

Publication status: Not informed by the submitting author

IMPACT OF THE COVID-19 PANDEMIC ON ADOLESCENTS' PERCEPTION OF SCIENCE, SCIENTISTS AND HEALTH CARE WORKERS, AND CHANGE OF CAREER CHOICES

Carol Perelman, Ma. de Lourdes Patiño-Barba, Jorge Padilla-Gonzalez

<https://doi.org/10.1590/SciELOPreprints.3554>

Submitted on: 2022-02-02

Posted on: 2022-02-09 (version 1)

(YYYY-MM-DD)

IMPACT OF THE COVID-19 PANDEMIC ON ADOLESCENTS' PERCEPTION OF SCIENCE, SCIENTISTS AND HEALTH CARE WORKERS, AND CHANGE OF CAREER CHOICES

Carol Perelman, BSc¹, Ma. de Lourdes Patiño-Barba, MSc², Jorge Padilla-Gonzalez, MSc³

¹ Universidad Nacional Autónoma de México (UNAM), SOMEDICyT, RedMPC, México. ORCID 0000-0002-0111-1154

² Fibonacci - Innovación y Cultura Científica, A.C., Sociedad Mexicana para la Divulgación de la Ciencia y la Técnica, A.C. ORCID 0000-0003-1399-6786

³ Fibonacci - Innovación y Cultura Científica, A.C., Sociedad Mexicana para la Divulgación de la Ciencia y la Técnica, A.C. ORCID 0000-0003-0938-8956

*Correspondence to, Jorge Padilla, MSc.. Fibonacci. Suiza 104, Col. Andrade, C.P. 37020, León, Gto., Mexico. jpadilla@fibonacci.org.mx

ABSTRACT

Since the onset of the COVID-19 pandemic, scientists and health care workers provided information based on scientific evidence for the general public, increasing their exposure on social and mainstream media. Society witnessed science-in-the-making while scientists and health care workers were dedicated to improve understanding and develop tools for the diagnosis, treatment, prevention and control of this novel disease. This study aims to assess the impact of the ongoing COVID-19 pandemic on adolescents' perception of science, scientists and health care workers; to understand whether it changed their career choices; and to learn about the resulting first-year applications and enrollments in scientific and medical careers for the 2020-2021 school year in Mexico. We conducted a voluntary national anonymous online survey and analyzed the official database of the National Association of Universities and Higher Education Institutions in Mexico (ANUIES) to answer these questions. With 983 valid responses (CI 95%) we found that by mid-2021, 9 out of 10 respondents aged 14-19 in Mexico had a positive perception of science; that the ongoing pandemic improved their perception of science (69%), scientists (70%) and health care workers (72%); and that their experience during the pandemic changed their career choices to pursue science (23%) and health care (28%) careers. The selected main reason (40-50%) for studying science and health care careers was "liking that type of knowledge"; while only 3% agreed that the pandemic was the main reason for their choice. A thorough analysis of the official ANUIES database showed an increase in first-year applications for scientific (22%) and health care (17%) careers for the 2020-2021 school year compared to the previous, non-pandemic 2019-2020 school year. Enrollment was partly limited by the number of places available. With this study we conclude that a silver lining of the COVID-19 pandemic could be the improvement of the perception of science, scientists and health care workers and possibly, the creation of a new generation of scientists, medical doctors, and health care workers. Future studies would need to investigate the duration and further positive consequences of this pandemic effect and to understand whether these results are consistent in other parts of the world where adolescents experienced different public policies, public messages and COVID-19 outcomes.

CONCLUSIONS:

Most Mexican adolescents in our study have a positive perception of science. By mid-2021, their experience during the ongoing COVID-19 pandemic significantly improved their perception of science, scientists and health care workers, increased their interests in these careers and inspired some of them in pursuing careers both in science and health care.

