

General knowledge and perception of climate change in undergraduate medical students

Summary

Objective: Climate change impacts public health, however, for its level of implication it is a topic little discussed within the training of health personnel, so the purpose of this study was to assess the awareness and perception of medical students on climate change and its impact.

Method: A qualitative, cross-sectional and descriptive research method was used and a survey was designed to collect quantitative and qualitative data. The sample was defined under the non-probabilistic strategy by convenience with a total of 112 students of the Bachelor's Degree in Surgeon and Midwife, from the first to the eighth semester in universities corresponding to the metropolitan area of Guadalajara.

Analysis: Qualitative data were analyzed using content analysis and public health frameworks.

Results: One hundred and ten students from the sample completed the survey. A bias was identified in the general knowledge of what climate change implies and misinformation regarding the extent of its effects on the health and daily life of individuals, at the same time a predominant feeling of concern was identified in relation to its consequences.

Conclusion: There is a deficiency of information on climate change among undergraduate medical students. Climate change is a global reality. The world needs to work collectively on this issue and education is the first critical step that requires the attention of health professionals.

Keywords: climate change, greenhouse effect, students, carbon footprint, public health

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Introduction

Climate change, which should be understood as long-term changes in temperatures and weather patterns,¹ is a global problem that threatens the conditions that ensure the life and security of human beings and other species. It constitutes a very serious threat to human health. Although the general perspective among the population is that this phenomenon only affects temperatures, it is necessary to understand that it is a sequence of effects whose implications transcend health, affecting the way we live in ways that we have not yet fully understood. Thus, climate change, based on data established by the World Health Organization,² affects both physical environments and all aspects of natural systems, including humans. This translates into an affectation of social and economic conditions and what is relevant to this topic: the functioning of health systems. Therefore, we must leave behind the perspective of believing that it is something that can happen, something that can affect and see it for what it is: a threat multiplier, which is currently undermining health and that the possibility of reversing decades of progress in the field of health is something that is already happening.

As climatic conditions change they bring with them more frequent and intense weather and climate events including but not limited to storms, extreme heat, floods, droughts and wildfires.² In turn, these changes are reflected as health impacts both directly and indirectly increasing the risk of mortality, transmission, recurrence and spread of diseases and other health emergencies. Therefore, the approach from different disciplines is essential and requires actions at the political, institutional, social, cultural and behavioural levels.

The United Nations¹ reports that the Earth's average temperature is currently 1.1°C higher than it was at the end of the 19th century,

prior to the industrial revolution. The last decade, from 2011 to 2020, was the warmest on record since 1850. This trend is only increasing, opening a world of possibilities to the alterations that we can present and not only those we already observe; for example the metabolism of drugs among other factors depends on our body temperature so it is fair to ask ourselves if the temperature in which we live will not change the pharmacokinetics subjecting the body to greater stress for thermoregulation under extreme conditions? Or the virulence factors that pathogens have, the susceptibility of individuals altered by the food, air or water we consume, and the reflection of this in the damage to our genome.

That is why it has been decided to study the knowledge and perceptions that undergraduate students have regarding climate change, because as health professionals in training it is essential that the world in which we will work will not be the same in which we grew up, nor the same one that brought the advances, that studied human physiology, that created the medicines as we know them today. The conditions in which patients live and therefore the way in which they get sick will be completely different from what we know today, consequently, it is imperative to recognize this and prepare ourselves for what it means in the health sector.

That is why analysing the behavioural level, from sociological and psychological ideas, provides information about the knowledge that undergraduate students have about climate change as reflected in the perception of their daily and academic life. This is important as perception is socially constructed and depends on social interactions and emotions, which play an important role in the response to climate change. People act based on how they imagine reality to be and not according to reality, thus, if a person does not perceive how climate

change affects them, they will hardly take actions that help mitigate the impact, or even engage in activities that aggravate climate change.³

The perception of this nature in Mexico will not be the same as in our neighbouring countries, much less in other continents. In the same way that the patients we treat have completely different demographic, genetic and epigenetic characteristics. And these same variations change according to the state of the republic in which we find ourselves. It is well known that the ideal is for medicine to be personalized. A suit made to measure for each patient in order to understand and treat them in their entirety; however, although it seems a very distant goal, the present research aims to function perhaps as a cornerstone to understand that our reality is changing, and that change must be included in our training, in our research, and in how we understand health.

