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Chapter

AVASUS' Contributions to Promoting Lifelong Learning in Health: Toward Achieving the SDGs and Strengthening Global Health Security

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Abstract

The Virtual Learning Environment of the Brazilian Health System (AVASUS) was developed by the Laboratory for Technological Innovation in Health (LAIS) and the Secretariat of Distance Education (SEDIS) at the Federal University of Rio Grande do Norte (UFRN) in partnership with Brazil's Ministry of Health (MoH). AVASUS provides open educational resources in the health field and has emerged as the third largest platform for massive health education globally, with more than one million students. Among the various learning pathways AVASUS offers, some specifically focus on meeting the educational needs to address public health emergencies and overlooked health contexts. The main argument in this study is that technology-mediated lifelong learning in health is an effective strategy for achieving the Sustainable Development Goals (SDGs) of the 2030 Agenda. This chapter analyzes the pathways related to COVID-19, syphilis, and prison health, focusing on the contributions towards achieving SDGs 3, 4, 5, 10, 11, 16, and 17 and fulfilling the Global Health Security Agenda. Our analysis revealed two key findings. Lifelong learning in health (i) prompts decision-making on public health policies and (ii) contributes towards implementing the SDGs. Ultimately, AVASUS should be recognized as a tool to improve health services and support policy-making.

1. Introduction

Over the last few decades, health and well-being have become a shared global resource, a fundamental principle available to all nations, and a human right defended by the United Nations (UN) and the World Health Organization (WHO). Well-being has a significant impact on social and economic progress on a global scale, while being crucial in the development of the individual, allowing them to live with dignity and fulfill their potential in society as a whole. As such, global public health plays a key role in promoting this goal by addressing health challenges that transcend national borders and affect communities around the world [1–4].

Crises, chronic problems, and emerging health threats significantly affect populations and health systems. This field progressively requires an interdisciplinary and innovative set of actions aimed at promoting health and controlling chronic and infectious diseases on a global scale [5, 6].

Global public health is confronted with a myriad of challenges, many of which are constantly evolving, affecting communities worldwide, especially middle- and low-income populations and marginalized groups. These challenges encompass emerging threats, acute crises, and chronic problems, all of which profoundly affect global health. Some of these challenges include pandemics and epidemics caused by infectious diseases such as COVID-19 and Sexually Transmitted Infections (STIs), e.g., syphilis; high maternal and infant mortality; high prevalence of chronic non-communicable diseases; and the growth of antimicrobial resistance, which in turn impacts the treatment of infections such as tuberculosis. In addition, other challenges lie in the poor state of primary health care services in many countries, the decrease in vaccination uptake, and the lack of care for marginalized populations [2, 7].

In Brazil, the COVID-19 pandemic, the syphilis epidemic, and the status of prison health are the issues that have been given institutional and governmental prominence due to their complexity and urgency. The COVID-19 pandemic represents one of the most wide-ranging public health challenges in recent history. Since its first appearance in December 2019, the SARS-CoV-2 virus has spread globally, impacting millions and triggering an unprecedented health and socio-economic crisis. The virus's rapid spread and its potential to cause severe illness and death have highlighted the vital need for effective public health systems for strategic responses to the pandemic. The WHO stresses the cruciality of "early detection and swift response at the global level to contain the virus's rapid spread." In turn, this underlines the essentiality of coordinated international cooperation and public health measures that ensure the protection of communities globally [2, 7–12].

The syphilis epidemic remains a public health problem, afflicting several nations. In 2016, the Brazilian Ministry of Health declared a syphilis epidemic in the country. Although it is preventable, easily treatable, and curable, the prevalence and incidence rates of the infection remain worrisome. This is especially the case for at-risk groups, including people with inadequate access to health services. For instance, the WHO estimates that syphilis in pregnancy accounts for over 200,000 fetal and neonatal deaths every year. The syphilis epidemic underscores the vital importance of accessible testing and treatment, as well as health education to equip professionals to tackle the infection. Combating the stigma associated with STIs is also a necessary

action. Effectively addressing these issues requires broad coordination and a global commitment to ensure that all people have equal access to prevention, treatment, and awareness-raising measures [5, 13–18].