KEY WORDS: Public Science Perception, Science Communication, Medical Education, Pandemic Impact, Career Change

INTRODUCTION

The ongoing COVID-19 pandemic required individuals to look for information to increase their safety, and to use terms previously only common in academic contexts and used by audiences interested in science and medicine. Since the beginning of the pandemic, platforms like *Google* reported an increase in the search tendency of words related to the detection, symptoms, transmission, treatment and prevention of COVID-19 ⁽¹⁾. Social media platforms like *Twitter* reported having “coronavirus”, “covid”, and “pandemic” as *trending topics*, while “quarantine” was mentioned 1.6 million times in 2020. Experts, both from scientific and medical fields used social media platforms to share technical information in real time with peers while also informing the general public ^(2,3). Few worldwide events in modern history have put science and health sciences on center stage as much as the ongoing COVID-19 pandemic, which by December 2021 had over 5 million confirmed deaths around the globe ^(4,5).

Mainstream media, decision makers and the general public increased their interest towards science understanding and engagement to take better decisions and lower the risk of COVID-19 transmission. Since the beginning of the pandemic, society showed great admiration and gratitude to both health care personnel and the scientific community for their dedicated work in managing and solving this health crisis ⁽⁶⁾. Life-transforming events such as a pandemic can dramatically impact young adults’ attitudes ⁽⁷⁾. The 1969 arrival of mankind to the Moon inspired a generation of youngsters to pursue careers in science ⁽⁴⁾. Since the onset of the COVID-19 pandemic, many countries and organizations have reported an increase in public confidence and interest towards science and an increase in applications for scientific and medical studies, an effect popularized as the “Fauci effect” ^(8, 9, 10, 11, 12).

We conducted this study to understand if the ongoing COVID-19 pandemic changed the perception that adolescents in Mexico had for science, scientists and health care workers, if it inspired them to change their career choices and if there was an increase in first year college applications and enrollment in Mexican Universities on scientific and health care careers.

OBJECTIVE

To understand the impact of the ongoing COVID-19 pandemic in the perception of science, scientists, health care workers, and career decisions of individuals 14 to 19 years of age.

We assessed four topics:

1. Science and Health care perception: appraisal of science, scientists and health care workers
2. Mexican adolescents’ professional interest to study scientific and health care careers (medicine, nursing, public health, clinical psychology, chemistry, biology)

3. Application to scientific and health care university careers
4. Enrollment to first year in scientific and health care careers.

METHODS

To address topics 1 and 2 (view, change on perception and interest on science, scientists and health professionals), we applied an anonymous quantitative multiple-choice on-line survey in Spanish to a voluntary national corpus of 14 to 19 year olds with Internet access in Mexico, between May 5 and June 27, 2021.

The survey was conducted following the code of ethics and practices established by the American Association of Public Opinion Research (AAPOR) for honesty, respect and integrity.

To address topics 3 and 4 (application and enrollment into first year of university for scientific and health care careers), we analyzed the official yearly reports of the National Association of Universities and Higher Education Institutions in Mexico (ANUIES) ⁽¹³⁾.

Univariable and multivariable statistical analysis was performed.

SAMPLE

The resulting cohort included 983 adolescents (63.5% women) of 14 to 19 years of age (mean 16.7, 66% 16-18) from all different states in Mexico distributed in a non-representative way according to their population, of whom 971 (98.8%) were in school (69.8% in public schools), most in their last years of high school (77%) and 48% reported that none of their parents underwent university studies. (Fig.1)

RESULTS

Topic 1. Perception

1.1 Science Perception

Respondents had to choose one of the eight enlisted words that best described their personal view of science: four positive words (knowledge, progress, solutions, well-being) and four negative words (pollution, dehumanization, incomprehensive, risks). (Fig. 2)

Most (91.4%) respondents selected a positive word to describe their perception of science, being “knowledge” (44.0%) the most popular, followed by “progress” (28.7%). A more positive view of science was held by men (94.2%), those in private schools (94.5%), those enrolled in high school (92.0%) and those with at least one university-educated parent (92.8%).