Target

Climate change greatly influences the health of individuals in the various societies that exist, which is why it is a topic of relevance for public health; despite this, it is not a topic that is often considered in the training of health personnel. The purpose of the study was to evaluate the awareness and perception of medical students in the metropolitan area of Guadalajara regarding climate change and its consequences.

Methodology

Design

The present research was framed within a qualitative, cross-sectional, descriptive design with the objective of exploring and describing participants' knowledge and perceptions of climate change and its relationship with health. A cross-sectional approach was used to capture the information at a specific moment in time, allowing a snapshot of the perspectives of the selected subjects.

Sampling strategy

For the selection of the sample, a non-probabilistic intentional sampling strategy by convenience was used, which consisted of inviting the students of the Bachelor's Degree of Surgeon and Midwife to participate. This population had a total of 112 participants from first to eighth semester from multiple university centers in the Metropolitan Area of Guadalajara, Jalisco. Mexico. The institutions with participating students were: the University Center of Health Sciences (CUCS) of the University of Guadalajara, LAMAR University, University of the Valley of Mexico (UVM) and the Autonomous University of Guadalajara. This sampling was used because, being a very large population of students, the subjects were selected given their convenient accessibility, proximity and availability for the research, in addition to requiring few selection criteria to be part of the sample.

Population and selection criteria

Population

Students from first to eighth semester of the Bachelor's Degree of Surgeon and Midwife whose study site is located in the Metropolitan Area of Guadalajara.

Inclusion criteria

- Active students of the Bachelor's Degree of Surgeon and Midwife (not exchange students, not repeaters).
- Study headquarters established in the Guadalajara Metropolitan Area.

- Availability of time to answer questions.
- Without distinction of gender.

Exclusion criteria

- Incomplete surveys.
- Refusing informed consent.
- Lack of adherence to the investigators' instructions.
- Not be an undergraduate student, a repeating student or an exchange student.
- Study site outside the Metropolitan Area

Measuring Instruments

General data survey

Its objective is to determine some sociodemographic variables such as age and sex, in addition to applying the selection criteria. It consists of 5 multiple choice questions, in interview format. This instrument can be consulted in [Annex 1](#).

Climate Change Knowledge and Perceptions Survey

A survey was designed through the digital tool "Google Forms" in order to allow greater accessibility to all participants; with a total of 19 items divided into closed answers in multiple choice format, separated into three sections. Our survey was in turn based on three other instruments validated by various organizations, in similar populations, whose questions were taken and adapted to be applied in a pertinent manner in this research setting. The first section addressed the topic of "General Knowledge about Climate Change", with a total of five questions adapted from the "Climate Change Survey 2016" Instrument provided by the Faculty of Social Sciences of the University of Chile in collaboration with *Center for Climate and Resilience Research (CR)*².⁴ The second section addressed the topic of "Carbon Footprint" with a total of 7 questions that were based on and adapted to the *online test* research provided by the environmental organization *Greenpeace*.⁵ Finally, the third section was named "Sentiments and Perceptions regarding Climate Change" and consisted of 7 more questions created from the instrument provided by the Sustainability Group of the Faculty of Physical Sciences of the Complutense University of Madrid⁶ to adapt it to the environment corresponding to Mexico and the study population. The entire instrument design can be consulted in [Annex 2](#).

Procedure

For data collection, a structured form was designed using Google Forms. This form included closed multiple choice questions aimed at collecting relevant information on the topic of study. Once the design of the form was completed, it was disseminated through various social network platforms, such as WhatsApp, Facebook and Instagram, as well as in academic groups relevant to each participating university network. The dissemination strategy focused on reaching a diverse and representative sample, encouraging the voluntary participation of users. This methodology allowed us to obtain a wide variety of responses over a two-week period, thus facilitating a comprehensive and detailed analysis of the data collected.

