

Survival and risk perceptions of healthcare professionals and patients

Carina Ferreira¹, Teresa Abreu¹, Ricardo Gonçalves¹, José M. Pereira², Mário Basto¹

¹EST, Polytechnic Institute of Cávado and Ave

Vila Frescainha S. Martinho, Campus do IPCA, Barcelos, Portugal

²CICF - Research Center on Accounting and Taxation, IPCA

Vila Frescainha S. Martinho, Campus do IPCA, Barcelos, Portugal

E-mail: mbasto@ipca.pt

Abstract

In order to make an informed, evidence-based decision, it is vital to recognize numbers, statistics and concepts that are apparently transparent but are not always adequately accounted for. Health professionals, patients, and others frequently misinterpret numbers, statistics and concepts in healthcare. Among the many repercussions of health literacy, appropriate decision-making and the reduction in the number of interventions and treatments stand out, resulting in an improvement in people's health and a decrease in overtreatment and health expenses. This study intends to evaluate how properly health professionals and the public, in general, comprehend and interpret some health-related numbers. To accomplish this goal, the researchers shared a questionnaire made available online in Portugal from January 2, 2019, until April 12, 2019. The final sample comprised 485 respondents; 154 physicians, 142 nurses, and 189 people from other professions. The findings suggest that there is a problem with widespread numerical illiteracy, which should not be the case, highlighting the need to improve the numerical and statistical health literacy of both health professionals and the general population. So, medical professionals and patients must thus comprehend the statistics and health-related concepts to obtain the proper consent.

Keywords: statistical literacy; survival rate; mortality rate; risk; decision-making

Article History

Received: August 11, 2022

Accepted: November 25, 2022

Cite this as: Ferreira, C., Abreu, T., Gonçalves, R., Pereira, J. M., & Basto, M. (2023). Survival and risk perceptions of healthcare professionals and patients. *Indonesian Journal of Social Sciences*, 15(1), 1–7. <https://doi.org/10.20473/ijss.v15i1.38236>

Introduction

Statistics and mathematics have become a part of everyday life in a world dominated by information. They support marketing materials and statements by lending credibility to them. A great deal of misinformation is given to physicians, nurses, and patients about health procedures' risks and benefits. It is common for health professionals and patients to misinterpret numbers and statistics (Ferreira, Abreu, & Basto, 2020, 2022; Gigerenzer, Gaissmaier, Kurz-Milcke, Schwartz, & Woloshin, 2007; Malhotra, 2018; Reyna & Brainerd, 2007; Sarfati, Howden-Chapman, Woodward, & Salmund, 1998; Schwartz, Woloshin, & Welch, 2005; Wegwarth, Schwartz, Woloshin, Gaissmaier, & Gigerenzer, 2012). Incorrect understanding of numbers affects nearly the whole population, including journalists, politicians, attorneys, journalists, physicians, nurses and others (Gigerenzer et al., 2007). Data transmitted by pamphlets, websites, and even medical journals frequently does not present information in a transparent manner, claiming great benefits and little damage (Sedrakyan & Shih, 2007), and is frequently the product of health system conflicts of interest (Gigerenzer et al., 2007). This issue will not only affect the medical judgment and informed consent between physician and patient, but it will also have a significant impact on the health of patients and the costs of the healthcare system.

Only when the physician and patient are fully informed of the risks and benefits can informed consent be given. For this reason, it is important to interpret health numbers correctly (Aggarwal, 2018). Physicians and patients must also consider the strength and quality of data from conducted



DOI 10.20473/ijss.v15i1.38236

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and published studies, the presence of conflicts of interest, and all medical knowledge regarding pathophysiology and treatments when drawing conclusions and decision-making. Patients' trust in healthcare personnel's expertise typically supports these issues. The incorrect interpretation of health information frequently results from a lack of basic statistical and numerical knowledge. However, it also results from the emotional nature of the doctor-patient relationship (doctor-patient relationship based on paternalism, on the trust of patients in health professionals who represent knowledge and the illusion of certainty) and the existence of conflicts of interest within the healthcare system (Gigerenzer et al., 2007). In this way, a significant portion of the information a patient relies on and receives comes from health professionals.

Consequently, the inability of these professionals to comprehend the information assumes greater significance, as they may inadvertently transmit inaccurate information to patients. Nevertheless, in order to make literate judgments, patients must also comprehend health concepts and statistics, as trusting others may not be enough (Gigerenzer et al., 2007). Every treatment carries risks, which must be appropriately weighed against its benefits.