Finally, it is imperative not to neglect the health challenges within the prison system. Health conditions in prisons are often precarious, with high incidences of infectious diseases, fragile mental health, and limited access to quality care. The health problems affecting prison systems represent a neglected but critical facet of public health. Recognizing and addressing these issues is essential not only to ensure the well-being of inmates, but also to protect society in general, since conditions in prisons can affect public health as a whole, requiring a more comprehensive and inclusive response [19–23].

To overcome these challenges, public health in the contemporary world must adopt a coordinated, innovative, and global approach. The search for effective solutions is paramount to preserving and improving the health of global populations. International collaboration plays a crucial role in global public health, facilitating the exchange of information, resources, and experiences between nations, and is fundamental to the prevention and control of communicable diseases. The development of research and technological advances are transforming public health, with the potential to revolutionize our approach to the challenges presented [5, 14, 24].

The relevance of education in global public health cannot be underestimated, as it plays a crucial role in health promotion, disease prevention, and the strengthening of health systems. Public health education provides people with essential information on maintaining a healthy lifestyle and preventing disease, including promoting healthy eating habits, physical activity, personal hygiene, the use of contraceptives, and other measures. With a better understanding of health risks and the preventive measures available, people tend to adopt healthier behaviors and contribute to a more resilient global community. Of particular note is the ongoing need for training health professionals to adapt to rapid global changes and to respond to these crises [10, 14, 19].

Faced with the global public health context, research centers, universities, and civil society organizations are committed to developing innovative strategies that strengthen access to health for all. The collaborative and multidisciplinary movement plays an essential role in improving health conditions on a global scale. The performance of the Laboratory for Technological Innovation in Health (LAIS) at the Federal University of Rio Grande do Norte (UFRN) stands out, reaffirming the importance of an ongoing commitment to well-being and equal opportunities in the field of health.

LAIS, located in the northeastern region of Brazil, stands out as a center of excellence in the research and development of innovative solutions for the health sector. With a multidisciplinary team of researchers and health professionals, the laboratory provides a fundamental role in the creation and implementation of advanced technologies aimed at improving the quality of health services, optimizing the diagnosis and treatment of diseases, and promoting public health in a comprehensive manner. Working in horizontal cooperation with national and international institutions, LAIS has contributed significantly to the advancement of knowledge and solutions that benefit society and strengthen Brazil's position at the forefront of health innovation.

A successful experience and innovative strategy of LAIS was the creation of the Virtual Learning Environment of the Brazilian Health System (AVASUS) [25], in collaboration with the Ministry of Health and the Secretariat of Distance Education (SEDIS) of UFRN. This initiative has proved to be highly effective, providing an online environment for training and upskilling health professionals across the country, and expanding access to quality education. AVASUS represents a concrete

example of LAIS' commitment to innovation and strengthening the Brazilian health system, reinforcing the importance of strategic partnerships to achieve significant results [10, 14, 17–19].

AVASUS stands out as the third largest global platform for mass health education, ahead only of the WHO's renowned OpenWHO platform and the Pan American Health Organization's (PAHO) Virtual Public Health Campus [26]. This prominent position demonstrates the firm commitment to disseminating health knowledge internationally, offering significant learning and training opportunities for health professionals and stakeholders around the world, thus contributing to the continuous improvement of global health [15, 27, 28].

It is of utmost importance to emphasize that several courses and educational resources have been designed and developed in close collaboration with PAHO, reflecting a solid commitment to improving health at the global level. These educational initiatives, the result of partnerships between institutions, play a crucial role in training health professionals and disseminating knowledge and practices that can significantly contribute to addressing complex health challenges and promoting well-being in communities around the world. This exemplary cooperation demonstrates the transformative potential of education and international cooperation in the field of health [1].

Currently, AVASUS offers an impressive collection of more than 400 courses and open educational resources (OER), with a student community that exceeds the 1 million milestone. This educational environment is the result of significant partnerships, continuous research, and innovations in the field of health, embodying the motto "science as an instrument of love for other people." This aligns directly with a fundamental principle of the UN's 2030 Agenda, which aims to "leave no one behind." AVASUS has a vital role to play in providing training and access to health education, contributing to the advancement of the Sustainable Development Goals (SDGs), and a more inclusive and equal society [29–31].

