

## Attitudes and Views of Medical Students toward Science and Pseudoscience

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**Abstract: Objectives:** To know opinions, attitudes and interest of medical students toward science and pseudoscience.

**Design:** A questionnaire was administered to 124 medical students of the San Marcos University in Lima, Peru.

**Results:** 173 students were surveyed. The response rate was 72%. Eighty-three percent (100/121) of respondents said that science is the best source of knowledge, 67% (82/123) said they were interested in science and technology news, 76% said they had not read any science magazine or book (other than medical texts and journals) in the last five years. Thirteen percent (16/124) of respondents said that astrology is “very scientific” and 40% (50/124) stated that it is “sort of scientific.” 50% of respondents shared the opinion that some people possess psychic powers.

**Conclusions:** Medical students' attitudes toward science are generally not favorable.

**Keywords:** Attitudes, views, scientific knowledge, medical education, scientific literacy.

Science has enabled successive generations to achieve an increasingly comprehensive and reliable understanding of the human species and its environment. In line with this assertion, medicine soon has had to be guided by science. Ever since the Flexner Report, a key objective of medical education has been making medicine a scientific profession.<sup>1</sup>

Nevertheless, the fact that uncertainty is inherent in medical practice,<sup>2</sup> as well as, the existence of some procedural norms not based on the scientific method, reinforce the view of those who claim that medical practice is to be understood as both an art and a science. Therefore, the best way of defining medicine may be to consider it an applied science.<sup>3</sup>

If medicine is an applied science, it is desirable that physicians know and understand the theoretical foundations of science, so they may develop a critical and skeptical mentality. This mentality is characterized by a permanent willingness to apply scientific habits of mind in a wide range of social contexts.<sup>4</sup> Also it subsumes attitudes, views, cognitive abilities, and behaviors coherent with science.<sup>5-6</sup>

An examination of the major goals for science education reveals unanimity of opinion that the development of scientific literacy includes the development of positive attitudes toward science<sup>7</sup>. According to the National Science Education Standards<sup>5</sup> a scientifically literate person should distinguish and recognize expertise, dogma,

pseudoscience, epistemic limitations, the temporal nature of knowledge, effective argumentation and relationships among claims, evidence and warrants.

On the other hand, several studies remark that the public's interest and attitudes toward science are generally not favorable. For example, according to Pew Research Center surveys, only two percent of the most closely followed news stories of the past 15 years were about scientific breakthroughs, research, and space exploration.<sup>8</sup>

Pseudosciences are defined as “claims presented so that they appear (to be) scientific even though they lack supporting evidence and plausibility.”<sup>9</sup> In contrast, science is “a set of methods designed to describe and interpret observed and inferred phenomena, past or present, and aimed at building a testable body of knowledge open to rejection or confirmation. Pseudoscience topics include yogic flying, therapeutic touch, astrology, fire walking, voodoo magical thinking, Uri Geller, placebo, alternative medicine, channeling, Carlos hoax, psychic hotlines and detectives, near death experiences, UFOs, the Bermuda Triangle, homeopathy, faith healing, and reincarnation.”<sup>10</sup>

Pseudosciences receive favorable ratings by university students. For example, a survey of 1,500 first-year college students found that 48.5 percent of arts and 33.4 percent of science students considered both astronomy and astrology as sciences.<sup>11</sup> In one

poll of students in Columbia's graduate school of journalism, 57 percent of the student journalists believed in extrasensory perception, 57 percent believed in dousing and 47 percent in aura reading.<sup>12</sup>

Beliefs in the paranormal and pseudoscience may indicate a decline in scientific literacy and critical thinking,<sup>12-13</sup> their prevalence among university students has motivated some to affirm that education in industrialized countries is not fulfilling its mission appropriately.<sup>14</sup>

Unfortunately, perhaps because it is assumed that today's medicine and medical education are appropriately scientific, there are not studies assessing physicians' or medical students' attitudes toward science. However, the facts referred in the preceding paragraph, should invite us to reflect. This study intends to gain insight into medical students' opinions, attitudes and interest toward the scientific endeavor.