Those who had a negative perception of science (8.6%) selected “pollution” (3.8%) as the most frequent word, and mostly they were those not studying (25.0%), or studying in public schools (9.7%), women (10.3%) and those who did not have any university-educated parent (10.2%).

1.2 Change in Science Perception

69.1% of respondents said that their perception of science improved as a result of the pandemic, 23.1% reported that it remained the same and 7.8% said that the pandemic worsened their view of science. These proportions are similar for both adolescents that reported a good and a bad perception of science in subtopic 1.1 (Fig. 3.a).

1.3 Change in the Perception of Scientists

70.4% of respondents said that their perception of scientists improved as a result of the pandemic, 25.9% reported that it remained the same and 3.7% said that the pandemic worsened their view of scientists. (Fig. 3.b)

When instructed to choose the best reason, out of four options to explain these changes, 53% of those whose opinion of scientists improved selected “because they are people who provide great discoveries to society” as the main reason, and 43% of those whose opinion of scientists worsened selected “other”, and in second place (33%) “they only discover things and develop products to earn money”.

1.4 Change in the Perception of Health Care Workers

71.9% of respondents said that their perception of health care workers improved as a result of the pandemic, 24.6% reported that it remained the same and 3.5% said that the pandemic worsened their view of health care workers. (Fig. 3.c)

When instructed to choose the best reason, out of four options to explain these changes, 28% of those whose opinion of health care workers improved selected “they are intelligent people that studied a lot” as the main reason and (26%) “they avoid suffering and save lives” as their second option. 35% of those whose opinion worsened selected “other” as their main option and (24%) “they are arrogant” in second place.

Topic 2: Change in Study Interests and Career Intentions

433 adolescents (44% of respondents) reported that their study intentions changed: half (**22.1%**) **stated that their study intentions changed as a result of the pandemic**, while the other half (22.6%) changed their study plans for “other reasons”, 56% of adolescents will continue with their same pre-pandemic study plans.

Those who reported a change in interests as a result of the pandemic were more female (23%) than men (20%), more studying in public schools (25%) than in private schools (17%), and those whose neither parents studied in universities (25.7%) than those whose both parents studied (17.2%). Two respondents (18%) out of the 11 adolescents (1.1% of N=983) that will not study a career stated that they changed their study intentions as a result of the pandemic.

When analyzing the responses of those who changed their career plans as a result of the pandemic according to area of knowledge we found that **23% of the**

adolescents who want to study science (natural sciences, math and statistics) (6.2% of the total), **28% of the adolescents that want to study health care** (22.2% of the total), and 20.0% of the adolescents who want to study careers unrelated to natural sciences or health sciences (71.6% of the total) **changed their study intentions as a result of the ongoing pandemic.** (Fig. 4 a. b.)

More respondents in the cohort interested in a health career (28%), followed by science (23%) changed their career plans as a result of their experience during the pandemic, compared to respondents studying other careers (20%) or not planning to study at all (18%).

Of those adolescents who changed their study intentions due to the pandemic to health sciences (28%), 26% also improved their perception of health care workers due to the pandemic (Subtopic 1.4). And of those adolescents who changed their study intentions to science (natural sciences, math and statistics) (23%) as a result of the pandemic, 15% also improved their perception of scientists (Subtopic 1.3).

When asked the reason for wanting to study science (natural sciences, math, statistics) or health sciences, the main reason selected by those pursuing careers in these areas was “I like that type of knowledge” in 39.7% of those intending to study health sciences and in 48.4% of those wanting to pursue natural sciences, math and statistics. **3.2% of those wanting to study these careers reported that the ongoing pandemic had inspired them to do so.**

Topic 3: Changes in Applications to First Year

Analyzing the official ANUIES reports' databases we found that overall applications rose by 6.5% from 2019-2020 to 2020-2021 school years (from 2,053,348 to 2,186,739). During this period, there was a 21.5% increase in applications for natural sciences, math and statistics (from 67,649 to 82,214) and a 17.1% increase during the same period for health sciences (from 374,231 to 438,284). **In the first year of the pandemic the increase in first year applications for scientific (science and health care) fields were well above (21.5% and 17.1%) than the increase in other fields of study (6.5%).** (Fig. 5.a)