Ethical considerations

In the present research on climate change and its perception among medical students, several ethical considerations were taken into account to ensure the well-being and privacy of the participants.

Informed consent was obtained from all respondents, clearly explaining to them the purpose of the study, the nature of their participation, and ensuring the confidentiality of their responses. In addition, it was ensured that participation was completely voluntary, allowing students to withdraw from the study at any time without any repercussions. The data collected were anonymized to protect the identity of the participants and were stored securely. Finally, the study was reviewed and approved by a university ethics committee to ensure that it met established ethical standards in academic research.

Limitations

One of the main limitations of this research project lies in the representativeness of the sample. Because participation was voluntary and conducted primarily through online surveys, the results may not be fully representative of the total population of medical students. In addition, the self-reported nature of the surveys may introduce biases, such as social desirability bias, where participants might provide answers that they consider more socially acceptable. Another limitation is the lack of depth in the data, as the descriptive methodology focuses on describing phenomena without exploring underlying causes or relationships between variables.

Analysis and results

Of the total sample, responses were collected from 110 students who agreed that their answers would be used in the research. This group was made up mainly of women, representing 69% of the sample; the students are part of the Bachelor's Degree of Surgeon and Midwife, mostly belonging to the University of Guadalajara (81 students; 73.63%) and LAMAR (27 students, 24.54%), the rest belonged to the University of Valle de Mexico, currently studying in the 8th (73 students, 66.36%) and 7th (27 students; 24.54%) semester mostly, the rest are between 1st, 2nd, 4th and 6th semesters. Regarding the knowledge they demonstrated about climate change, most of the participants defined it as "change in temperature" (87 students; 79.09%), the rest opted for "change in the seasons" and "stronger or more intense droughts"; among the causes of these changes they proposed "combination of human activity and natural effects of the planet" (81 students; 73.63%) and "human activity" (29 students; 26.36%). Regarding whether they considered that climate change was a phenomenon that was currently happening, 108 (98.18%) participants answered affirmatively, of which 25 (22.72%) were unaware of the magnitude of this event; in addition, when asked how informed they felt about this issue, 89 (80.90%) participants stated that they felt little informed, while 21 (19.09%) of the people felt quite informed. Subsequently, they were asked to mark the environmental problems that most concerned them, among which were the depletion of natural resources (98 students; 98.09%), water pollution (87 students; 79.09%), climate change (79 students; 71.81%), loss of biodiversity (78 students; 70.90%) and the increase in waste (77 students; 70%). As we can see from the answers obtained, most of the university students have a fairly clear idea of what climate change is and how it has been a consequence of both human actions and natural phenomena, even in the list of environmental problems it was considered the third most relevant; in spite of this, most of them perceive themselves as having only basic knowledge of the subject without investigating its impact on their daily lives.

Another section of the survey dealt with the carbon footprint, with the purpose of finding out if the participants were aware of this tool and if so, how it impacts their daily activities. Favourably, most of the students affirmed having knowledge about the carbon footprint (102 students; 92.72%) and the greenhouse effect (104 students;

94.54%); they were also asked to indicate what they considered to be the main consequences of the increase in the greenhouse effect, among which they highlighted the increase in global temperature (107 students; 97.27%), melting of the poles (85 students; 77.27%), displacement and disappearance of species (68 students; 61.81%), changes in the hydrological cycle (58 students; 52.72%), and collapse of ocean currents, atmospheric movements and terrestrial dynamics (51 students; 46.36%); on the other hand, the least mentioned options were increase in cases of malaria and salmonellosis (15 students; 13.63%), increase in cardiovascular and respiratory problems (17 students; 15.45%), spread of diseases and pandemics (27 students; 24.54%), and dehydration of children and other intestinal infections (26 students; 23.63%). The results in this section are interesting because the majority of the study population has knowledge about the carbon footprint and the greenhouse effect, as well as being able to identify the main consequences of the increase of these phenomena, however, in this last item they mainly recognize the environmental problems they cause, However, they mostly ignore the direct effects on the health of citizens, such as the increase in diseases and the decrease in the functionality of certain body systems and devices, which should be of greater relevance for future health professionals, since they will later have to face these health problems.

