The pandemic brought a whole newfound collection of words into our everyday language, some of which had been terms that were infrequently used outside academic and medical settings. However, as familiar as this new pandemic vocabulary has become, there are still several terms that often get mixed in everyday conversations, media communications, and even in the medical field. Some of these terms are often mistaken, which may lead to issues in the understanding of important concepts. Science communication, as a facet of scientific literacy, intends to educate people in an easy-to-understand manner, and this communication is even more important in health care, when a literate patient's medical decisions depend frequently on this process. In this article, we explore the use and misuse of some of the most common terms utilized during the 2019 coronavirus disease (COVID-19) pandemic by nursing and medical students, i.e., future health care professionals, in the hospital environment. This single-center hospital-based cross-sectional study, performed throughout September 2022, included 30 medical and nursing students. All participants completed a self-administered 15-item anonymous questionnaire at a single time point. Nine multiple-choice questions evaluated knowledge, diagnosis, disease manifestations, and vaccines related to the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus. Six questions provided demographics and quality assessment information. The analysis of the answers indicated that for at least 75% of the population surveyed, COVID-19 literacy was better for terms related to technology and actions (3/5 questions answered correctly) than for terms related to the disease (1/4 questions answered correctly). The overall median score for questions 1 to 9 was 4.5 of 9 points in total. Based on the results, the language used in the questionnaire was considered easy to understand, with an easy to medium level of complexity, and the perceived time required to complete the questionnaire was less than 5 min. In conclusion, our results showed that efforts need to be made in continuous professional education to increase the knowledge in COVID-19 literacy in the health care environment for medical and nursing students. Larger studies are recommended to identify and to fulfill the challenges that COVID-19 brought to medical and nursing education.

KEYWORDS COVID-19, scientific literacy, survey, infodemic, nursing students, medical students

INTRODUCTION

In the past 2 years, there has been an increasing effort worldwide for finding effective treatments, diagnostic tools, and vaccines to control the 2019 coronavirus disease (COVID-19) pandemic that, as of May 2022, had caused over 1 million confirmed deaths in the United States (1). Pneumonia and severe acute respiratory syndrome (SARS) are the most important clinical presentations of this infectious disease caused by SARS-coronavirus 2 (SARS-CoV-2) (2, 3), which was initially named COVID-19 virus by the World Health Organization (WHO) (2). During this viral pandemic, we also experienced emergence of a “COVID-19 infodemic,” an overflow of information that included false or misleading information in digital and physical environments (4). Mixed information in the field of health and hygiene flooded the Internet in a short period of time. Since it was difficult for the general public to distinguish between rumors and objective facts, such information had an adverse impact on the prevention and control of COVID-19 (4, 5). The COVID-19 pandemic has led to an accelerated use of new terminology into everyday conversations, but some of these terms are often mixed up, causing misunderstanding of important concepts (4, 6). Consequently, the dangers of health misinformation include...
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but are not limited to inaccurate information shared by people who do not realize its inaccuracy (4, 6), most importantly in the health care environment, where scientific communication is a facet of scientific literacy (7).

Scientific literacy is the ability to use appropriate evidence-based scientific knowledge and skills, for everyday life and a career, in solving personally challenging decisions as well as making responsible socio-scientific decisions (8). Therefore, having a comprehensive understanding and making sense of conflicting information received daily through the influence of social media are important key aspects of scientific literacy (9).

In this context, scientific literacy during COVID-19 has been associated with the acceptance of public health measures adopted to control the pandemic, such as vaccine acceptance (1). How to fight the infodemic has become a major problem in the field of public health (10). Health communication intends to scientifically inform people about the COVID-19 severity and how to avoid getting or spreading the infection (5). Scientific literacy encourages constantly seeking knowledge about a disease or a treatment. It helps us to embrace revision, as what is known one day is replaced with a different explanation and allows us to sort through and select among competing alternatives (11).

The life cycle of science communication includes how scientists produce science information, how media compile and share the information, and how individuals process this information and decide their actions (6). Science literacy as part of the process of science communication could be conceptualized in the same way in three dimensions: civic science literacy, digital media science literacy, and cognitive science literacy (6). This led our research team to focus on the problem of COVID-19 scientific literacy in nursing and medical students in the hospital environment by administering a brief survey.

RESULTS

The analyses presented here are based on the 30 questionnaires that were returned by the nursing and medical students. Sixteen females (53.3%), 13 males (43.3%), and one (3.3%) person who did not answer the question related to sex completed the survey. The youngest participant in the survey was 24 years old and the oldest was 35 years old, with a mean age (± standard deviation [SD]) of 28.06 (±2.29) years.