Topic 4: Changes in First Year Enrollment

Analyzing the official ANUIES reports' databases we found that first year enrollment for natural sciences, math and statistics in the 2020-2021 school year (32,095) was lower than the total number of applications received (82,214) but also lower than the available spots (45,608), resulting in a 70.4% coverage of the places offered. Similarly, the first year enrollment in health sciences for the 2020-2021 school year (126,132) was lower than the total number of applications received (438,284) but also lower than the spots available (180,423) for entry, resulting in a 69.9% of coverage of places offered. The disparity between demand and supply, along with other variables, resulted in a 2020-2021 first year enrollment of 126,132 students for health sciences (a decrease of 6.1% from the previous school year) and 32,095 for natural sciences, math and statistics (an increase of 3.9% from the previous school year). Both the supply of places and

the demand in applications have increased in these fields over time (2011-2021). (Fig. 5.b)

DISCUSSION

As of mid-2021, almost all 14-19 year olds that responded the anonymous questionnaire had a favorable perception of science (91%) being “knowledge” the main word associated with it. Also, 7 out of 10 adolescents stated that their experience during the COVID-19 pandemic improved their opinion of science, scientists and health care workers while only 8% and 4% worsened their perception of science and of scientists and health care workers, respectively. It is interesting to note that more adolescents improved both their perception of scientists and health care workers as a result of the pandemic (58%) than those who worsened their perception of both professionals (1%).

The COVID-19 pandemic had an impact on the study intentions in one fifth of the respondents (22%), being this impact higher in those interested in health care (28%) followed by those wanted to study a career in natural sciences, math and statistics (23%). Most of the adolescents who wanted to study health sciences and natural sciences stated that the reason for selecting these careers was “I like that type of knowledge” and only 3% of them reported that the pandemic inspired their choice.

As a result of the ongoing COVID-19 pandemic, two out of ten adolescents that want to study a career in health sciences or natural sciences, math and statistics also improved their perception of health workers and scientists, respectively.

For the first year of the pandemic (school year 2020-2021) there was an increase in applications for health sciences (17%) and natural sciences, math and statistics (22%) careers which represented a higher increase than seen for other fields of study (7%) from the previous, pre-pandemic school year 2019-2020. However, although applications were higher for this first year of the pandemic in both fields of study, the enrollment was limited in part by the availability of spots, resulting in a 6% decrease in first year health science students and a 4% increase in science careers. It is important to understand this disparity and the variables affecting this process. So far, there is a clear increase in demand in both fields, but interesting to note is the slight increase in science enrollment and the larger decrease in health enrollment.

Future studies should investigate the duration and long-term consequences of the COVID-19 pandemic on both scientific and health care careers in order to assess the real impact of the so-called “Fauci effect”.

Some studies had begun to emerge looking at the effects of the pandemic on perceptions of science, scientists and health care workers, as well as the impact on professional careers in other parts of the world. It will be of value to compare the results observed in this study with those conducted in different parts of the world, where adolescents experienced other public health policies, pandemic messages and COVID-19 outcomes.

This apparent silver lining in the pandemic could possibly result in a new generation of scientists, physicians and health workers, and it could also be an

opportunity for science communication professionals to enhance their engagement with the general public, for scientists to continue their approach to wider audiences, and for educators to promote science literacy and scientific thinking in students.

CONFLICT OF INTEREST:

The authors declare no conflict of interest

FUNDING/SUPPORT:

No funding was required

KEYWORDS:

Science Communication, Perception of Science, Career Change, COVID-19 Pandemic

AUTHOR STATEMENT:

All relevant ethical guidelines have been followed, and any necessary IRB and/or ethics committee approvals have been obtained. Authors declare no conflict of interest.