Gigerenzer et al. (2007) also describe several common misconceptions that prevent patients from giving informed consent, such as the illusion of infallibility of tests or treatments, the overestimation of the benefits of screening while the harms are usually unknown, the confusion of early detection with the prevention, and the lack of understanding of basic health statistics. Even highly educated individuals exhibit health illiteracy, demonstrating trouble with very simple math queries (Lipkus, Samsa, & Rimer, 2001; Schwartz, Woloshin, Black, & Welch, 1997; Schwartz et al., 2005). It is essential that patients and healthcare workers have a thorough understanding of what health figures actually indicate in order to respond appropriately to health questions. Mortality and survival rates are widely used healthcare notions that are commonly misunderstood.

The mortality rate, which takes into account both healthy and ill people, is the ratio between the number of deaths related to a certain illness over a specific time period and the entire population over the same period. The mortality rate indicates how many people a disease kills in a given population. In addition, there is a survival rate. The most common measure of cancer survival is five-year survival; however, five years are not especially meaningful. Any time can be used. The five-year survival rate is computed by dividing the number of cancer patients living five years after their first diagnosis by the total number of cancer patients diagnosed. That is in contrast to the survival rate associated with an intervention or an acute disease, when the endpoint, cure or death, occurs in a rather short period of time. Since cancer is a chronic disease, using a temporal frame to track a patient's recovery makes the measurement inaccurate because it makes the measure highly dependent on the moment of diagnosis. The apparent increase in survival time with an early cancer diagnosis through screening procedures can be attributed to the fact that earlier diagnosis coincides with an erroneously extended survival period (leading time bias).

Moreover, the inclusion of non-progressive tumors or false positives (overdiagnosis bias) falsely inflates the survival rate (Folkman & Kalluri, 2004; Mooi & Peeper, 2006; Serrano, 2007). For many people, the expression "survival rate" incorrectly relates only to the probability of survival. The cancer survival rate is an unclear metric that should be replaced by the mortality rate (Gigerenzer et al., 2007; Wegwarth, Gaissmaier, & Gigerenzer, 2011; Wegwarth et al., 2012).

One of the purposes of this study is to evaluate, using three questions, whether healthcare professionals and the general population comprehend and interpret the term "survival" when used in two different settings. In addition, three additional questions were asked to assess the perception of the respondents regarding situations that, despite being overly evident, are frequently overlooked. More specifically, to determine whether the participants understand and assign the necessary relevance to the fact that the likelihood of death from all causes is larger than that from a single cause and that the risk of death for a given time period is greater than the risk of death for a shorter time period. Despite the fact that these ideas seem self-evident, misunderstandings in the minds of medical professionals and patients can arise and may even be brought on by the expanding specialization in the area of medicine, where participants seem to have lost sight of the broader picture.

Methods

From January 2, 2019, until April 12, 2019, a quantitative questionnaire was developed and made available online in Portugal. The subject matter was health statistical literacy. Each participant's anonymity was assured, and the single required question evaluated the participant's professional condition. No monetary remuneration or other incentive was offered to respondents in exchange for their participation in the study. It was based on questions posed by Gigerenzer, Krauss, & Vitouch (2004), Gigerenzer et al. (2007), Sarfati et al. (1998), and Schwartz et al. (2005). The majority of the questions were copies of those already posed and validated in the preceding investigations. The questionnaire was then put to a preliminary test. The observed minor shortcomings were incorporated into the final questionnaire. As this was an exploratory study, the minimum sample size was not previously determined. Six questions were evaluated in this study (Table 1).

Table 1.
The six questions asked

No.	Questions	Answers
1	Mr. Miguel needs surgery knowing that 9 out of 1000 people die in this surgery. How would you describe the surgery?	a) Too risky b) Risky c) Slightly risky d) Not risky
2	Mrs. Julia needs a surgery in which 991 out of 1000 survive it. How would you describe the surgery?	a) Too risky b) Risky c) Slightly risky d) Not risky
3	Suppose the survival rate for prostate cancer is 95% in country A and 55% in country B. A friend of yours is diagnosed with prostate cancer. What recommendation would you give him?	a) Go to country A for treatment b) Go to country B for treatment c) The information is incomplete so that I can give my opinion
4	What is your best guess about your risk of dying from a heart attack in the next 3 years?	a) 1 in 1000 b) 5 in 1000 c) 30 in 1000 d) 80 in 1000 e) 250 in 1000 f) 600 in 1000
5	What is your best guess about your risk of dying from any cause in the next 3 years?	a) 1 in 1000 b) 5 in 1000 c) 30 in 1000 d) 80 in 1000 e) 250 in 1000 f) 600 in 1000
6	What is your best guess about your risk of dying from any cause in the next 10 years?	a) 1 in 1000 b) 5 in 1000 c) 30 in 1000 d) 80 in 1000 e) 250 in 1000 f) 600 in 1000

The first two questions are designed to determine whether health professionals (physicians and nurses) and the general population are aware that the chances of dying 9 times out of 1000 are the same as those of surviving 991 times out of 1000. The likelihood of surviving a given medical intervention is the survival rate for that intervention. That differs from the survival rate for a chronic disease with a reference time period. In this scenario, a person's chances of dying and surviving are added together to yield one.