The overall Q1–9 score (i.e., with 1 point possible for each question) ranged from 3.0 to 6.5 points, the median was 4.5 points, and the most frequent overall score was 5.5 points. A detailed analysis of the COVID-19 scientific literacy survey answers to explore the cognitive science literacy dimension is shown in Fig. 1. Responses to 75% (3/4) of the COVID-19 technology and actions SMCQ (Q3, Q7, and Q8) and to 33% (1/3) of the COVID-19 disease-related SMCQ (Q6) were selected correctly by more than 75% of the students. In contrast, 25% (1/4) of responses for the COVID-19 technology and actions SMCQ (Q4) and 66% (2/
3) of COVID-19 disease-related SMCQ (Q1 and Q5) were selected correctly by less than 25% of the survey participants (Fig. 1A).

SMCQ Q5 explored the knowledge of the correct name for the pneumonia caused by SARS-CoV-2 virus (Q5.2 pneumonia secondary to COVID-19); only 23.33% of the participants selected Q5.2 as the correct answer, followed by 26.67% selecting Q5.1, 10% selecting Q5.3, and 40% selecting Q5.5 (Fig. 1A).

Answers for MMCQ Q2 (name of the coronavirus disease that appeared in 2019) were characterized by a similar uncertainty trend as that observed for SMCQ Q5, in which 78.80% of the participants selected the correct answer (Q2.2 COVID-19) but, additionally, ~50% selected Q2.1, Q2.3, Q2.4, and/or Q2.5. This was in contrast with MMCQ Q9 (COVID-19 vaccines composition, technology and action category), for which 93.33% of the participants selected Q9.4 (mRNA) as the correct answer and less than 20% selected Q9.1, Q9.2, and/or Q9.4 as the correct answer. Q9.4 (adenovirus with a coronavirus protein) was identified as a correct answer by only 16.67% of the students (Fig. 1B).

Based on the assessment of the participant’s answers to

<table>
<thead>
<tr>
<th>Topic (category)</th>
<th>Correct answer</th>
<th>Incorrect answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1. COVID-19 is an infectious disease caused by SARS-CoV-2 (Disease)</td>
<td>Q1.2 SARS-CoV-2 infection (807 articles)</td>
<td>Q1.1 COVID-19 infection (18,450 articles)</td>
</tr>
<tr>
<td>Q2. Abbreviated name of the coronavirus disease that appeared in 2019 (Disease)</td>
<td>Q2.2 COVID-19 (ICD10)</td>
<td>Q2.1 COVID</td>
</tr>
<tr>
<td>Q3. Diagnostic test results (Technology and actions)</td>
<td>Q3.2 SARS-CoV-2 positive/negative</td>
<td>Q3.1-COVID-19 positive/negative</td>
</tr>
<tr>
<td>Q4. Prevention of spread after COVID-19 confirmed diagnosis (Technology and actions)</td>
<td>Q4.1 Isolation</td>
<td>Q4.2 Quarantine</td>
</tr>
<tr>
<td>Q5. Pneumonia due to COVID-19 (ICD10) (Disease)</td>
<td>Q5.2 Pneumonia secondary to COVID-19 (ICD10)</td>
<td>Q5.1 COVID-19 pneumonia (5,557 articles)</td>
</tr>
<tr>
<td>Q6. SARS (Disease)</td>
<td>Q6.1 Severe acute respiratory syndrome (ICD10)</td>
<td>Q6.2 Systemic acute respiratory syndrome</td>
</tr>
<tr>
<td>Q7. Ventilator vs respirator (Technology and actions)</td>
<td>Q7.1 The patient is connected to the ventilator</td>
<td>Q7.2 The patient is connected to the respirator</td>
</tr>
<tr>
<td>Q8. SARS-CoV-2 mRNA vaccines (Technology and actions)</td>
<td>Q8.3 A fragment of the virus genetic material that produces a protein that allows the body to create immunity</td>
<td>Q8.1 A dead or weakened form of a virus that allows the body to create immunity</td>
</tr>
<tr>
<td>Q9. COVID-19 vaccines composition (Technology and actions)</td>
<td>Q9.3 mRNA</td>
<td>Q9.1 Microchip</td>
</tr>
<tr>
<td>Q9.4 Adenovirus with a coronavirus protein</td>
<td>Q9.2 Viral proteins</td>
<td></td>
</tr>
</tbody>
</table>

*MCQ Q1, Q2, Q5, and Q6 focused on concepts related to the disease, and MCQ Q3, Q4, Q7, Q8, and Q9 were related to technologies and actions. Article numbers, reported in parentheses, refer to the number of articles found in PubMed using the indicated term(s).
the SMCQ (Fig. 1C), the language used in the questionnaire was considered easy to understand (Q10.1, 96.70%), with an easy to medium level of complexity (Q11.1 and Q11.2, approximately 97%), and the perceived time required to complete was less than 5 min (Q12.1, 86.70%). Additionally, a neutral response was obtained for Q13 and Q14, for which only 56.70% and 53.30% answered that they would like to receive further training and learned something new.