AUTHORS' CONTRIBUTION:

J.P.G. performed the statistical analysis, J. P. G. and L.P.B. collected the data, C.P. performed the literature search and wrote the manuscript, all authors interpreted the results, created the figures, and made edits. All authors provided critical feedback and contributed to the final manuscript. Correspondence and requests for materials should be addressed to J.P.G.

FIGURES:

983 valid questionnaires (63.5% women, 971 in school, 69.8% public school)
 Adolescents 14-19 years (mean 16.7, 66% 16-18 years)



FIGURE 1. RESULTING SAMPLE: on-line anonymous multiple-choice questionnaire

Fig. 1 Resulting sample included 983 adolescents (63.5% women) of 14 to 19 years of age (mean 16.7, 66% 16-18) from all different states in Mexico distributed in a non-representative way according to their population, of whom 971 (98.8%) were in school (69.8% in public schools), most in their last years of high school (77%) and 48% reported that none of their parents underwent university studies.

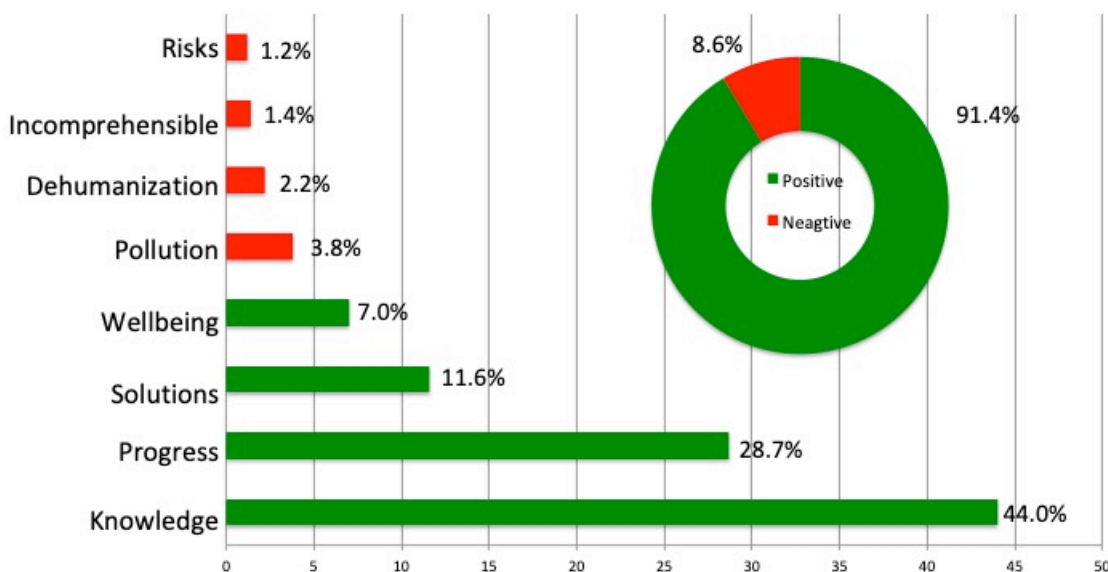


FIGURE 2. ADOLESCENTS' PERCEPTION OF SCIENCE AS A RESULT OF THE PANDEMIC

Fig. 2 Most (91.4%) respondents selected a positive word to describe their perception of science, being “knowledge” (44.0%) the most popular, followed by “progress” (28.7%). Those who had a negative perception of science (8.6%) selected “pollution” (3.8%)