This virtual environment of free and open knowledge in health stands out for its organization of carefully planned learning pathways, providing access to courses related to specific themes. Among the various pathways available are those related to COVID-19, syphilis and other STIs, rare diseases, telehealth, and the prison system. This strategic approach allows students and health professionals the opportunity to deepen their knowledge in relevant areas, contributing to a more complete and specialized understanding of these crucial topics in the field of public health [10, 14, 17–19].

The Syphilis and other STIs pathway, the prison system, and COVID-19 bring together a total of 128 courses, offering a wide range of training opportunities for health professionals, managers, and decision-makers in public health, as well as the general population [25]. This range of courses addresses critical health-related issues, enabling participants to improve their knowledge and understanding of these key topics thus contributing to the empowerment of a more qualified and informed workforce, and to raising society's awareness of significant health challenges [14].

Through analysis carried out by UFRN's LAIS, in the context of the aforementioned learning pathways, we have highlighted two aspects that merit reflection and understanding. These are: (1) the process of continuous learning in health plays a fundamental role in decision-making related to public health policies and (2) the process of continuous learning contributes substantially to the effective implementation of the SDGs. AVASUS, as an educational platform, stands out as a valuable instrument

that has the potential to promote health security on a global scale and drive progress toward the SDGs, thus consolidating itself as an impactful tool for promoting well-being and sustainability [10, 14, 17–19].

In this chapter, we present three analyses of the learning pathways offered on AVASUS, to highlight their contributions to the achievement, above all, of SDGs 3, 4, 5, 10, 11, 16, and 17 and their fundamental role in the realization of the Global Health Security agenda. The pathways analyzed were as follows: syphilis and other STIs; COVID-19; and health in the prison system. The choice of these pathways was based on their remarkable contributions to meeting training needs in dealing with public health emergencies and in contexts that are often neglected in the health field. First, we will present the methodology used to analyze these pathways. Subsequently, the respective analyses will be presented, together with reflections and discussions on their contributions within the scope of the central objective of this chapter.

2. Methodological journey: how have we analyzed the contributions of the AVASUS REAs/MOOCs in the context of public health?

To analyze the learning pathways and their respective contributions to achieving the SDGs, we will employ the analysis model that LAIS/UFRN is developing with a team of interdisciplinary experts. While this model is still being developed, the preliminary findings have laid the groundwork for the discussion put forward in this chapter.

This model assumes that "analyzing social impacts from the perspective of the SDGs means reflecting on how massive open and online education has acted and intervened in a transdisciplinary and transversal way in multiple social dimensions" [14]. To this end, it was necessary to triangulate quantitative and qualitative methods, as well as primary and secondary data sources, to investigate the interrelationship between (1) health policy, (2) technology-mediated education, and (3) work processes in health services.

In line with the impact analysis model used, we used the following data sources in quantitative terms: (a) secondary data from AVASUS itself [25], the National Register of Health Facilities (CNES) of the Ministry of Health [32], and the Brazilian Classification of Occupations (CBO) of the Ministry of Labor [33]. Based on this information, the profile of the course participants, their field of work, and the level of health care provided in their work settings were drawn up, which, according to the guidelines of Brazil's Ministry of Health (MoH), are divided into Primary Health Care (PHC), Secondary Health Care (CHC), and Tertiary Health Care (THC) [34]; (b) epidemiological data from the Notifiable Diseases Information System (SINAN) [35], and (c) the SDGs [36].

As for the secondary data, the information from AVASUS included attributes and characteristics of two learning pathways—"Syphilis and other STIs" and "Prison System,"—of course, participants and enrollment data. All course participants' data was duly anonymized. After processing, information from the CNES database was inserted to supplement the data and improve the analysis, from which the course participants' CBOs were extracted. Supplementing the data was important for identifying the field of work and the level of healthcare provided by the course participants.

The epidemiological data was related to case notifications of syphilis and the Brazilian prison system. The information came from the following databases: (a) Notifiable Diseases Information System (SINAN) (BRASIL, 2022e), from which

information was taken on reports of cases of congenital syphilis (CS) and maternal syphilis (MS); (b) Brazilian Health System Informatics Department (DATASUS) [37], on syphilis testing in Brazil; and (c) DEPEN, on serological tests carried out within the Brazilian prison system [37].

In qualitative terms, we draw on [38] to comprehend that impact assessments should not only analyze numerical results of teaching quality. Accordingly, we acknowledge the necessity of conducting contextual analyses of Continuing Health Education (CHE) actions. Asking, "How and why did the program work, and what else happened?" can provide us with a closer understanding of the scenario studied [39].