## Methods

The study population included all sixth-year medical students of the San Marcos University in Lima, Peru. We chose sixth-year students because

they have completed almost all of their basic and clinical science courses. The basic medical degree in Peru is *medico-cirujano* and is equivalent to the American MD degree. The duration of the major is of six years followed by one year of compulsory rotating internship. The listing of students was provided by the Register Office of the Medical School.

This study was approved by the Research Unit of San Marcos University (Of. N° 354-UDI-FM-02) and by the Direction Office of San Marcos Medical School (Of. N° 592-EAPMH-FM-02).

From October to November 2002, each medical student who had agreed to participate was personally given a two-page questionnaire with twenty-two items. The participants were previously informed about the nature of the study, as well as of their voluntary and confidential participation. The questionnaire was administered in the classroom under our supervision to prevent students from interacting with each other and thus introducing bias into the study. Average completion took about 30 minutes.

The questionnaire, which was previously validated by one pilot survey, included five multiple-choice

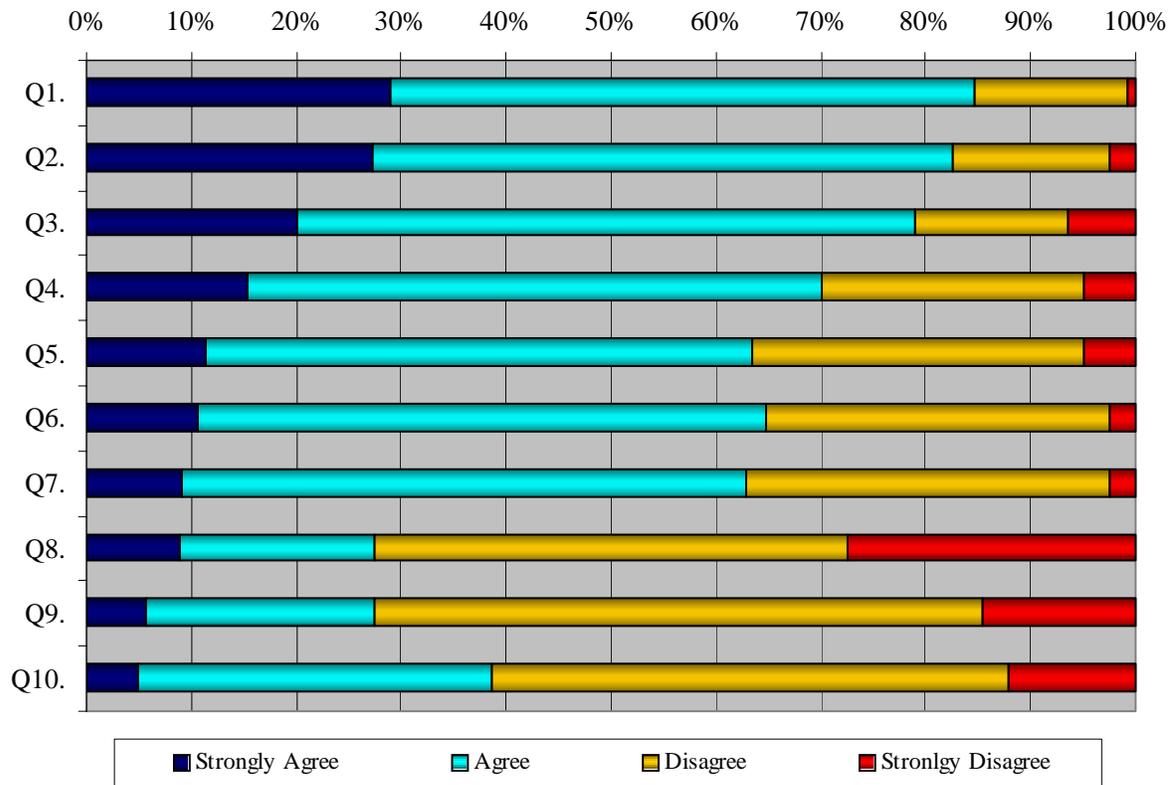
**Table 1**  
**Science books, magazines and authors cited by respondents\***