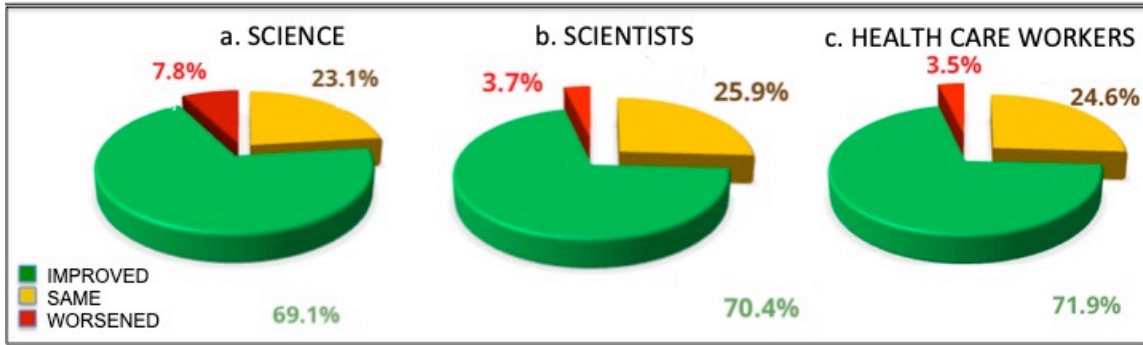


FIGURE 3. CHANGE IN ADOLESCENTS' PERCEPTION AS A RESULT OF THE PANDEMIC

Fig. 3.a. 69.1% of respondents said that their perception of science improved as a result of the pandemic, 23.1% reported that it remained the same and 7.8% said that the pandemic worsened their view of science. **Fig. 3.b.** 70.4% of respondents said that their perception of scientists improved as a result of the pandemic, 25.9% reported that it remained the same and 3.7% said that the pandemic worsened their view of scientists. **Fig 3.c.** 71.9% of respondents said that their perception of health care workers improved as a result of the pandemic, 24.6% reported that it remained the same and 3.5% said that the pandemic worsened their view of health care workers.

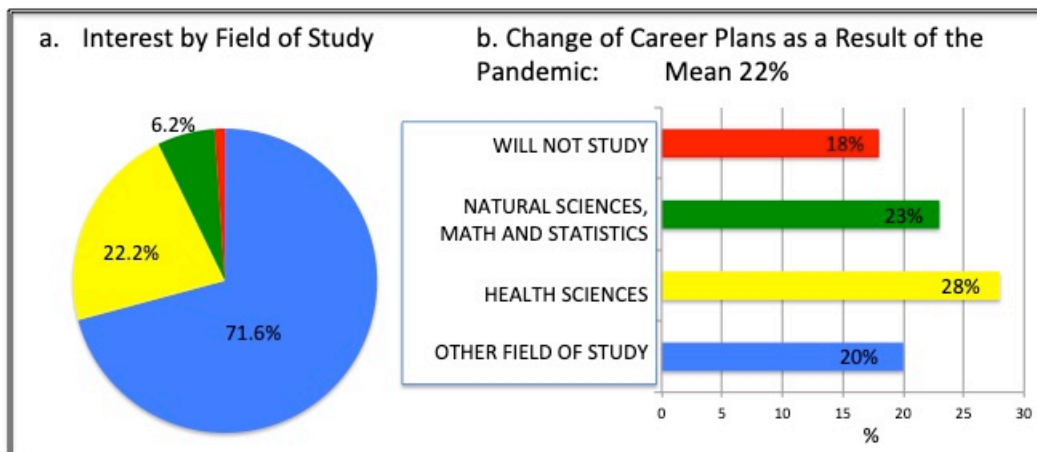


FIGURE 4. FIELD OF INTEREST AND CHANGE OF CAREER PLANS DUE TO THE PANDEMIC

Fig. 4.a.b 433 adolescents (44% of respondents) reported that their study intentions changed: half (**22.1%**) **stated that their study intentions changed as a result of the pandemic**, while the other half (22.6%) changed their study plans for “other reasons”, 56% of adolescents will continue with their same pre-pandemic study plans. More respondents in the cohort interested in a health career (28%), followed by science (23%) changed their career plans as a result of their experience during the pandemic, compared to respondents studying other careers (20%) or not planning to study at all (18%).