Evaluation of the social impacts of massive training and lifelong learning in health, through learning pathways, was conducted based on the SDGs. Our focus was on the significant contribution of training to advancing the global health agenda [1]. This approach demonstrates how educational initiatives, such as learning pathways, play an indispensable role in achieving the SDGs, promoting the dissemination of knowledge, strengthening capacity building in health, and contributing to the improvement of health indicators, in line with the goals set by the international community for a more sustainable future.

3. First context: combating the syphilis epidemic in Brazil

In the context of the syphilis epidemic, promoting the resilience of the Brazilian health system resulted from the actions of the national policy to tackle the infection linked to the provision of open educational resources on the subject. The "Syphilis and other STIs" pathway was developed to encourage changes in the work processes of SUS professionals in an epidemic context. These authors also explain that learning pathways are "a systematic set of educational resources in which the student has the opportunity and autonomy to progress through learning modules according to their goals and objectives." [14]. From this perspective, the curricular design of the learning pathways offers the possibility of choosing from the available courses, which can then be tailored to the training needs of the student and their place of work [40–42].

Based on a study of the profile of enrollees in the "Syphilis and other STIs" pathway, Caitano et al. [14] found that as syphilis testing increased and the number of congenital syphilis reports decreased in Brazil, the number of enrollees grew significantly. Thus, the researchers highlighted three findings. Firstly, the pandemic has not reduced the number of people enrolled in the courses. Secondly, the changes in SUS work processes were more significant in primary and secondary health care. Thirdly, the triangulation of methods and data from syphilis testing and the training course showed the importance of CHE in designing strategies to address crises.

Caitano et al. [14] indicated that more than 41% of the health professionals who participated in the pathway worked as nursing technicians and nurses. In the SUS reality, these professionals operate on the front lines of combating the syphilis epidemic. However, the authors noted that most professionals work in primary and secondary health care. Notably, these care levels employ 84% of the participants in the training course.

Based on statistical correlations and evidence, these researchers found that the courses in the "Syphilis and other STIs" pathway foster public health policymaking and the resolution of public health problems. This socio-political process should bring together professionals from all levels of health care, such as those who participated in the courses. Thus, as positive changes in work processes are made possible through health education, public health policies are strengthened. In sum, AVASUS drives

these changes through the scalability of online and open courses, which are planned based on the demands of the health system.

In light of the SDGs, the analysis of the learning pathways offered on AVASUS allowed for the following inferences [14]:

- Observing SDGs 3 and 4: it is possible to promote equity and social justice in an epidemic context through technology-mediated continuing health education.

- Observing SDG 10: in scenarios of public health crises, it is also possible to mitigate social inequalities in developing countries.

- Observing SDG 11: technology-mediated health education builds bridges of resilience between health professionals, communities, and health systems.

- Observing SDG 17: the development of learning pathways through international technical-scientific cooperation fosters a diversity of knowledge and expertise, as well as broadens the networking of institutions.

The learning pathway on syphilis and other STIs is key to fulfilling SDGs 3 and 4, which aim for quality health and education. While contributing to SDG 10, it plays a significant role in reducing social inequalities, especially in developing nations during public health crises. It should be noted that SDG 11 highlights how technology-mediated health education can strengthen resilience among health workers, communities, and health systems. Ultimately, SDG 17 is promoted through international cooperation, enriching knowledge sharing, and strengthening institutional networks [1, 36].

Contributing to the SDGs' achievement requires a comprehensive approach to combating syphilis and other STIs. Pursuing health and well-being for all and preventing and treating STIs play a decisive part in this goal [1, 36]. Reducing the incidence of syphilis and STIs helps to achieve the goal of eliminating epidemics of infectious diseases. By providing sex education and comprehensive health promotion, access to testing and treatment, and promoting the use of condoms, we contribute directly to promoting healthy living and preventing the spread of these infections, to gender equality, education, and partnerships for development.

As of today, the "Syphilis and other STIs" learning pathway includes 100 courses [25]. In 2022, the pathway had more than 177,000 participants. On average, participants enrolled in one to two courses, highlighting the importance, acceptability, and need for lifelong training and learning in health. The results also demonstrate the effectiveness of technology-mediated learning in changing work processes, with an increase in syphilis testing in Brazil. In this way, the impact of massive health education through the pathway is evident, underscoring the importance of education for health professionals, especially in a public health crisis [14].