<b>Science Magazines:</b>	
Science	8
Investigación y Ciencia	5
Nature	4
National Geographic	3
Scientific American	3
Mundo Científico	3
Other	4
<b>Science Books:</b>	
A Brief History of Time	4
La Ciencia, su Método y su Filosofía	3
The Edge of Infinity	2
Others	4
<b>Science Authors :</b>	
Stephen Hawking	7
Mario Bunge	6
Carl Sagan	4
Paul Davies	3
Others	2

\*Note:

1. Eighty-eight percent (103/117) of respondents declined knowing any author of science books (best sellers science books), only 7 respondents provided at least one authors' name.
2. Since the open-ended format allowed subjects to offer more than one response for each question, the sum of responses exceeds 100%.

**Figure 1**  
**Attitudes and views of medical students toward science**



**Items are listed in order of agreement based on average ratings of medical students who responded the questionnaire.**

1. Medical practice is an art, the art of therapeutics and the diagnosis
2. Science is the best source of knowledge about nature and world
3. The purpose of science is knowing, but only what is useful and practical
4. Most scientists serve to political and economic power
5. Science makes our life more stressful and less reflexive
6. Same scientific evidence can be interpreted to fit opposing views
7. We depend too much on science and not enough on faith
8. The purpose of science is to acquire knowledge for the sake of knowledge, although what is being studied does not have immediate usefulness
9. Scientists are almost always cold people desensitized toward nature and art; they reduce everything to calculus and equations
10. Scientific research is almost always affected by the values held by the researcher

items, two structured YES/NO open-ended question; and fifteen statements each scored on a four-point Likert-type scale with items ranging from "strongly agree" to "strongly disagree" with no neutral option. All these items were designed to collect medical students' opinions, attitudes and beliefs about science and pseudoscience. The questionnaire also requested

certain sociodemographic information about respondents.

Of the 173 medical students, 124 completed the questionnaires, a response rate of 72%. For illustrative reasons, the proportions of the categorical variables were reported excluding blank answers,

**Table 2**  
**Level of respondents' interest toward science and technology news\***

Very interested	29	(23%)
Interested	82	(67%)
Not interested	12	(10%)
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Sample size	123	(100%)

\*Note. Responses are to the statement: "There are a variety of news in the media. Could you tell how interested you are in science and technology news?"

when those represented less than 5%. In the open-ended questions 16 categories were obtained.

All data were stored electronically in a MS Excel 9.0 spreadsheet. Data processing was a manual, tally-based process, as the intended results were primarily frequencies.

## Results

**Respondents' Characteristics** - Respondents were predominantly males (68%). Age mean was 24,9 years (standard deviation  $\pm$  2.2). Ninety-eight percent of respondents were regular students. Regular students are those who register in the academic period they were expected to considering the year they started their major.

**Interest, Attitudes and Views toward Science** - Seventy-six percent (91/120) of respondents said they had not read any science magazine or book (other than medical texts or journals) in the last five years. Only 16 respondents provided names of science magazines or books that they had read. The results of other items are shown in Tables 1-3, and Figure 1.

**Interest, Attitudes and Views toward Pseudoscience** - Thirteen percent (16/124) of

respondents said that astrology is "very scientific", 40% (50/124) answered it is "sort of scientific", 40% (49/124) that it is not scientific, and 7% said they did not know. Five percent of respondents said that homeopathy is "very scientific", 53% (64/121) answered it is "sort of scientific", 22% (27/121) that it is not scientific, and 20% (24/121) said they did not know. Sixty-one percent (75/123) of respondents reported having almost never read an astrology report (horoscope), 29% (36/123) report having read it only occasionally, 9% "quite often", and only 1% reported they do it every day. The results of other items are shown in Figure 2.

