Public Health and Sustainable Development: training future generations in a developing country

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Abstract. The adoption of the Sustainable Development Goals in the Colombian Caribbean Region is a priority, specifically in the city of Santa Marta, because in this city are several factors involved in public health problems known as Social Determinants of Health: the city has lack of vegetation and high population density which can be a conditioning factor for the progressive increase in temperature and for heat index; and power outages are common. Therefore, in this paper is presented the curricular design of the course "Public Health and Sustainable Development" offered at Universidad del Magdalena. This course covered three topics in its order: 1) the relationship between sustainability and health; 2) the knowledge about SDGs and their global agenda; 3) and ways for increase healthy life and sustainable development in context. With these three topics the SDGs analyzed were: #3 Good health and well-being #4 Quality education, #6 Clean water and sanitation, #7 Affordable and clean energy, #11 Sustainable cities and communities, and #13 Climate action. The evaluation was based on rubrics, the students presented oral workshops and group written reports, and a final report that addressed the relationship between health and public and SDG. It can be concluded that the students achieved a first level of knowledge in the relationship between public health and the SDGs. This work identified that there are three main environmental problems of the city of Santa Marta: the public supply of drinking water for human consumption, continuous increase of high temperatures, and lack of vegetation. In this way, new buildings must generate an impact on public health, guaranteeing a healthy urban environment. In Santa Marta, the University must have a central role as an integrating axis, promoting healthy and sustainable behavior in society; and based in this work there are elements for a climate emergency declaration in Universidad del Magdalena.

1. Introduction

The Sustainable Development Goals (SDGs) are an agenda of the United Nations Organization (UN) \([1]\) to establish an economically prosperous and sustainable society friendly with the environment, socially inclusive and guaranteeing well-being for future generations \([2]\); there are 17 SDGs and 169 goals \([1\text{-}3]\), and achieving them implies that the SDGs must be networked, and one of the SDGs that is transversal to all is SDG # 4: Education \([2]\). In Santa Marta, Colombia, there are several problems identified in relationship to health and environment, and in the sector public politics and university these problems not are analyzed in a global manner, as should be leading role of universities: promoting the SDGs among society \([4]\); this vision were the fundament to generate the course in the Universidad del Magdalena. Therefore, it can be considered that the university can have a first
approach with university students, who can then work in decision-making spaces [3,4]. The local governments and university could adopt the SDGs as part of their political strategies for problem-solving and sustainability by 2030. But, from the area of public health, there is a lack in the workforce [5], which makes it necessary to integrate the SDGs into public health training [6].

Then, this article is based in the experience of a course in Public Health and SDGs in context of problems in Santa Marta and Colombian Caribbean. The course presented three topics based in the next problems: First topic on the relationship between sustainability and health, as an approximation to Colombian social security and health system; according with Sustainable Development Report (Available from https://dashboards.sdgindex.org/#/COL) Colombia is in 67 global rank, and SDG #3 Good health and Well Being has an score of 79,3; in Colombia, there are not rankings of SDG for cities or states.

Family insurance is the financial basis of the Colombian health system, which means that people who have enough resources to contribute financially pay, and the others (through a solidarity scheme) receive health services without paying. This theoretically would work. However, some elements difficult the proper functioning of the system: (1) Financial intermediation (through private insurers) produces high system costs; (2) Financial imbalance derived from the fact that the majority of the population is in poverty conditions compared to those whose income allows them to contribute to the system; (3) A system focused on disease care which has significantly weakened the health promotion and disease prevention, and (4) the existence of a collective imaginary of health (only as care for the disease) not as a fundamental human right [7-9].

Second topic, the knowledge about SDGs and their global agenda: in this phase the students and professor analyzed scientific evidence from effects on different events such as: air pollution, heat waves and drought and its relationship with health, analysis not only as environmental problems. The scientific evidence in Santa Marta have shown that the city has multiple social determinants that influence public health problems [10]: although, 95% of the houses have water supply, more than 50% presented water supply interruptions and [11]; lack of pedestrian and cycle paths; lack of green spaces was identified [12]; the lack of vegetation and the high degree of population density of the city can be conditioning factors for the progressive increase in temperature that had an average of 29°C for the year 2017, and a heat index of 34, between 1972 and 2017 [13]. In Colombia about 70% of the electric power is of hydroelectric origin, so due to the increase in the temperature the water level in the reservoirs decreases and power outages occur, and these power outages are greater in the Colombian Caribbean [14-16]; besides, Santa Marta is an endemic region for dengue spread [17].

Third topic, the ways for increase healthy life and sustainable development: in this topic students described an utopic city healthy and sustainable. There is a relationship between education and other variables as: health, economy and sustainability [18]; but this relationship not only is proportional directly: in Santa Marta, it was found that having a university or high education level, and having a medium or high socioeconomic stratum was directly related to the increase carbon footprint, indicating that university education does not guarantee that professionals adopt environmentally friendly consumption practices [19].

2. Materials and Methods

2.1. Curriculum topics

The Public Health and ODS course were offered to students in all areas of the University’s knowledge. The course is taught for two hours per week for 16 weeks, and includes three topics in order: 1) the relationship between sustainability and health; 2) the knowledge about SDGs and their global agenda; 3) and ways for increase healthy life and sustainable development.
2.2. Students who received the course.
In this first course, 55 students attended the areas of: nursing, psychology, engineering and education; including an exchange student from Mexico. The students were divided into two groups, each group with a professor different, but with the same topics.