In addition to this section, students were asked about their school activities that have a greater impact on the environment, such as the means of transportation they use, the flights they take for academic purposes, and the diet they follow. The results of these questions reveal that most of the respondents use public transportation (50 students; 45.45%), gasoline or diesel vehicles (39 students; 35.45%) or walking (19 students; 17.27%), the rest have an electric vehicle; the distance at which the participants live is very variable, ranging from 0 to 5 kilometers to more than 20 kilometers, the results did not show a predilection for any range of distance, what we can highlight is that 73.63% (81 students) live more than 6 kilometers from their faculty, making it more difficult for them to move. Regarding academic flights, most of the students (100 students; 90.90%) report taking only 1 flight per year, the rest take from 2 to more than 4 flights per year. Finally, the diet that predominated among the university students was "I eat everything, and often meat" (51 students; 46.36%), while the least practiced was "I am vegetarian/ pescetarian/ vegan" (7 students; 6.36%), the rest were divided between those who eat little meat (30 students; 27.27%) and those who eat mostly meat (22 students; 20%). As can be seen, a large part of the participants maintain an academic lifestyle within the limits of responsible care for the environment by using shared or nature-friendly means of transportation, and limiting themselves to those that generate a greater amount of pollution; their diet is also based on the appropriate consumption of meat; although the predominant options are not the most beneficial for the environment, they do denote the students' efforts to care for the environment, despite the long road they still have to travel to help the environment.

Finally, in the section on feelings and perceptions of the respondents regarding climate change, the most relevant thoughts of the students regarding this phenomenon were questioned, from the emotions it generates to the actions implemented by governments, educational institutions and citizens in their particular sphere. Firstly, it is highlighted that the predominant emotions in the study population when talking about climate change are concern (68 students; 61.81%) and fear/fear/anguish (32 students; 29.09%), the rest are divided between sadness/pain, anger/rage and confusion; which together is understandable when looking at the perception they have regarding how prepared they consider Mexico is to face climate change, where the results were divided between "not prepared" (59

students; 53.63%) and “not very prepared” (49 students; 44.54%), only 2 people (1.81%) think that the country is quite prepared. A section was conducted where participants were asked to select how much they agreed with the statement presented on a scale from 1 for “disagree” to 5 for strongly “agree”, the results were as follows: with the statement “climate change is out of my control”, most of the options are centered on a neutral point (38 students; 34.54%) and a greater amount disagree (22 students; 20%) than agree (15 students; 13.63%) with the sentence (the rest focus on midpoints 2 and 3), indicating that a large portion of respondents are not fully confident that they can impact the course of climate change; the next sentence “nothing I can do will solve climate change” concentrates its results in the disagree item (78 students; 70.90%); continuing with the sentence “taking action to address climate change is a moral duty” the total of 66 students (60%) were found to strongly agree with it; subsequently referring to alternative fuels 60% (66 students) were found to strongly agree to use them, contrary to the divided opinions of the sentence “I have developed actions to decrease emissions” where the answers are concentrated in a neutral point (31 students; 28.18%) and inclined to agree (28 students; 25.46%) with the statement; in question of the negative phrases about climate change the opinion remained notably in disagreement, among these phrases are “taking actions against climate change can worsen our quality of life” (64 students; 58.18%), “climate change is unstoppable” (57 students; 51.81%) and “the importance of climate change has been exaggerated” (81 students; 73.63%). The last section of this item considered whether “it is important to develop activities that contribute to reducing emissions both at the university and at the faculty”, a statement with which there was mostly strong agreement (69 students; 62.72%). Thanks to the previous answers we can analyze that although the study population identifies the importance of climate change and that the actions we carry out to some extent have an impact on this phenomenon, a neutral position has been demonstrated with respect to the self-perception that the actions currently carried out are sufficient to reduce the impact of some pollutants, such as the emissions generated; likewise, this may influence the fact that the majority have an impartial opinion about whether in the future we can really control the outcome of climate change, demonstrating that there is no certainty that we will be able to combat the consequences of this phenomenon.

