Infographics in Health risk communication: the contribution of design in guiding citizens during pandemic situations

A infografia na comunicação de risco em Saúde: o contributo do design na orientação dos cidadãos em situações pandémicas

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infographics, risk communication, infographic design, Health, covid-19 pandemic

This article, which is part of the research project "Health Risk Communication: Design and Digital Communication of Official Public Health Sources to Guide Citizens in Pandemic Situations" (HERIC 2D), investigates the contribution of infographics to more effective and comprehensible health risk communication. The preliminary analysis of the websites of health institutions revealed that an excess of text-based information can compromise accessibility and reader comprehension, leading to the hypothesis that infographics may serve as a complementary solution to text. The results confirmed that infographics enhance readers' efficiency and satisfaction in understanding information. The high satisfaction of participants, measured by the System Usability Scale (SUS), validated the infographic design guidelines based on established principles from the literature review and the tests conducted in this study. It is concluded that the implementation of infographics in official communications can improve accessibility during public health crises. It is also suggested that future studies apply these guidelines in different contexts and populations to reinforce their applicability.

infografia, comunicação de risco, design infográfico, Saúde, pandemia covid-19

*Este artigo, inserido no projeto de investigação "*Health Risk Communication: Design and Digital Communication of Official Public Health Sources to Guide Citizens in Pandemic Situations*" (HERIC 2D), investiga a contribuição da infografia para uma comunicação de risco em Saúde mais eficaz e compreensível. A análise preliminar dos websites de instituições de Saúde revelou que o excesso de informação em texto pode comprometer a acessibilidade e compreensão do leitor, levantando-se a hipótese da infografia ser uma solução complementar ao texto. Os resultados confirmaram que a infografia aumenta a eficiência e a satisfação do leitor na compreensão de informações. A alta satisfação dos participantes, medida pela* System Usability Scale *(SUS), validou as diretrizes de design infográfico, fundamentadas em princípios consolidados da revisão de literatura e nos testes realizados neste estudo. Conclui-se que a implementação de infografias nas comunicações oficiais pode melhorar a acessibilidade durante crises de Saúde pública. Sugere-se igualmente que estudos futuros apliquem essas diretrizes em diferentes contextos e públicos para reforçar a sua aplicabilidade.*

1 Introduction

This article, conducted within the framework of the research project "*Health Risk Communication: Design and Digital Communication of Official Public Health Sources to Guide Citizens in Pandemic Situations*" (HERIC 2D), funded by the Foundation for Science and Technology (FCT), investigates the contribution of infographics to more effective health risk communication. The necessity for this research arose from an issue identified in a preliminary analysis of the websites of the main public health institutions in Portugal – namely, the Directorate-General of Health (DGS) and the National Health Service (SNS), including SNS 24 – which revealed an excessive use of text during the Covid-19 pandemic (Figure 1). This overload compromised the clarity and accessibility of information, hindering citizen guidance.