4. Second context: promoting health in the Brazilian prison system

The Brazilian prison system faces complex and persistent challenges. Overcrowding, poor conditions, violence, and a lack of resocialization programs are chronic problems. With one of the largest prison populations in the world, the overload of prisons exacerbates criminal recidivism. Reforms are needed to promote the reintegration of inmates into society, emphasizing education, and professional training. It is crucial to improve

oversight and transparency in prisons and fight corruption and abuse. The prison system needs to be seen not merely as a punishment but as an opportunity for rehabilitation, helping to reduce crime and strengthen the social fabric [20–23].

With a prison population exceeding 800,000 people, overcrowding is a critical problem, resulting in inhumane conditions and spreading diseases such as tuberculosis, HIV, and syphilis. Lack of health promotion and access to adequate care further exacerbates these issues. The absence of effective resocialization programs and corruption hinder the reintegration of inmates into society. It is imperative to invest in infrastructure, health, and education in prisons while implementing reform policies that address the underlying causes, seeking a more humane and effective approach to the prison system [43, 44].

As the prison population has grown more than the overall population in percentage terms in many countries, health problems in the prison environment have escalated. In Brazil, the prevalence of STIs has been increasing and higher in the prison environment [19]. When health in the system deteriorates, global health is also affected. Thus, initiatives that deal with prison health in isolation fragment the care of the community integrated with the prison population. Valentim et al. [18] explained that "[p]rison health implies considering prisons and the territory in which they are placed, including imprisoned persons, their families, custodial staff members, and the surrounding community interacting with this system."

It should be noted that Continuing Health Education (CHE) in the prison system transcends the mere inclusion of the issue on the national health agenda. The Brazilian government has recognized CHE as a policy designed to promote universal access to health through the SUS. AVASUS represents a technology-mediated and large-scale education strategy with the potential to impact more than 200,000 health facilities nationwide [18]. This demonstrates the commitment to expanding knowledge and improving health practices in Brazil.

The analysis of the learning pathway "Prison Health" revealed that continuing health education, technology-mediated in the prison system, plays a pivotal role in promoting health services and fulfilling the SDGs [18]. In addition, this type of training emphasizes and supports the central principle of the UN's 2030 Agenda, which is "Leave no one behind," covering five fundamental pillars. These are people, planet, prosperity, peace, and partnerships, especially in the social, economic, and institutional dimensions [23].

Lastly, the results of our analysis indicate the observance of SDGs 3, 4, 10, 16, and 17 in the context of the "Prison System" pathway [18, 36]. This highlights massive open online education as an essential tool for boosting such goals and improving prison health, not only for people deprived of liberty. From this perspective, the learning pathway included four courses until now. It features more than 36,000 enrolments on AVASUS, which provides specific courses for health professionals operating in the prison system, police officers, and people deprived of their liberty.

5. Third context: the impact of the COVID-19 pandemic on health services

The COVID-19 pandemic, which emerged at the end of 2019, is continuing to shape the world. With millions of lives lost and profound impacts on society, health, and the economy, such a global crisis has highlighted the importance of international cooperation and science. Historically, "the first actions by governments to articulate efforts in the field of international health are related to the intensification of pandemics [...] during the 19th century" [45].

Meanwhile, in the twenty-first century, vaccines have been developed in record time. Nevertheless, inequalities persist in their distribution. Social distancing, the use of facemasks, and hand hygiene have become routinized. Remote working and online learning have transformed our lives. As the pandemic progresses, hope rests on adaptation, learning, and global solidarity, as we face ongoing challenges and pursue a sustainable recovery [46, 47].

Overburdened hospitals, a shortage of protective equipment, and the search for hospital beds and ventilators highlighted health systems fragilities. The need for resilience was apparent, with health systems adapting quickly to meet changing demands. Haldane et al. [48] argue that "[d]uring a crisis, a resilient health system is able to effectively adapt in response to dynamic situations and reduce vulnerability across and beyond the system." Given this scenario, digital health has emerged as a solution, while researchers have hastened the development of vaccines. However, the fight against variants of the virus persists. This crisis has reinforced the importance of continued investment in public health, pandemic preparedness, and global collaboration. Resilience is essential as we face the uncertainty of future health challenges [48].