In addition to the last question, where the population affirmed that it is necessary for the different faculties to implement actions that have a positive impact on climate change, such as the reduction of emissions, other questions were also asked regarding the role of these institutions in the phenomenon studied. First, we asked how much importance the university gives to this issue, the opinions were divided between “it gives little importance” (48 students; 43.63%) and “it gives some importance” (47 students; 42.72%), while 4.54% (5 students) consider that it gives a lot of importance. Subsequently, we asked if global warming has affected their academic performance where the results were a little (70 students; 63.63%), it has not affected me (23 students; 20.90%) and quite a lot (17 students; 15.45%); which is consistent with the need for air conditioning/heating in the classrooms, since most indicated that it was moderately necessary (53 students; 48.18%) and only 15.45% (17 students) indicated that it was not necessary, the other responses are focused on different degrees of need. As we can see, students perceive that it is necessary for universities to carry out actions that benefit the environment, but for the moment they do not feel a significant negative impact of climate change in their school environment, despite the fact that most of them require a temperature regulator for their place of study.

The last item addressed the main actions that each individual can take to combat climate change, this item was diverse but mainly

highlighted the reduction of water and energy use (39 students; 35.45%), the use of bicycles and/or public transportation (26 students; 23.63%) and taking care of green areas (18 students; 16.36%); of which it is worth mentioning that these are activities that can be implemented in any area of their daily lives.

Discussion

Summary of principal findings

The study collected responses from 110 students, mostly women (69%), of the Bachelor's Degree in Surgeon and Midwife, mainly from the University of Guadalajara (73.63%) and LAMAR (24.54%). The results revealed a general knowledge of climate change, with the majority of participants associating it with “change in temperature” (79.09%) and considering it as a current phenomenon (98.18%). Students showed a predominant concern (61.81%) and fear/anger (29.09%) towards climate change. The majority feel that Mexico is unprepared (53.63%) or poorly prepared (44.54%) to face this phenomenon. Regarding perception of control, 34.54% feel neutral about the statement “climate change is out of my control”, while 70.90% disagree with “nothing I can do will solve climate change”, suggesting that they recognize the importance of individual action. In addition, 60% believe it is a moral duty to take action against climate change.

However, only a minority have developed actions to reduce emissions, with opinions concentrated in neutral (28.18%) and somewhat agree (25.46%). The majority disagrees with negative statements about climate change, such as “taking action against climate change can worsen our quality of life” (58.18%) and “climate change is unstoppable” (51.81%). Finally, 62.72% of students believe that it is important to develop activities that contribute to reducing emissions at the university. However, they feel that universities currently give little importance to the issue (43.63%). Although many feel that climate change has affected their academic performance to some degree (63.63%), they do not perceive a significant negative impact on their school environment, although they do express the need for temperature regulators in classrooms. These results reflect an awareness of the seriousness of climate change and the importance of collective and individual action, although with a neutral self-perception regarding the effectiveness of their own actions.

Thus, in this study, it was confirmed that undergraduate medical students consider that they are poorly informed about climate change and its implications. However, when analyzing their answers to other questions such as the definition of climate change, its causes and consequences, knowledge about it is part of their background. Similarly, they are aware of the most worrisome environmental problems such as resource depletion, water pollution, climate change, loss of biodiversity and the increase in waste; they express a sense of fear and concern about the present and future consequences of these environmental phenomena. Analyzing the students' basic knowledge and awareness of the issue, these data differ somewhat from their initial response, which highlights their perception of their knowledge about climate change and its implications. Possibly their denial to that point is due to the fact that the question was not so objective, their answer referred to their little information about current news or their little participation towards actions that counteract climate change.

Comparison with previous studies

It is extremely difficult to find previous studies on the same population considering the lack of relevance of climate change in Mexico's public policies; however, it is feasible to establish a general

panorama based on the report established by the National Autonomous University of Mexico (UNAM).⁷ Among relevant data to understand the context of climate change in Mexico, it should be noted that in our country the average air temperature in Mexico has increased around 1.69°C (1.59°C-1.81°C) with respect to the beginning of the 20th century.⁷ This places us with an increase of 0.5 higher than the global average established by the United Nations.¹ In turn, Mexico is positioned as an important country in the context of the influence on the Greenhouse Effect since it is the 13th largest emitter of Greenhouse Gases (GHG).