The third question involves a less intuitive understanding of the survival rate and seeks to assess whether health professionals (physicians and nurses) and the general population comprehend what the survival rate for particular cancer exactly means and its limitations. The cancer survival rate often refers to a period of five years after diagnosis and is the most frequently cited figure about cancer survival.

The purpose of questions four and five is to evaluate if respondents estimate the risk of death from all causes to be higher than the risk of death from a particular cause. In addition, questions five and six are used to determine if respondents believe the risk of death over a ten-year period is larger than the risk of death over a three-year period.

The final sample was made up of 485 individuals, comprising 154 physicians, 142 nurses, and 189 people from other professions. Tableau Desktop (Tableau, 2019) was employed to construct the four bar graphs illustrated in Figures 1 through 4.

Results and Discussion

Since the information presented is the same for the first two questions, one asking about the likelihood of dying and the other asking about the likelihood of surviving, the answers should be identical. The results revealed that the vast majority realized that the risks are identical, with physicians having the highest rate of right responses (87.0%), followed by nurses (71.8%), and the general population (70.9%) (Figure 1). The percentage of accurate responses is highest among physicians, followed by nurses and the general population, who do not differ much from one another. In nurses and the general population who failed to answer properly, the risk was perceived as greater when information was provided as the probability of death as opposed to survival. The opposite occurred with physicians.

The observed differences in replies between physicians, nurses, and the general public were statistically significant regardless of whether or not non-responses were considered $\chi^2 (6) = 19.715, p = 0.003; \chi^2 (4) = 19.635, p = 0.001$.

Answers	Profession			Grand Total
	Physician	Nurse	Other	
Same risk	87.0%	71.8%	70.9%	76.3%
Probability of death more risky	3.9%	14.8%	18.0%	12.6%
Probability of survival more risky	5.8%	10.6%	8.5%	8.2%
Did not reply to the two questions	3.2%	2.8%	2.6%	2.9%

Figure 1.

Bar chart of the distribution of combined answers to the first and second questions by profession (correct answers are highlighted in darker bars)

The third question addresses the proper interpretation of the survival rate for particular cancer. The cancer survival rate typically refers to a period of five years after diagnosis and is the most frequently cited figure about cancer survival. The timing of the diagnosis strongly influences this measure. One of the tools that most distort the meaning and interpretation of survival rate is widespread screening. Cancer screening facilitates early diagnosis, i.e., more cancers are identified early, but also overdiagnoses tumors that would not have behaved as such if screening had not been performed or whose growth would have been so sluggish that the individual would have died from some other cause prior to being killed by cancer. Screening artificially increases the survival rate, favoring those who undergo it.

Therefore, the appropriate response to the posed question is that the information is incomplete. Very little is known about the countries mentioned, as well as their implementation of screening processes. The disparity may stem from the fact that, unlike country A, country B may not have broad screening programs, which would explain the high survival rate in country A. In other words, there is no information about screening in either country A or country B. Importantly,

nothing is known about the mortality rates in each country. As demonstrated with real-world examples by Gigerenzer et al. (2007), caution must be taken while interpreting these values so as not to draw erroneous conclusions.

With 65.6% of replies choosing the correct option, physicians outperform other groups, including nurses (50.7%) and the general public (36.0%) (statistically significant differences between the two major alternatives ($\chi^2 (2) = 28.426, p < 0.001$). These findings indicate that the majority of health professionals have a reasonable knowledge of what the survival rate indicates. The general population seems to be more easily misled by the biases inherent in the way the survival rate is defined (Figure 2).

Answers	Profession			Grand Total
	Physician	Nurse	Other	
Go to country A for treatment	31.2%	47.2%	58.2%	46.4%
Go to country B for treatment	0.6%	2.6%	1.2%	1.2%
The information is incomplete	65.6%	50.7%	36.0%	49.7%
Did not reply	2.6%	2.1%	3.2%	2.7%

Figure 2.

Bar chart of the distribution to the third question by profession (correct answers are highlighted in darker bars)

In order to determine if people realize that the risk of death from all causes is greater than the likelihood of dying from a specific cause, questions four and five were used.