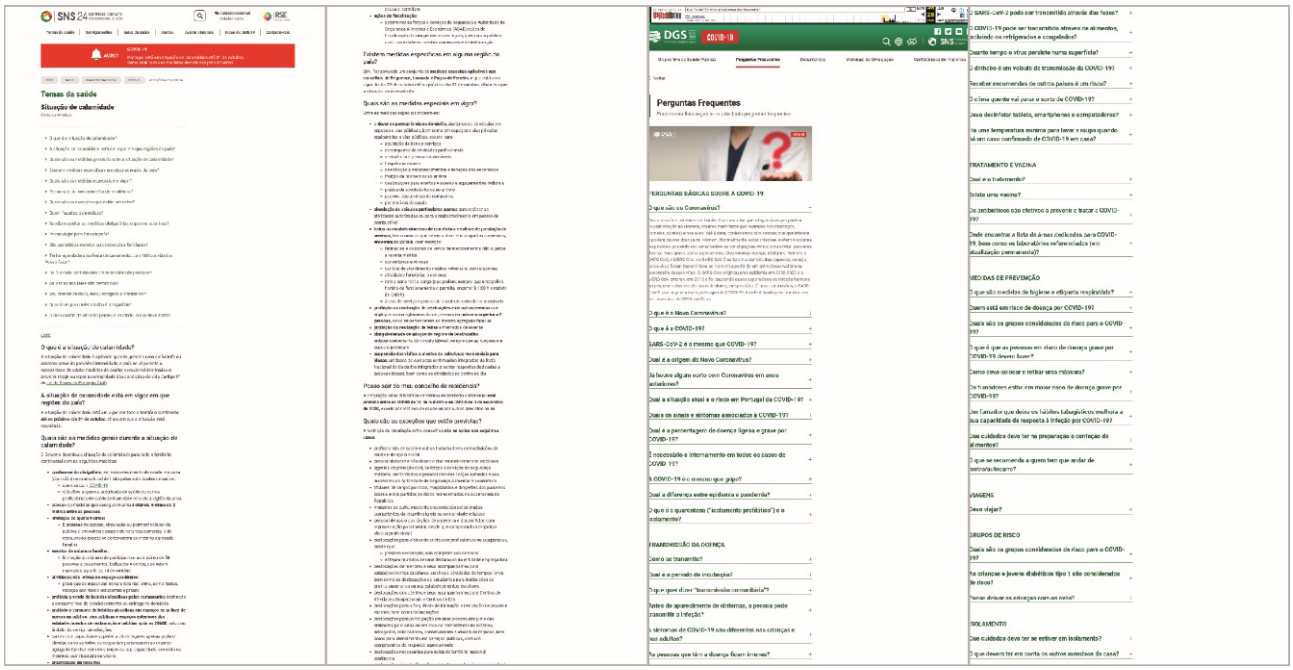

Figure 1 Excessive text usage on the websites of DGS and SNS 24.

To prevent future public health crises, this study suggests a set of infographic design guidelines aimed at enhancing communication between health institutions and citizens during these critical periods. To achieve this objective, the investigation will provide a literature review to determine the importance of graphic elements in risk communication, identify the benefits of infographics, and establish principles for creating high-quality infographics. Additionally, a prototype infographic was developed and validated through usability testing to ensure the effectiveness of the proposed guidelines. Finally, comparative tests were conducted between the two formats to demonstrate that infographics facilitate more effective communication compared to text alone.

2 Literature review

Health risk communication is crucial during pandemics, as the public's perception of the severity of a disease is directly associated with the adoption of protective behaviors (Webster et al., 2020).

Health promotion can, therefore, contribute in various ways to address the health crisis caused by COVID-19, particularly in its social impact and in managing both aspects. It is also necessary that this health promotion considers factors related to the health literacy levels of the affected populations, as is the case in Portugal, where certain vulnerable groups require targeted communication (Espanha & Garcia, 2023; Espanha, 2020).

Effective communication can help reduce fear and uncertainty, promoting essential behavior changes during crises (Finset et al., 2020). For this, the message must be accessible to all, including individuals with low visual literacy, who face challenges when interpreting complex visual content (Houts et al., 2006).

Graphic elements have proven to be an effective strategy in the field of Health, as they play a fundamental role in improving the comprehension and retention of information, especially for individuals with difficulties in visual literacy (Houts et al., 2006; Mayer, 2009). Studies reveal that an overload of text hinders the ability to understand content (Houts et al., 2006; Mayer, 2009; Lagassé, 2011), while the combination of text and images significantly improves memory and information comprehension (Houts et al., 2006; Mayer, 2009; Medina, 2008).

Thus, infographics emerge as a valuable tool for conveying diverse types of information, combining text and graphic components to leverage the soundness of each medium, resulting in a more effective and engaging solution that overcomes the individual limitations of both (Smiciklas, 2012). Supporting this view, Colle (2004) emphasizes that an infographic is a spatial unit that employs both verbal and non-verbal language to present comprehensive and precise information that would be too complex and time-consuming to communicate verbally. Arroyo (2013) further highlights that the central role of infographics lies in their ability to synthesize large volumes of data, making them comprehensible at a glance.

However, as noted by Arcia et al. (2016), an effective infographic goes beyond merely conveying information; it must be easily understandable and appealing to its target audience. This quality is essential for promoting positive behavioral changes. In this way, infographics are not only visual representations of data but also persuasive tools with the power to influence how people perceive and respond to the presented information (Martins, 2020a; Martins, 2020b).

Studies indicate that health infographics are particularly useful, enabling the public to better understand diseases, medical procedures, and critical topics in a clear and swift manner (Balkac & Ergun, 2018; Jerome, 2021). These visual representations stand out during public health crises, such as pandemics, due to their ability to quickly convey vital information, overcoming the limitations of information overload (Lam et al., 2022).

The creation of high-quality infographics, however, requires the application of specific principles. Cairo (2013) highlights that the creation of a good infographic is not merely a matter of beauty but also of utility.

Lankow et al. (2012) expand on this approach by introducing Vitruvius' design standards, found in *De Architectura*, a classical treatise on Roman architecture. These standards – defined as utility, soundness, and beauty – seek a timeless conception of beauty, inspired by universal laws of proportion and symmetry.