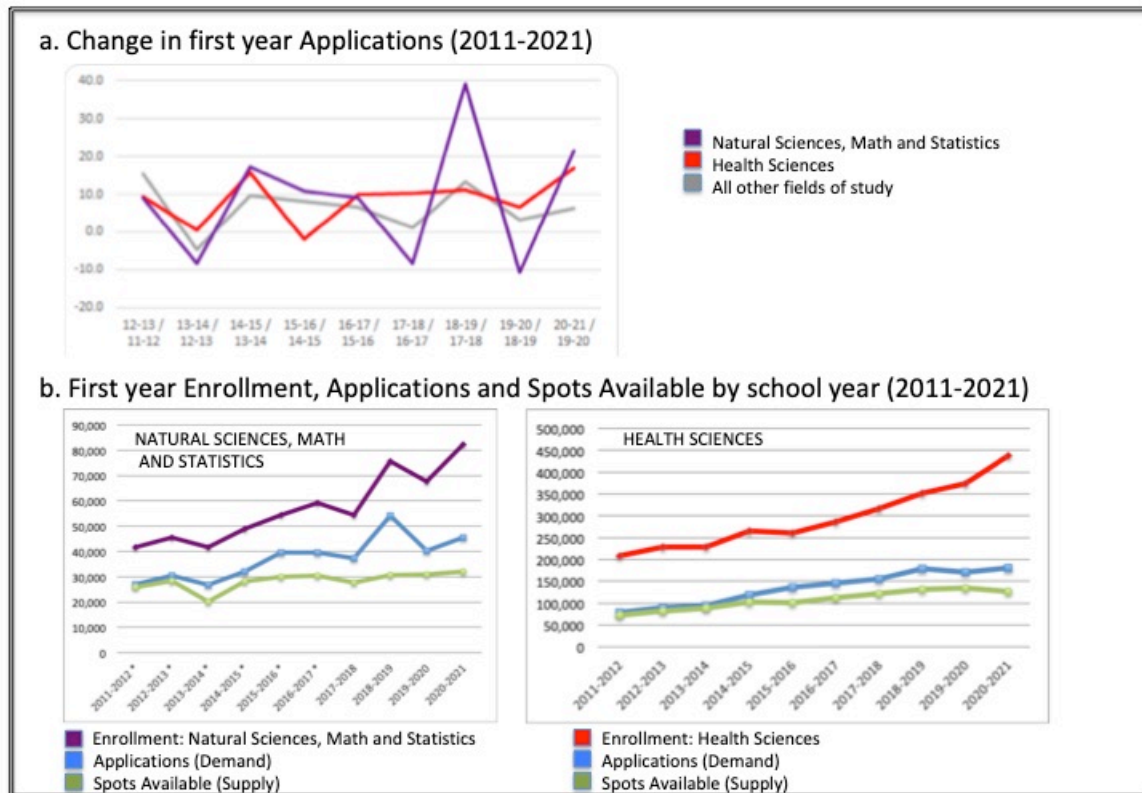


FIGURE 5. CHANGE IN APPLICATIONS AND ENROLLMENT FOR FIRST YEAR UNIVERSITY, 2011-2021

Fig. 5.a.b. In the first year of the pandemic the increase in first year applications for scientific (science and health care) fields were well above (21.5% and 17.1%) than the increase in other fields of study (6.5%). First year enrollment for natural sciences, math and statistics in the 2020-2021 school year (32,095) was lower than the total number of applications received (82,214) but also lower than the available spots (45,608), resulting in a 70.4% coverage of the places offered. Similarly, the first year enrollment in health sciences for the 2020-2021 school year (126,132) was lower than the total number of applications received (438,284) but also lower than the spots available (180,423) for entry, resulting in a 69.9% of coverage of places offered. The disparity between demand and supply, along with other variables, resulted in a 2020-2021 first year enrollment of 126,132 students for health sciences (a decrease of 6.1% from the previous school year) and 32,095 for natural sciences, math and statistics (an increase of 3.9% from the previous school year). Both the supply of places and the demand in applications have increased in these fields over time (2011-2021).

