**
G1		**A03**	Prepare research questions (systematic review). Prepare and test the search and realization strategy	Present strings and data collection results.	**Month 02**	**Month 03**
G1		**A04**	Compile and organize data to be made available in open-source databases.	Open-source model.	**Month 02**	**Month 04**
G1		**A05**	Prepare documentation on the effect of conflicts of interest.	Conflict of interest document	**Month 03**	**Month 04**
G2	Register both protocols on the systematic review PROSPERO database and assemble initial documents based on the writing guide PRISMA.	**A01**	Write to the systematic review (SR) PROSPERO database.	Submit the SR proposals to the PROSPERO platform.	**Month 03**	**Month 06**
G2		**A02**	Evaluate the progress of the study and the quality of the reported results based on the Prospero submission.	Prospero confirmation.	**Month 05**	**Month 05**
G2		**A03**	Write the first version of SR.	Provisional texts (SR).	**Month 04**	**Month 07**
G2		**A04**	Select, purchase, and install essential software to conduct the SR.	Grammaly; InstaText; STATA; *Review Manager* (RevMan); Robot Reviewer; and WebPlotDigitizer;	**Month 03**	**Month 07**
G3	Systematic Review - PICO textual syntheses to review and synthesize experts' opinion, and narratives and policy. In this case, PICO is: Population; Intervention or	**A01**	Apply search strategies. Select, identify, and manage references.	List of articles for mining and conduct the SR.	**Month 07**	**Month 08**

	Phenomenon of Interest and Context.					
G3		**A02**	Evaluate eligibility and quality, and extract data for PICO Systematic Review.	Prepare the text, including eligible articles and data.	**Month 07**	**Month 09**
G3		**A03**	Data Meta-analysis. Statistical definition.	Statistical textual preparation.	**Month 08**	**Month 09**
G3		**A04**	Assess bias and conduct meta-analyses in Review Manager (RevMan).	Textual preparation biases.	**Month 09**	**Month 10**
G3		**A05**	GRADE application; PRISMA publication, statement recommendations.	Analytical textual preparation**.**	**Month 10**	**Month 11**
G3		**A06**	Write and publish our results.	Submission on the indexed journal.	**Month 10**	**Month 12**
G4	PICO cost/economic review	**A01**	Apply search strategies; select, identify, and manage references.	List of articles for mining and conduct the SR.	**Month 07**	**Month 08**
G4		**A02**	Evaluate eligibility and quality. Extract data. PICO Systematic Review.	Textual preparation, including eligible articles and data.	**Month 07**	**Month 09**
G4		**A03**	Data meta-analysis. Statistical definition.	Statistical textual preparation.	**Month 08**	**Month 09**
G4		**A04**	Assess bias and conduct meta-analyses in Review Manager (RevMan).	Textual preparation biases.	**Month 09**	**Month 10**
G4		**A05**	GRADE application; PRISMA publication, statement recommendations.	Analytical textual preparation**.**	**Month 10**	**Month 11**
G4		**A06**	Write and publish our results.	Submission on indexed journal.	**Month 10**	**Month 12**

REFERENCES

3223: TÉCNICOS EM óptica e optometria. *Classificação Brasileira de Ocupações,* Brasília, DF, 2022. Disponível em: http://www.mtecbo.gov.br/cbosite/pages/pesquisas/BuscaPorTitulo.jsf. Acesso em: 3 jan. 2022.

ALVARENGA, A.T.; PHILIPPI JUNIOR, A.; SOMMERMAN, A; ALVAREZ, A. M. S.; FERNANDES, V. Histórico, fundamentos filosóficos e teórico-metodológicos da interdisciplinaridade. *In*: PHILIPPI JUNIOR, A.; SILVA NETO, A. J. (eds.). *Interdisciplinaridade em ciência, tecnologia & inovação*. Barueri: Manole, 2011. p. 3.

APLO. ASSOCIAÇÃO DE PROFISSIONAIS LICENCIADOS DE OPTOMETRIA. *Parecer Proposta de Lei n.º 34/XIII/2ª Lei dos "Atos em Saúde"*.

BRASIL. Presidência da República. *Constituição da República Federativa do Brasil de 1988*. Brasília: 1988. Disponível em: http://www.planalto.gov.br/ccivil_03/constituicao/constituicao.htm. Acesso em: 8 set. 2021.

BRASIL. *Lei nº 8.080, de 19 de setembro de 1990*. Dispõe sobre as condições para a promoção, proteção e recuperação da saúde, a organização e o funcionamento dos serviços correspondentes e dá outras providências. Brasília, 1990.

BRASIL. Ministério da Saúde. Secretaria de Ciência, Tecnologia e Insumos Estratégicos. Departamento de Gestão e Incorporação de Tecnologias em Saúde. *Entendendo a Incorporação de Tecnologias em Saúde no SUS: como se envolver*. [recurso eletrônico] Brasília: 2016.

CBO. Conselho Brasileiro de Oftalmologia. *As condições de saúde ocular no Brasil*. [S. l.]: CBO, . 2019.

CONSELHO BRASILEIRO DE ÓPTICA E OPTOMETRIA – CBOO. *Perfil profissional do optometrista brasileiro*. Disponível em: < https://www.cboo.org.br/publicacoes>. Acesso em 20 de jan. 2022.

COOK, D. J.; MULROW, C. D.; HAYNES, R. B. "Systematic reviews: synthesis of best evidence forclinical decisions". *Annals of internal medicine*, v. 126, n. 5, p. 376-380, 1997.