## Discussion

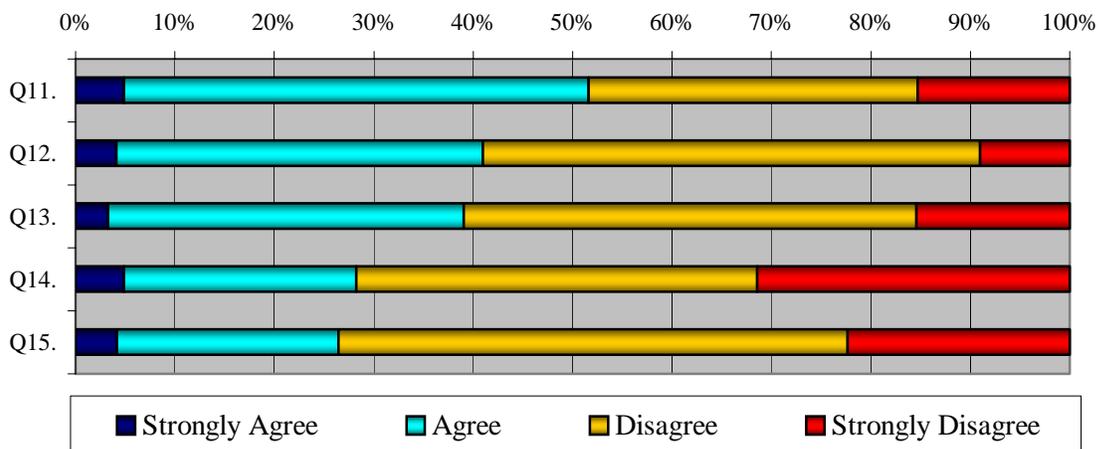
Students express a high level of interest in science news; however, very few of them report reading science magazines or books (other than medical ones.) According to famous editor Malcom Longair:<sup>15</sup> "One of the more encouraging developments in the last decade has been the publication of a number of books by eminent scientists in which they attempt to communicate the essence and excitement of their science to the lay reader. Some of the more striking examples [...] [is] the extraordinary success of Stephen Hawking's A Brief History of Time [1988.]"

**Table 3**  
**Attitudes and Views toward Science\***

Benefits from scientific research have outweighed its harmful results	60	(48%)
Benefits from scientific research equal its harmful outcomes	57	(46%)
Scientific research has produced only benefits	5	(4%)
Scientific research has produced only harmful results	2	(2%)
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Sample size	124	(100%)

\*Note. Responses are to the statement: "People have frequently noted that scientific research has produced both beneficial and harmful consequences. You would say that, on balance, scientific research has produced:

**Figure 2**  
**Attitudes and views of medical students toward pseudoscience**



**Items are listed in order of agreement based on average ratings of medical students who responded the questionnaire.**

11. Some people possess psychic powers or extrasensory perception.
12. Paranormal studies, as extrasensory perception, aura reading, and telekinesis, have scientific grounds.
13. Parapsychology is a science.
14. Some numbers are especially lucky to some people.
15. Some personality characteristics are related to the month in which a person is born.

Science books (best-seller science books) are good tools to make laymen know and understand scientific areas that are beyond the scope of their specialty. The discrepancy between the sizeable interest and the scant reading do not seem to make any harm, as it may be desirable a special dedication toward medical courses on the part of physicians; however, it would be too bad for students to be focused only on science related to medicine without embracing science in general.

Students show favorable attitudes toward science, as most respondents claim to rely on science as the best source of knowledge. Other studies have revealed similar favorable attitudes among the public.<sup>8,12</sup> Nevertheless, a sizeable portion of students have some reservations concerning science and technology—more than half of respondents think that science has made our lives more stressful, and most believe that most scientists serve political power. This is a rather questioning attitude, and in some regards, this is preferable to simply taking a naïve, “science-is-all” stand, and may reflect a mature and healthy mentality.

But some may object just for the sake of assuming a sophisticated pose without carefully considering the grounds upon which their opinions are based. Determining which was the case or whether the grounds of their opinions are valid or not, is beyond the scope of this study.

Opinions about some theoretical foundations of science show probable incoherence. Regarding the purpose of science, 70% of respondents thought science involves acquiring knowledge about, or making research on, what is useful only, and almost four fifths of them do not think the purpose of the science involves the acquisition of knowledge for the sake of knowledge. This can show a biased view about science's objectives. It is true that some sciences are interested only in what is of immediate usefulness, as pharmacology and clinical investigation. But the core of science involves knowing for the sake of knowledge. Science originated from the interest for knowledge. Just remember Galileo, Newton and Hawking.