2.3. Pedagogical tools
The students had access to all the information via virtual through the Blackboard platform. For the first topic, it was presented information about Colombian social security and health system, process for requesting a medical appointment and its inconveniences, concepts of sustainability and its application to wellness and health. For the second topic, knowledge of the SDGs and its global agenda, information was presented based on the UN website (https://www.undp.org/content/undp/es/home/sustainable-development-goals.html) [20] and from Sustainable Development Report 2019 report [21]; In addition, scientific articles in relationship with Santa Marta (10-17) were analyzed in relation to the effects on public health due to air pollution, heat waves and current climate change; And topics such as access to renewable energy and desalination of seawater for human consumption were discussed. In the third topic, arguing for healthy living and sustainable development, students were assigned a workshop describing a healthy and sustainable city.

2.4. Databases and statistics software
In addition to the readings, students developed data analysis skills from different sources of open access including database from Sustainable Development Report 2019 [21]. In Colombia, there is only air quality monitoring in the capital of Bogotá and the city of Medellín, but there are no open air quality databases, for this reason we use a database on the London government website: Excel database of average air quality in London between dates 01/01/2008 al 31/07/2019, (Available from: https://data.london.gov.uk/dataset/london-average-air-quality-levels). These database were analyzed with the next statistics software: Epi-Info™ statistical software (US Centers for Disease Control and Prevention, https://www.cdc.gov/epiinfo/index.html), R software (http://R-project.org) and R Studio (http://www.rstudio.com); the statistics analysis was descriptive and of correlations.

2.5. Evaluation method based on rubric skills and learning objectives
Each topic was evaluated with rubric based in skills and learning objectives. So, students presented oral workshops and group written reports, participation in blogging through Blackboard, and a final report of a topic selected by them were carried out, the report addressed the relationship between health and public and SDG. All work after evaluation received a feedback from the professor.

3. Results and Discussion
This was the first time that the Public Health and SDG course was offered at the University of Magdalena. In this first course was concluded what students understood the relationship between environmental problems and its effects on health, and SDGs is a route map for government and universities for problems solution locals and global. In this course were analyzed the SDGs: #3 Good health and well-being #4 Quality education, #6 Clean water and sanitation, #7 Affordable and clean energy, #11 Sustainable cities and communities, and #13 Climate action. In the manuscript submitted by students, it can be concluded that there are three main environmental problems of the city of Santa Marta: the public service of drinking water for human consumption, continuous increase of high temperatures, and scarce vegetation; and the students achieved a first level of knowledge in the relationship between public health and the SDGs.

In improvement for the next courses, the following Table 1 is presented, as a specific guide for the city of Santa Marta of the relationship between the SDGs, the specific problems, the possible solutions and the expected impact on public health. The results of Table 1 were presented to planning staff of
university and was suggested that are elements for a climate emergency declaration in Universidad del Magdalena.

**Table 1.** Relationship between the SDGs, specific problems, possible solutions and the expected impact on public health for the city of Santa Marta, 2019-2020.

| SDGs                              | Specific problems                                                                 | Possible solutions                                                                 | Expected Impact on Public Health                                                                 |
|-----------------------------------|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| #3 Good health and well-being     | Morbi-mortality due to air pollution and lack of drinking water [11]. Vector-borne diseases [17]. | Adequate universal health coverage. Ensure access to drinking water for human consumption. Early diagnosis and adequate treatment of vector-borne diseases through early warning systems. | Reduction of heat stress, dehydration, and diarrheal diseases. Decrease in morbi-mortality due to air pollution and lack of drinking water. |
| #4 Quality education              | Ignorance of the SDGs among university students                                   | Maintain the public health course and the SDGs                                    | Acquisition of knowledge of sustainable practices                                              |
| #6 Clean water and sanitation     | Lack and failure to provide the public drinking water service for human consumption in the city of Santa Marta [11]. | Desalination of seawater for human consumption                                    | Decreased heat stress, dehydration, and diarrheal diseases                                      |
| #7 Affordable and clean energy    | There is no massive use of solar energy                                            | Use of solar panels, and avoid the unique dependence on hydroelectric power.      | Adaptation to high temperatures reducing heat stress and reducing heart attacks [13].          |
| #11 Sustainable cities and communities | There are no constructions adapted to the tropics or to the interior of the houses or in the surrounding environment. | Increase of green space areas. Construction of houses adapted to the tropics. Design of healthy interior spaces with an impact on public health [22]. | Decreased effect of heat islands [13]. Increase in physical activity, decrease in obesity. Indicators to quantify the impact of constructions on health [22], for improvement of quality of life and mental health [23-24]. |
| #13 Climate action                | Continuous increase in temperature and heat index. Very low vegetation in urban areas. Increase in the felling of trees. High population density [13]. | Increase of vegetation in the city. An adequate territorial organization plan for urban growth. | Adaptation to high temperatures reducing heat stress and reducing heart attacks. Decreased effect of heat islands. |
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