BIBLIOGRAPHY

- (1) Chandrasekaran R, Mehta V, Valkunde T, Moustakas E (2020) Topics, Trends, and Sentiments of Tweets About the COVID-19 Pandemic: Temporal Infoveillance Study. *J Med Internet Res* 22(10) <http://doi.org/10.2196/22624>
- (2) Colton M, Brown N, Gregory C., et al. (2021). *J Med Internet Res* ;23(7) <http://doi.org/10.2196/28615>

- (3) Chevaz Clarke (2020, December 7). What were the most popular Twitter trends this year? CBS News <https://www.cbsnews.com/news/twitter-top-trends-2020/>
- (4) Burns Judith (2019, May 17). The Moon landings: How one small step inspired a generation BBC News <https://www.bbc.com/news/education-48298597>
- (5) Johns Hopkins University & Medicine Coronavirus Resource Center <https://coronavirus.jhu.edu/map.html>
- (6) Giskin D, Glenn R, Kathlee L., (2021) An outbreak of appreciation: A discursive analysis of tweets of gratitude expressed to the NHS at the outset of the COVID-19 pandemic *Health Expect.* <http://doi.org/10.1111/hex.13359>
- (7) Latefa D, Inaam K, et.al. (2020) Developing an Understanding of Adolescents' Knowledge, Attitudes, and Practices Toward COVID-19 *J Sch Nurs*; 36(6):430-441. <http://doi.org/10.1177/1059840520957069>
- (8) https://www.3m.com/3M/en_US/state-of-science-index-survey/
- (9) <https://www.aamc.org/media/49911/download?attachment>
Fall Applicant, matriculant, and enrollment Data Tables, AAMC, Dec, 2020
- (10) Caitlyn Stulpin (2021, September) 'Fauci effect': ID experts could inspire new generation of doctors, *Healio Infectious Disease* <https://www.healio.com/news/infectious-disease/20210917/fauci-effect-id-experts-could-inspire-new-generation-of-doctors>
- (11) Rachel Hall (2021, January 25) Have you been inspired by the pandemic to study science at university? *The Guardian* <https://www.theguardian.com/education/2021/jan/25/have-you-been-inspired-by-the-pandemic-to-study-science-at-university>
- (12) Marta Pinedo (2021, May 18) La pandemia dispara la demanda para estudiar Ciencias de la Salud, *El Pais* <https://elpais.com/educacion/2021-05-15/la-pandemia-dispara-la-demanda-para-estudiar-ciencias-de-la-salud.html>
- (13) <http://www.anuies.mx/informacion-y-servicios/informacion-estadistica-de-educacion-superior/anuario-estadistico-de-educacion-superior>

This preprint was submitted under the following conditions:

- The authors declare that they are aware that they are solely responsible for the content of the preprint and that the deposit in SciELO Preprints does not mean any commitment on the part of SciELO, except its preservation and dissemination.
- The authors declare that the necessary Terms of Free and Informed Consent of participants or patients in the research were obtained and are described in the manuscript, when applicable.
- The authors declare that the preparation of the manuscript followed the ethical norms of scientific communication.
- The authors declare that the data, applications, and other content underlying the manuscript are referenced.
- The deposited manuscript is in PDF format.
- The authors declare that the research that originated the manuscript followed good ethical practices and that the necessary approvals from research ethics committees, when applicable, are described in the manuscript.
- The authors declare that once a manuscript is posted on the SciELO Preprints server, it can only be taken down on request to the SciELO Preprints server Editorial Secretariat, who will post a retraction notice in its place.
- The authors agree that the approved manuscript will be made available under a [Creative Commons CC-BY](#) license.
- The submitting author declares that the contributions of all authors and conflict of interest statement are included explicitly and in specific sections of the manuscript.
- The authors declare that the manuscript was not deposited and/or previously made available on another preprint server or published by a journal.
- If the manuscript is being reviewed or being prepared for publishing but not yet published by a journal, the authors declare that they have received authorization from the journal to make this deposit.
- The submitting author declares that all authors of the manuscript agree with the submission to SciELO Preprints.