During the COVID-19 pandemic, technology-mediated education has emerged as a crucial tool for the efficient dissemination of information related to disease prevention, symptoms, and treatment. In this respect, the courses and educational resources offered by the AVASUS have gained utmost relevance. These resources have provided access to essential educational content for health professionals and managers, allowing for a more comprehensive understanding of the pandemic and its implications. The availability of these courses and educational resources has underscored the importance of specialized online platforms, e.g., AVASUS, as valuable instruments for CHE, contributing to addressing public health challenges effectively [49, 50].

The COVID-19 learning pathways provided by AVASUS consist of 24 courses targeted at health professionals and other players in the public health sector, as well as society in general, demonstrating its importance and impact. With more than 400,000 enrolments, where each student participates in at least two courses on average, the pathway reflects the effectiveness of structuring the courses into such a format. This approach stimulates active participation and encourages the search for knowledge, thereby contributing to information dissemination and education for health promotion in various areas of health. **Table 1** details the number of enrolments in the courses in this pathway.

Table 1 highlights that the first five courses account for over 240,000 enrollments. The demand for these courses has two forms: (1) a global and general view of the context of the pandemic and (2) a micro and specific view of the pandemic. The number of enrolments on the course "Emerging respiratory viruses, including COVID-19" reveals the need for a global and general view of the effects of the pandemic. Meanwhile, enrollments in "COVID-19: Protocol for the clinical management of coronavirus in Primary Health Care" indicated the more micro and specific need given the emergencies of the pandemic. These two forms show that the courses offered by AVASUS are based on actual needs and the concreteness of the reality of those experiencing the problems of the public health system.

As highlighted by Caitano et al. [14], technology-mediated education meets not only urgent training needs but also strengthens the capacity of the health system to address complex challenges, such as the COVID-19 pandemic. Despite the limitations in observing the contributions of this specific pathway to achieving the SDGs, it is worth noting that, as it is a global problem and a humanitarian need, it is strongly aligned with the principles of the UN's 2030 Agenda.

Number	Title of the learning pathway	Number of enrollments
1	Emerging respiratory viruses, including COVID-19	100,494
2	COVID-19: safe use of PPE	48,865
3	COVID-19: management of patients with respiratory disorders	37,240
4	Management and follow-up of patients with suspected coronavirus	28,037
5	COVID-19: protocol for the clinical management of coronavirus in Primary Health Care	26,175
6	Prevention and control of infections (PCI) caused by the new coronavirus (COVID-19)	22,530
7	COVID-19: training for vaccinators	22,232
8	Instructions for performing the rapid test to detect antibodies against SARS-CoV-2	18,218
9	COVID-19: why do we need physical isolation?	16,737
10	Breastfeeding in the context of COVID-19	13,969
11	Physical and psychosocial protection in health work and essential areas in the fight against COVID-19	12,256
12	Prenatal and puerperium care in times of the COVID-19 pandemic	12,153
13	The covid-19 pandemic in the context of Long-Term Care Institutions for the Elderly	11,702
14	Safety and hygiene in hospital services to combat COVID-19	10,210
15	COVID-19: caring for the elderly in long-term institutions	8692
16	Development of vaccines and therapies to control COVID-19	7070
17	Protecting the elderly in times of Covid-19	6511
18	Use of antivirals in COVID-19 - what is the scientific evidence?	5410
19	Main clinical aspects and therapeutic perspectives for the treatment of patients diagnosed with COVID-19	3905
20	COVID-19 and mental health: therapeutic actions for health professionals	1957
21	Health strategies in Portugal to control COVID-19	1717
22	The new coronavirus pandemic in Rio Grande do Norte and its impact on society	1523
23	Self-care and well-being strategies for COVID-19 survivors and their caregivers/families	1365
24	Estrategias de autocuidado y bienestar para personas sobrevivientes de la COVID-19 y sus cuidadores/famílias	583
Total number of enrollments		419,551

Note that the title of course number 14 is mentioned in Spanish because it was offered in such a language. Source: AVASUS, available at: https://avasus.ufrn.br/local/avasplugin/dashboard/transparencia.php.