So that these specific data are reflected in the country, as far as the health sector is concerned, the population in general understands that climate change of anthropogenic origin is recognized as a threat to human health. And as previously mentioned, direct impacts are identified, mainly related to changes in the frequency of extreme meteorological events and indirectly, mediated by the effect on natural systems that can alter the dynamics of life cycles of a particular pathogen.

This second scenario is of utmost relevance since globally, about 70% of infectious diseases affecting humans originated from zoonotic pathogens. However, the vast majority of research has been conducted on the observed impacts of dengue and its relationship with temperature and precipitation. Except for the case of dengue and the El Niño/Southern Oscillation, there are no studies on the effects of extreme events and climate variability on these diseases. This same UNAM report establishes that several studies show a strong association between temperature/humidity conditions and respiratory disease morbidity, such that temperatures above 33.2°C are correlated with increases in acute respiratory infections in children under 5 years of age.

Associating this information with the recent pandemic that crossed the planet with the transmission of COVID19, it was found that a 1 °C increase in temperature reduces the transmission of this virus by 13%. A positive association between exposure to O₃ and cases of COVID-19 infections and deaths has also been documented. Regarding the cardiovascular system, it was found that there is an increase in the risk of mortality in metropolitan areas associated with temperature. This increases by 7.1% in extreme conditions, with temperatures that are too cold or too hot in relation to the average in these areas. In addition, there is consistent evidence of a positive association between short-term exposure to O₃ and an increase in emergency department visits for cardiovascular causes.

Recently, the increase in temperature has been considered a risk factor for kidney disease, due to periods of dehydration and the metabolism of certain hormones essential for water balance. Regarding mental health, it has been observed that the pattern of suicides has seasonal fluctuations that could be related to changes in social activities and exposure to variables such as temperature and sunlight.⁷ In Mexico, the Centroids species of scorpion is endemic, positioning itself as the main cause of poisoning in the country and therefore a relevant element in emergency departments.⁸ The incidence of scorpion stings shows a strong seasonal pattern, as fewer stings have been documented with temperatures below 16 °C. Additionally, for every 1 °C increase in temperature, scorpion sting cases increase by 9.8% in warmer regions.⁷

This should be associated to our study since it is worrying that among the undergraduate students of the Bachelor's Degree in Surgeon and Midwife on the knowledge of the greenhouse effect on health, the least referred options were increase of malaria and salmonellosis cases (15 students; 13.63%), increase of cardiovascular

and respiratory problems (17 students; 15.45%), propagation of diseases and pandemics (27 students; 24.54%). The same elements that UNAM establishes as a priority in relation to health affectations.⁷

On the other hand, a study conducted at the National University of Asuncion in Paraguay sought to describe the perception and knowledge of climate change among students at the university, with the intention of proposing sustainability strategies. They implemented semi-structured interviews and identified that the study population perceives the effects of climate change in day-to-day life and also agrees that actions in favor of the environment should be planned, however, they are only superficially aware of the relevant scientific information on the subject. Comparing the conclusions with our results we can observe the degree of awareness that students have and their attitude towards climate change, which coincides with our study population.⁹

Likewise, they highlight that 63% of the students consider that the professors are well informed on the subject, however, the development of the subject and its effects are not adequately addressed, since the content they receive is scarce. From these results, it was observed that there is a need to incorporate the promotion of sustainable development in the classroom and through University Extension activities. Within our results it is reported that students consider that the university to which they belong considers climate change important in 47.26%, from which it can be inferred that like the study cited, there is a need to incorporate more strategies and activities aimed at promoting sustainable development.⁹