CORREIA, C. V. S. R.; REZENDE, K. S.; ROSA, S. S. R. F.; BARRETO, J. O. M.; FELIPE, M. S. S. Pesquisa translacional no Brasil: temas de pesquisa e sua aderência à Agenda do SUS. *Saúde Debate*, Rio de Janeiro, v. 43, n. 2, p. 75-86, 2019.

DANDONA L.; DANDONA, R. What is the global burden of visual impairment? *BMC Medicine, [S. l.], v. 4, n. 6, 2006*. doi:10.1186/1741-7015-4-6.

DIÁRIO OFICIAL DA UNIÃO. *20 de setembro de 1990*. Brasília: 1990. Disponível em: http://www.planalto.gov.br/ccivil_03/leis/l8080.htm. Acesso em: 8 set. 2021.

ELLIOTT, D. B.; HANDLEY, N. A historical review of optometry research and its publication: are optometry journals finally catching up? *Ophthalmic & Physiological Optics*, Hoboken v. 35, p. 245-251, 2015.https://doi.org/10.1111/opo.12211.

HARTMANN, E. E.; BLOCK, S. S.; WALLACE, D. K. National Expert Panel to the National Center for Children's Vision and Eye Health. Vision and eye health in children 36 to <72 months: proposed data system. *Optom Vis Sci*, [*S. l.*], v. 92, n. 1, p. 24-30, 2015.doi:10.1097/OPX.0000000000000445.

HUNT, L. *A invenção dos direitos humanos: uma história*. São Paulo: Companhia das Letras, 2009.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA (IBGE). *Censo 2000*. Deficiência [Internet]. Brasília: IBGE; 2000. [citado 2021 Jan 18]. Disponível em: https://ww2.ibge.gov.br/home/presidencia/noticias/20122002censo.shtm.

KARA, J. N; ALVES M. R. Problemas oftalmológicos mais frequentes em escolares. *In*: CONCEIÇÃO, J. A. (coord.). *Saúde escolar: a criança, a vida, e a escola*. São Paulo: Elsevier, 1994. p. 195-2003.

LINO, L. H.. Optometria na atenção básica: uma proposta de melhoria na qualidade da saúde visual da população. *Revista Espaço Acadêmico*, Maringá,, n. 79, dezembro de 2007.

MATEUS, M. A. V. *Análise da relevância do optometrista no contexto da saúde visual da população brasileira*: uma leitura a partir do ponto de vista dos egressos do curso de Bacharelado em Optometria da Universidade do Contestado. Joinville: Instituto Federal de Santa Catarina, 2019.

MEHRY, E. E. *Saúde: a cartografia do trabalho vivo*. São Paulo: Hucitec, 2014.

OMS. Organização Mundial de Saúde. *World report on vision*. Licence: CC BY-NC-SA 3.0 IGO. Genebra: World Health Organization; 2019.

PHILIPPI JUNIOR, A.; SILVA NETO, A. J. *Interdisciplinaridade em ciência, tecnologia & inovação*. Barueri: Manole; 2011.

ROSA, M. F. F. et al. "Pesquisa translacional em saúde para o enfrentamento da covid-19: desenvolvimento e produção do respirador VESTA como equipamento de proteção individual". In: DUARTE, A. G.; AVILA, C. F. D. *A covid-19 no Brasil: Ciência, Inovação Tecnológica e Políticas Públicas*. v. 1. Curitiba: Editora CRV, 2021.

SILVA, W. S.. *História da Optometria: origens, personagens, instituições*. Alagoinhas: OPTO – Centro de optometria, 2017.

SONADA, et al. "Optometria no Brasil: contextualizando sua atuação e função social". *RECISATEC – Revista Científica Saúde e Tecnologia*.

STERN, J.; BURNETT, A.. *Mapping the global optometry workforce*. IAPB – The Internacional Agency for the Prevention of Blindness, 2021. Disponível em: https://www.iapb.org/blog/mapping-the-global-optometry-workforce/. Acesso em: 15 out. 2021.

SUSSMAN, S.; VALENTE, T. W.; ROHRBACH, L. A.; SKARA, S.; PENTZ, M. A. Translation in the health professions: converting science into action. *Eval Health Prof*., Bethesda, v. 29, n. 1, p. 7-32, 2006.

UNB. *Regimento Interno Do Programa De Pós-Graduação Em Engenharia Biomédica – PPGEB/FGA.* Brasília: Universidade de Brasília, 2017. Disponível em: https://fga.unb.br/articles/0001/9024/Regimento_Interno_PPGEB_aprovado_CPP_26_05_2017.pdf. Acesso em: 3 jan. 2022.

UNB. *Projeto Político-Pedagógico Institucional da Universidade de Brasília*. Brasília, DF: Universidade de Brasília, 2017.

UNB. Plano de Internacionalização da Universidade de Brasília (UnB) [Internationalization Plan of the University of Brasília]. Brasília: [s.n.]. 2018. Disponível em: https://noticias.unb.br/images/Noticias/Docs/PlanoInternacionalizacaoUnB_2018-2022.pdf. Acesso em: 5 jan. 2022.

VENUGOPAL, D., et al. Optometry students' perspective on optometry in suburban Western India: A qualitative study. *J Optom*, [*S. l.*], v. 14, n. 2, p. 215-223, 2020.

WEIL, P.; D'AMBROSIO, U.; CREMA, R. *Towards the new transdiciplinarity*. São Paulo: Summus, 1993.

YASHADHANA A.; SEROVA, N.; LEE L.; CASAS L. L.; RAMIREZ L.; SILVA C. J., et al. Access to school-based eye health programs: a qualitative case study, Bogotá, Colombia. *Rev Panam Salud Publica*, Washington, v. 45, 2021. https://doi.org/10.26633/RPSP.2021.154.