Thus, Lankow et al. (2012) align with the principles of utility and beauty highlighted by Cairo (2013), while introducing the additional dimension of soundness, arguing that a good infographic must incorporate these three elements:

1. **Utility**: It is essential to ensure that the infographic effectively communicates the message in a clear and direct manner, fulfilling the established communication objectives. Lankow et al. (2012) emphasize the importance of aligning the infographic's approach with the project's purpose, choosing between a narrative or exploratory structure as needed. The narrative approach is useful for guiding the reader through a story or sequence of ideas, while the exploratory approach allows the audience to interact with the information more freely.
2. **Soundness**: This refers to the ability to convey relevant and meaningful information to the target audience. Lankow et al. (2012) and Krum (2013) highlight the importance of avoiding the inclusion of incomplete, uninteresting, or unreliable content, as this can undermine the credibility of the message.
3. **Beauty**: Two aspects must be considered: format and design quality (Lankow et al., 2012). In the context of this study, the choice of a vertical format is advantageous, given that the infographic will be displayed on a web page (Krum, 2013). Design quality, on the other hand, is influenced by factors such as visual order, color, contrast, typography, and graphical representations.

Regarding visual organization, Knaflic (2015) emphasizes the importance of a careful arrangement of elements, noting that good visual order should not be perceived; however, its absence can compromise the quality of the design and the comprehension of the information conveyed. The author suggests using clean and consistent lines, both horizontal and vertical, to ensure proper alignment of graphic elements. This facilitates reading and helps maintain the organization of information. The inclusion of white space should be strategically applied, as it contributes to separating different visual areas and creating a clear hierarchy, assisting the reader in quickly identifying the most relevant information.

The choice of colors and the use of contrast are other crucial aspects of beauty. Arcia et al. (2016) and Luth et al. (2013) highlight that colors not only aid in information identification but also carry symbolism that can influence public perception. When selecting colors, one must consider their emotional and cultural impact. Contrast, as noted by Knaflic (2015), should

be used to highlight important information and guide the reader's eye, while avoiding excess that may lead to visual clutter.

Typography is also an essential element in the design of an infographic. The use of up to three type families is recommended to avoid visual overload (Murray et al., 2017). Complementary yet distinct typefaces are ideal for creating a clear hierarchy and ensuring that the reader can easily differentiate between titles, subtitles, and body text (Tselentis et al., 2012). Furthermore, legibility should be a priority, with a recommendation to choose a simple typographic design that does not distract from or compromise the understanding of the information (Hartley, 2004). For online infographics, Ling and van Schaik (2007) suggest left-justifying the text and using a line spacing of 1.5 or 2, which improves readability in digital environments. To emphasize important information, a moderate use of bold type is recommended (Lonsdale, 2014), as well as creating a clear size difference between titles and body text (Williams & Spyridakis, 1992).

Finally, the relevance of graphical representations in visual communication as discussed by Krum (2013), who asserts that the use of these representations – such as graphs, icons, illustrations, and diagrams – in infographics can simplify complex information, making it more accessible to readers. Moreover, another important aspect, highlighted by Arslan and Toy (2015), is ensuring that the graphic elements used are original and specifically created for the infographic in question, in order to achieve a harmonious integration with the remaining content.

3 Definition of guidelines

Based on the literature review conducted, a set of guidelines has been established for the creation of infographics with the aim of guiding designers in developing effective infographic designs for communication with their audience.

An infographic should adhere to core principles, and for each of these principles, it is recommended to follow a specific set of guidelines, namely:

1. **Utility**

- Ensure that the infographic meets the communication objectives (Lankow et al., 2012).
- Choose between an exploratory or narrative approach, according to the project (Lankow et al., 2012).

2. **Soundness**

- Convey significant information to the target audience (Lankow et al., 2012; Krum, 2013).
- Avoid incomplete, uninteresting, or unreliable content (Lankow et al., 2012; Krum, 2013).

3. **Beauty**

- Choose a visual format that meets the communication objectives, considering the platform and the target audience (Lankow et al., 2012; Krum, 2013).
- Maintain clear alignment and use white space to separate visual areas (Knaflic, 2015).
- Select colors that enhance information identification and consider their symbolism (Arcia et al., 2016; Luth et al., 2013).
- Use contrast strategically to guide attention and avoid visual clutter (Knaflic, 2015).
- Limit typographic diversity to a maximum of three families (Murray et al., 2017).
- Choose complementary yet notably distinct typefaces (Tselentis et al., 2012).
- Opt for a simple typographic design, avoiding elements that may compromise comprehension (Hartley, 2004).
- Left-justify the text and use a line spacing of 1.5 or 2 (Ling & van Schaik, 2007).
- Highlight the relevance of information with moderate use of bold text (Lonsdale, 2014) and a relative size difference between titles and body text (Williams & Spyridakis, 1992).
- Utilize visual representations to simplify complex information (Krum, 2013).
- Avoid the use of inauthentic graphic elements (Arslan & Toy, 2015).