The distinction between the two questions can be found in the text. The first relates to the risk of death from a specific cause, in this case, a heart attack, while the second refers to the chance of death from any cause during the same time period (three years). Correct responses should indicate that the chance of dying from any cause is greater than the risk of dying from a heart attack over the course of three years.

There were no substantial differences between the responses of health professionals and the general population (Figure 3), with 36.4% of physicians, 33.1% of nurses, and 36.5% of the general population correctly assessing the risks, and despite suggesting equal risks, 2.6% of physicians and 1.4% of nurses did it in the option with the maximum value (risk of 600 in 1000). Notably, the success rates of physicians, nurses, and the general population were nearly identical. Risk assessment was viewed as the same by 46.1% of physicians, 45.8% of nurses, and 41.8% of the general population. There were no statistically significant differences between the correct and incorrect answers among physicians, nurses, and the general population ($\chi^2 (2) = 0.769, p = 0.681$).

Answers	Profession			Grand Total
	Physician	Nurse	Other	
Risk from heart attack greater than risk from any cause	10.4%	16.2%	17.5%	14.8%
Risk from any cause greater than risk from heart attack	36.4%	33.1%	36.5%	35.5%
Equal risks	46.1%	45.8%	41.8%	44.3%
Equal risks but the highest risk value was given (600 in 1000)	2.6%	1.4%	1.2%	1.2%
Did not reply to the two questions	4.5%	3.5%	4.2%	4.1%

Figure 3.

Bar chart of the distribution of combined answers to the fourth and fifth questions by profession (correct answers are highlighted in darker bars)

In addition, questions five and six were used to determine if respondents believe the risk of death over a ten-year period is larger than the risk of death over a three-year period. The wording clearly distinguishes between the two questions, as it did with the previous case.

One relates to the chance of death over the next three years, while the other relates to the risk of death over the next ten-years. Correct responses should reflect a greater likelihood of mortality in the next ten years than in the next three years. Figure 4 shows the outcomes.

Answers	Profession				Grand Total
	Physician	Nurse	Other		
Risk at 3 years exceeds risk at 10 years	4.5%	3.5%	2.6%	3.5%	
Risk at 10 years exceeds risk at 3 years	61.7%	49.3%	56.1%	55.9%	
Equal risks	27.9%	40.1%	34.4%	34.0%	
Equal risks but the highest value was given (600 in 1000)	1.3%	2.8%	2.6%	2.3%	
Did not reply to the two questions	4.5%	4.2%	4.2%	4.3%	

Figure 4.

Bar chart of the distribution of combined answers to the fifth and sixth questions by profession (correct answers are highlighted in darker bars)

In this case, the hit rate was significantly higher, with 61.7% of physicians, 49.3% of nurses, and 56.1% of the general public correctly estimating the risks, and with 1.3 % of physicians, 2.8 % of nurses, and 2.6 % of the general population pointing out identical risks in the option with the highest value (risk of 600 in 1000). It should be observed that, as in the previous case, the nurses' accuracy rate was lower than the general population, which is surprising. The risk assessment was deemed equal by 27.9% of physicians, 40.1% of nurses, and 34.4% of the general population. There were no statistically significant differences between the correct and incorrect answers among physicians, nurses, and the general population ($\chi^2(2) = 4.008, p = 0.135$).

Conclusion

The likelihood of surviving a particular acute disease or medical intervention must not be confused with the survival rate of a chronic condition such as cancer. While the first concept is simple and straightforward to interpret, the survival rate is deceptive since it assumes a predefined time frame and thus depends on the moment when the disease is diagnosed, which may be more or less time after its onset. Therefore, the mortality rate should be used instead of the survival rate. The purpose of the first two questions was to determine whether health professionals and the general public are aware that the chances of dying 9 times out of 1000 are identical to the chances of surviving 991 times out of 1000. That is not the same as the survival rate for a chronic condition within a time frame. The third question analyzes whether or not healthcare providers and the general public have a clear understanding of what cancer's survival rate actually signifies and its limitations. Physicians are the ones who appear to comprehend these concepts the best, yet their literacy levels are generally not good.

Concerning the risk of death from all causes is greater than the risk of death from a specific cause and the risk of death over a given period being greater than the risk of death over a shorter time period, the answers were disappointing and health professionals do not appear to understand these concepts better, possibly as a result of the advertising to which they are exposed and the excessive compartmentalization of modern medicine.

These findings cannot be applied to the whole population (the sample was not random), but they serve as a red signal for long-recognized concerns that do not seem to have been adequately addressed or remedied. The dissemination and strengthening of numerical and statistical education must be spread to all persons, especially to health professionals, so that medical treatments may be deliberately and rationally chosen. To obtain proper informed consent, medical personnel and patients must acknowledge and understand the numbers and concepts related to health.

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