Almost three fifths of respondents said that the same scientific evidence can be interpreted to fit opposing views, and two fifths of them said that scientific research is almost always affected by the researcher's values. It is possible that these students' opinions may be related to some physicians' relativistic and subjectivist epistemological attitude, shown in a previous study conducted by us.<sup>16</sup> It is possible too, that students assume the so-called postmodernist view, that philosophy argues against universal belief: "To the postmodern eye truth is not out there waiting to be revealed but is something which is constructed by people."<sup>17</sup> However, according to philosopher Mario Bunge, the postmodern position is unsustainable and incoherent with science: "If postmodernism were valid, objective facts would not be possible, everything would be subjective, everyone and every group would have its own [valid] world, everything would be relative, nothing would do any difference, and anything would be valid."<sup>18</sup>

Concerns have been raised, especially in the science community, about widespread belief in pseudoscientific phenomena. Studies report that 40% to 60% of surveyed individuals believe astrology is "very scientific" or "sort of scientific", and between one third and one half of interviewees believe in extrasensory perception and other pseudoscientific matters.<sup>8,11-12</sup> In this regard, our results are similar. Therefore, medical students' opinions toward pseudoscience seem to be favorable.

The word "pseudo" means fake. The surest way to spot a fake is to know as much as possible about the real thing in this case, about science itself. Knowing science does not mean simply knowing scientific facts. It means understanding the nature of science, i.e., the criteria of evidence, the design of meaningful experiments, the weighing of possibilities, the establishment of theories, and the many aspects of scientific methods that make it possible to draw reliable conclusions about the physical universe. Because the media bombard us with nonsense, it is useful to consider the earmarks of pseudoscience. Believing that pseudosciences are scientific may express ignorance about the underlying philosophy and methodology of science and, according to many authors, a noxious ignorance to understand the science's outlook.<sup>4,6,13-14,17</sup> No matter how attractive pseudoscientific topics and how effective their results may be (recent meta-analysis seems to show higher effectiveness of some homeopathic treatments against placebo<sup>19</sup>). It should be remarked that the underlying methodology, logic and epistemology of pseudoscience do not belong to science.

Medical students seem to agree with the assertion that medical practice is an art. We think that students' beliefs about the nature of medicine are very important and should be inquired. If medical students consider medical practice as an art, how does this belief influence their medical practice? Would they regard it in a more relativistic, empiric, and independent manner? Would they rely more on his personal experience at the moment of deciding on a clinical case?

An examination of the major goals for science education reveals a unanimity of opinion that the development of scientific literacy includes the development of positive attitudes toward science.<sup>7</sup> This small study may suggest that some medical students' attitudes and views are not positive toward science. It could be understood as a sophisticated view on the part of students; nevertheless, it could also be recognized as an unfavorable signal of students' perception of the scientific endeavor. The manner in which students' positive attitude toward science is related to higher medical performance, and how critical a component it is of medical instruction, is something that deserves more research.

Finally, we believe that our results may be somewhat idiosyncratic. However, San Marcos University is one of the most prestigious universities of Peru, it is the oldest university of America, and its student population may be similar to that of other universities. Furthermore, the questionnaire used in this study may produce some bias, as some questions are not very specific. In addition, our analysis can be interpreted as positivist, as contrasted with the relativistic and postmodern views. Finally, the selection of the cluster to be inspected, i.e. the School of Medicine of San Marcos University, was not selected on a random basis, but rather based on the accessibility to the researchers, the other potentially eligible clusters being the Medical Schools of the remaining universities in Lima, which total six.

In conclusion, medical students' attitudes seem not to be evenly positive toward science. Although most students trust it, many consider that pseudosciences have scientific grounds. In addition, students' opinions toward some theoretical aspects of science do not seem to be very coherent to it. If that corresponds or not to a mistaken and unfavorable view toward the scientific endeavor is subject to further debate and evidence.

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