4 Development of the infographic prototype

Based on the established guidelines, a prototype infographic was developed, and the corresponding process is outlined below.

The first step involved defining the communication objectives of the infographic, ensuring its utility as proposed by Lankow et al. (2012). Considering the importance of effective communication in risk situations, such as pandemics, the decision was made to create an infographic presenting relevant information about COVID-19, intended to serve as a general and informative resource. To this end, a narrative approach was adopted, recognized for its effectiveness in sequentially organizing information, facilitating the rapid comprehension of the data presented, and aligning with the communicative objectives of the project (Lankow et al., 2012).

In the subsequent phase, it was essential to ensure the soundness of the infographic by adhering to the guidelines established by Lankow et al. (2012) and Krum (2013). To ensure that the information was meaningful and reliable for the target audience, data was sourced from the website of the Directorate-General of Health (DGS), a reference authority in the field of health in Portugal. These contents were sourced from the Internet Archive, a digital library that stores historical content, allowing access to the DGS pages as they were available in 2020, during the pandemic. The selected content

created a cohesive infographic about COVID-19, addressing essential aspects such as definition, origin, symptoms, prevention, and transmission modes.

However, to make the infographic clearer and more accessible, the original texts were simplified, adapting the content to a visual format, prioritizing relevant information, and removing excessive details (Figure 2).

COVID-19
CORONAVÍRUS

O que é?

MCOVID-19 é a designação dada pela Organização Mundial da Saúde para identificar a doença provocada pelo novo coronavírus SARS-CoV-2.

Como surgiu?

Este novo coronavírus foi identificado pela primeira vez em dezembro de 2019 na China, na cidade de Wuhan. Os casos iniciais da doença COVID-19 foram associados a um mercado em Wuhan (Wuhan's Huanan Seafood Wholesale Market). O mercado foi encerrado a 1 de janeiro de 2020, mas a doença foi progredindo desencadeando uma epidemia mundial ou pandemia.

Quais são os sintomas?

Algumas pessoas com Covid-19 podem ser assintomáticas, não apresentando qualquer sintoma.

- Cansaço
- Dores musculares
- Febre
- Dor de garganta
- Tosse seca

Quais são as medidas de prevenção?

As medidas de higiene e etiqueta respiratória têm como objetivo reduzir a exposição e transmissão da doença e são:

- Tapar o nariz e a boca ao espirrar ou tossir
- Lavar as mãos frequentemente
- Evitar contacto próximo com pessoas com infecção respiratória
- Evitar tocar na cara com as mãos
- Evitar partilhar objetos pessoais ou comida em que tenha tocado

Como se transmite?

Pessoa-a-pessoa por contacto próximo (transmissão direta)
A transmissão por contacto próximo ocorre principalmente através de gotículas que contêm partículas virais que são libertadas pelo nariz ou boca de pessoas infetadas, quando tossem ou espirram, e que podem atingir diretamente a boca, nariz e olhos de quem estiver próximo.

Contacto com superfícies e objetos contaminados (transmissão indireta)
As gotículas podem depositar-se nos objetos ou superfícies que rodeiam a pessoa infetada e, desta forma, infetar outras pessoas quando tocam com as mãos nestes objetos ou superfícies, tocando depois nos seus olhos, nariz ou boca.

Figure 2 Base text for the creation of the infographic.

With the base text defined, the next step involved translating it into an effective visual format, starting with the creation of initial sketches and culminating in the production of a final prototype (Figure 3).

The vertical format was strategically chosen to accommodate the various sections sequentially, facilitating logical reading. This choice adhered to the guidelines established by Lankow et al. (2012) and Krum (2013), allowing the infographic to be tailored to the display platform and the expectations of the target audience.

Visual order was ensured through imaginary horizontal and vertical lines, ensuring component alignment and a balanced layout (Knaflic, 2015). Furthermore, whitespace was strategically utilized to separate sections and create a clear visual hierarchy (Knaflic, 2015), thereby enhancing comprehension and avoiding information overload.

Regarding color selection, the choices were influenced by their role in information identification and symbolism, as suggested by Arcia et al. (2016) and Luth et al. (2013). A palette of aqua green and dark blue was chosen. Green was selected for its association with tranquility and health. Dark blue, in addition to conveying seriousness, was used to contrast with green, enhancing the readability of the text. Additionally, red was used to emphasize elements that symbolize danger or require special attention, while neutral and vibrant tones (white, gray, orange, pink, purple, and turquoise) added balance and dynamism.