The number of failed answers exploring the cognitive science literacy dimension in terms of disease concepts,
particularly virus name and disease name interchangeability, motivated us to expand our search to the digital media science literacy dimension. The PubMed search for “COVID-19 infection” and “SARS-CoV-2 infection” showed that from 2019 to 2022, 18,459 references used the phrase “COVID-19 infection” (incorrect term) when referring to the infection caused by SARS-CoV-2, compared to 807 references that used “SARS-CoV-2 infection” (correct term) in the same period of time. Additionally, we searched for influenza virus and varicella-zoster virus using similar quoted phrases from 2017 to 2022. The results for this search are shown in Fig. 2A; influenza virus phrases had the same trend as observed for SARS-CoV-2 from 2017 to 2020, and this trend changed from 2020 to 2022. Varicella-zoster virus do not show an interchangeable trend for names.

The same search strategy was used for the phrase “COVID-19 pneumonia” and “SARS-CoV-2 pneumonia”. A total of 5,557 searches used the term “COVID-19 pneumonia,” compared to 680 references that used “SARS-CoV-2 pneumonia” (Fig. 2B). The search for “influenza pneumonia”
and “varicella pneumonia” showed interchangeability of the virus names and the disease names. Figure 2C shows some examples of ICD10 codes for viral pneumonias; the code J12.82, pneumonia due to coronavirus disease 2019 was introduced during the pandemic. Interestingly, in none of the examples is the disease name interchanged with the virus name.

DISCUSSION

In recent years, it has been increasingly noted that epidemics and pandemics are accompanied by an infodemic, which requires new skill sets applied to public health to understand and address the overwhelming amount of information, including mis- and disinformation (4, 13), and the COVID-19 pandemic was not an exception (1, 5, 10, 14). Multiple science-based disciplines require a technology-driven background to develop a broader approach, with problem-solving, critical thinking, oral and written communication, and the ability to interpret data as four core components of scientific literacy (15).

The increase in the use of social media in clinical care highlights the need for awareness and its implications for the medical profession. Expectations in society about its medical practitioners include the ability to appropriately use scientific evidence, by applying credible and reliable sources of information (11, 16). During these times, where information is easily accessible and sources are from an unknown provenance, these elements are of immense importance. In our study, we explored the problem of COVID-19 literacy in two different dimensions of scientific literacy: cognitive science literacy, by administering a survey to a group of 30 nursing and medical students, and digital media science literacy, by performing a literature search in PubMed.

The mean overall Q1–9 score for participants was 4.63 ± 1.09 (SD) points. This result was influenced by a deficient answer to the question exploring concepts related to COVID-19 as a viral disease. In this context, it is worth mentioning the drastic and unprecedented change in the education system from traditional face-to-face education to digital remote learning acting as a catalyst for communication development (14, 17, 18) during the “quarantine time.” Consequently, the students probably were more exposed to digital content from diverse sources, which may have been used as a learning tool. In our study, we also conducted searches in PubMed, a digital media with more than 35 million citations and abstracts of biomedical literature (19) and one of the most widely accessible biomedical resources globally (20), and we found phrases that used interchangeably the disease name and the virus name.

This life experience joined to the confusion generated by the infodemic most probably generated the distortion in the response to Q4 (prevention of COVID-19 spread after confirmed diagnosis), for which Q4.2 (quarantine) was the selected answer by 76.67% of the participants. Our results showed that probably during this period the students also learned by their exposures to real-life situations, since most of the universities closed and sent the students back home during the quarantine (lockdowns).

In a study by Rodon et al., higher COVID-19 health literacy was associated with the adoption of effective protective behaviors (PBs). In contrast, people with low literacy would be more likely to adopt PBs if they believed that they may get COVID-19 due to the behavior and health conditions of others. This study showed the implications for the design of public health campaigns for people with inadequate health literacy (21).

The interchangeability of the virus name with the disease name, as found in the students, e.g., COVID-19 infection versus SARS CoV-2 infection, or COVID-19 pneumonia versus pneumonia due to COVID-19, also reflected deficiencies in terms of basic concepts. This problem was also influenced by the journalism language, as illustrated in Fig. 2A and B. Based on the literature search done in PubMed, the problem seems to have been present before the COVID-19 pandemic. Specialized languages should influence the lexis and syntax of the common language, leading to the “scientification of literature” of the other languages (14). The problem with lack of an appropriate pneumonia classification system (22) may also influence the knowledge deficiencies found in Q5 (Fig. 1A).

This study is a first approach of identifying knowledge in medical students and provides valuable insights into the need to reinforce training in critical appraisal of scientific literature during medical school. Its impact could increase awareness of the potential improvements to be made for easier understanding and use of the appropriate terminology.

In conclusion, our results show that efforts need to be made in continuous professional education to increase the knowledge in COVID-19 literacy in the health care environment in medical and nursing students. Larger studies are recommended to identify and to fulfill all the deficiencies that the unprecedented COVID-19 pandemic times brought to medical and nursing education.

SUPPLEMENTAL MATERIAL

Supplemental material is available online only.

SUPPLEMENTAL FILE 1. PDF file, 0.3 MB.

REFERENCES