Table 1.
Number of enrollments per course in the learning pathway "COVID-19." Collected data refers to the period from 2020 to 2023.

6. Perspectives for technology-mediated health education: toward global health security

Considering that global public health is faced with multiple challenges, offering Open Educational Resources in the format of learning pathways is a strategic approach to fostering access to health education in an interdisciplinary fashion. Furthermore,

such actions should make use of multiple communication strategies, platforms, and tools that technological progress and innovation have provided to education today.

At present, especially in developing countries, there are regions and communities with basic educational needs in health—as contemplated in SDG 4, which seeks inclusive, equitable, and quality education for all—but who do not have sufficient communicative development to access the learning opportunities offered by an open, online, and massive education platform such as AVASUS. It should be noted that AVASUS reaches health professionals, managers, and students, as well as the general public. Due to its scalability, the platform promotes health education nationally and internationally.

Following experiences of international technical-scientific cooperation with more than 18 countries, such as Portugal, Tanzania, Colombia, Italy, Spain, and the United States, LAIS/UFRN recognizes that technology-mediated health education is a fundamental global resource. Through these cooperations, the laboratory has excelled in the collective development, with researchers from such countries, of open educational resources for AVASUS. In this endeavor, some fundamental guidelines have been set. These are as follows: (1) the use of communication strategies aimed at very specific audiences, belonging to marginalized groups, which require accessible language and prioritized use of audiovisual resources; (2) the offer of courses in different languages, such as Portuguese, Swahili, English, and Spanish; (3) the development and offer of courses that cover aspects of culture, local infrastructure, and the structure of the local health system; and (4) the use of communication strategies underpinned by communication theories, such as the cross and transmedia concepts.

Our experience points to AVASUS' enormous potential for inclusion, which could simultaneously meet global and local needs. It also indicates the relevance and richness of sharing experiences in the process of developing educational resources between researchers from different countries and backgrounds. Hence, AVASUS is a successful case of what contemporary life is increasingly demanding of us. In other words, multidisciplinary and transdisciplinary work that transcends the frontiers of knowledge, a macro as well as micro view of health needs, a concern to reach out to a variety of audiences without leaving anyone behind, and the creativity and resilience to respond to emergencies and urgencies in the field of health.

7. Executive summary/conclusions

In this chapter, we presented and discussed analyses of the AVASUS learning pathways related to the syphilis epidemic, health in the prison system, and COVID-19, focusing on their essential contributions to the achievement of SDGs 3, 4, 5, 10, 11, 16 and 17, as well as their fundamental role in the realization of the Global Health Security agenda. The AVASUS platform emerged in Brazil in response to a demand for a qualified workforce to work in the health system which, as a result of the structuring of the SUS, saw the need to contribute to the training of health professionals to work on various fronts. At present, AVASUS extends far beyond what was initially envisioned, contributing nationally and internationally to continuing health education.

The impact of training through AVASUS can be seen in various dimensions, such as (a) the demand for lifelong learning to improve professional practice, (b) the sharing of learning in the workplace, (c) the health of the population by strengthening the supply of services, such as the increase in the testing, diagnosis, and treatment of syphilis in Brazil; and (d) the response to public health crises and problems.

With our methodological approach, we argue that the learning pathways offered on AVASUS, such as "Syphilis and other ist," can positively shape responses to public health crises at a global level. Furthermore, we believe that research into the impact of learning pathways should be part of the evaluation of the practices of health system professionals. This is due to the fact that continuing health education facilitates the qualification of health services, as highlighted in other works developed by LAIS.

Continuing health education or lifelong learning in health, an area that is already quite solid in Brazil and widespread throughout the world, is becoming increasingly widespread through technological mediation. It is in this context that AVASUS becomes a protagonist, acting with its learning pathways, promoting training that directly reflects on the practice of health professionals, the decision-making of managers, and the improvement of comprehensive health for all people. Through this virtual environment, the concreteness of education is revealed as a strategy that drives contributions to sustainable development and global health security.

To look at AVASUS' contributions toward achieving SDGs 3, 4, 5, 10, 11, 16, and 17 is to look at the social needs of people, the economic urges, and the institutional emergencies of our world. The transdisciplinary practices of LAIS/UFRN put science as an instrument of love for others and the world, contributing to improving public health globally. In this way, living in the future with sustainable development on our planet will be possible.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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