Finally, it is relevant to know these data regarding the perceptions that undergraduate students have about a current phenomenon that greatly affects the health of the general population, such as climate change. For the same reason, it is necessary to identify specifically what causes this phenomenon in health, due to the fact that these will be the challenges that these students will soon face in their working life. This is analyzed in the systematic review "Effects of climate change on public health, 2015-2020". This literature refers to how climate change has caused alterations in meteorological phenomena turning them into extreme events such as heat and cold waves, extreme rainy or dry seasons and increased pollution of natural elements, mainly air. These changes have caused an increase in the mortality of the population and in the contagion of certain diseases.¹⁰

Among the aforementioned events, heat and cold waves have been specifically related to an increase in mortality from various causes, with heart attacks being predominant; alterations in rainfall and drought have led to a higher incidence of diarrhea in the population under 5 years of age, as well as other gastrointestinal infections, hand-foot mouth disease and leptospirosis; infectious disease infections have also increased, a main trigger being the progressive adaptation of some vectors such as *Aedes aegypti* and *A. albopictus* to certain areas that were previously inaccessible due to weather conditions. *albopictus*, to certain areas that were previously inaccessible due to their climatic conditions; likewise, air pollution by fossil fuels has been associated with greater morbidity and mortality, which has been estimated to have reduced life expectancy by 2.9 years worldwide.¹⁰ It is necessary to know these data in order to establish the relevance that this phenomenon should have in future health professionals, and to instill them in their education so that they can later contribute relevant knowledge to public health.

Implications of the results

The results indicate that although students have a basic understanding of climate change and its causes, there is a gap in

in-depth and practical knowledge, especially in relation to health consequences. This is crucial for future health professionals who will have to deal with the effects of climate change on public health.

Limitations of the study

One limitation of the study, as mentioned in the methodology section, is its focus on a specific population (medical students at specific universities), which may not be representative of all university students. In addition, the selfassessment of knowledge may be subject to biases, among which we can mention applying the surveys virtually and students who do not correspond to the specific universities answering the surveys.

Suggestions for future research

Future research could explore the implementation of more comprehensive educational programs on climate change, especially those that highlight its effects on human health. It would also be beneficial to investigate the effectiveness of different environmental communication strategies in universities. Likewise, it is considered that the present research can function as a precedent for future topics that can establish causal relationships between the climatic phenomena experienced in Mexico and specific alterations to health, human physiology, epigenetic modifications and the mechanisms of action of the drugs that are used, thus adapting the educational programs to the changes that the world is going through and, therefore, forming properly prepared health professionals.

Conclusion

Research conducted on the general knowledge and perception of climate change in undergraduate medical students reveals significant gaps in education and awareness of this critical issue. Although most students recognize the existence and seriousness of climate change, many lack a thorough understanding of its specific impacts on health and daily life. The results show that although students have a basic understanding of concepts such as carbon footprint and the greenhouse effect, their knowledge of the direct consequences of climate change on human health is limited. The majority of respondents perceive climate change as an important concern, but feel that they are poorly informed and not fully confident in their ability to influence the course of this phenomenon.

In addition, an urgent need was identified to integrate more training and education on climate change into medical curricula. This is essential to adequately prepare future health professionals, who will have to face the challenges that climate change imposes on health systems and the health of populations. In relation to previous studies, the scarcity of research on the implications of climate change on health in Mexico is highlighted, mainly due to its limited recognition in public policies. However, the knowledge provided by the National Autonomous University of Mexico (UNAM) offers a valuable context where its findings underline the urgent need to recognize the health risks associated with climate change.

Additionally, revealing the existence of a disparity between student awareness and urgency of climate change health impacts emphasizes the need for improved educational initiatives as a study conducted in Paraguay reflects similar sentiments, revealing students' superficial understanding of the scientific nuances of climate change and advocating for sustainable action. Importantly, future research should explore causal relationships between climate phenomena and specific health outcomes, informed by a systematic review highlighting the role of climate change in increasing mortality rates and disease burdens globally.

In conclusion, climate change education should be an essential component in the training of health professionals. It is crucial that educational institutions take steps to improve understanding of this issue among their students, thereby fostering greater preparedness and responsiveness to the adverse effects of climate change on public health. Climate change is a global reality and therefore the world needs to work collectively on this issue with education as a fundamental first step.

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Conflicts of interest

The authors declare that there are no conflicts of interest.

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