For typography, *Open Sans*, a sans-serif font, (known for readability), was chosen in line with Hartley's (2004) recommendations. Limiting typography to a single family, as advised by Murray et al. (2017), prevents visual overload. Two weight variations, bold and light, established content hierarchy. The size difference between headings and body text was also considered to ensure visual distinction among different levels of information (Williams and Spyridakis, 1992). Furthermore, key words were highlighted in bold (Lonsdale, 2014) to underscore importance while maintaining reading flow. The body text was left-justified, with 1.5 line spacing, following the Ling and van Schaik's (2007) guidelines to enhance readability on digital platforms.

Concerning visual representations, icons and illustrations were developed to simplify information and increase the communicative effectiveness (Krum, 2013). To achieve a coherent design, all images were created specifically for this project, avoiding the use of non-authentic graphical elements (Arslan and Toy, 2015).

The visual style, characterized by smooth and rounded lines, ensures coherence throughout the infographic. This uniformity, combined with a consistent color palette, reinforces the overall aesthetics and guarantees that the design remains cohesive.

In the infographic, the illustrations and icons serve to create an immediate connection with the themes of health and prevention, highlighting the relevance and seriousness of the context. They help contextualize COVID-19, locate Wuhan, illustrate symptoms, outline preventive measures, and explain modes of transmission, ensuring a clear and continuous understanding of the subject.

Figure 3 Infographic prototype (source: own formulation, 2024).

5 Usability testing

Usability tests were conducted to evaluate the infographic prototype and to compare it with the original text from the DGS website regarding COVID-19. The objective was to determine whether the infographic provides a better presentation of information than the text alone. Additionally, the tests aimed to validate the established guidelines. To complement this evaluation, two post-test questionnaires were administered: one to compare the effectiveness of both formats and another to measure satisfaction with the infographic design, utilizing the System Usability Scale (SUS).

Usability testing is an essential method for evaluating the usability of a product or system (Cooper et al., 2007). The assessment was based on three pillars defined by the ISO 9241-11 standard: effectiveness, efficiency, and satisfaction (Blog Mosaico, 2021). Effectiveness refers to users' ability to complete the proposed tasks, efficiency measures the time and resources required to execute those tasks, and satisfaction evaluates the user's level of comfort and acceptance while interacting with the product.

A competitive evaluation approach was employed, which proved appropriate for the purpose as it allowed for the comparison of different design solutions and identification of the one that exhibits superior usability (Neusesser, 2024). This approach determines which format – infographic or isolated text – is more effective in communicating information.

The study included eight participants, divided according to gender and literacy levels, a choice grounded in Windisch's (2015) work, which demonstrates the relationship between literacy and the ability to comprehend information. The selection of the number of participants follows the recommendations of Spillers (2019), who suggests that between 8 to 10 participants are adequate to obtain meaningful data without generating excessive redundancy.

Participants were invited to perform a set of tasks in both the isolated text format and the infographic. A total of four tasks were established:

- Find information about when and where COVID-19 was first identified.
- List the symptoms associated with COVID-19.
- Identify the preventive measures to reduce the transmission of COVID-19.
- Explain how COVID-19 is transmitted.

In addition to the quantitative data, a post-test questionnaire was administered to assess participants' subjective perceptions of the usability of both formats, complementing the results obtained in the usability tests. This direct comparison approach, as advocated by Neusesser (2024), provided valuable insights into the strengths and weaknesses of each format. The questionnaire contained the following questions:

1. Which format did you find easier to understand and why?
2. Which format seemed faster for finding information?

Finally, a second questionnaire was administered utilizing the SUS to assess the quality of the infographic design and to verify whether the guidelines established based on the literature review were correctly implemented. This post-test questionnaire consisted of 10 questions evaluated on a Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree) (Blog Mosaico, 2021). The final score obtained ranged from 0 to 100, with scores above 80 indicating above-average usability. The questions from the SUS questionnaire were as follows:

1. The infographic effectively fulfills the established communication objectives.
2. The information presented in the infographic is not relevant to the topic.
3. The infographic is easy to read, and the typography used is legible and appropriate.
4. The format of the infographic is not suitable for communicating the content.
5. The organization of visual elements in the infographic is clear and logical.
6. The colors and contrast used in the infographic are not adequate to highlight important information and avoid visual clutter.
7. The visual representations (icons, illustrations, etc.) are clear and contribute to the understanding of the content.
8. Related graphical elements are not grouped in a way that facilitates the overall understanding of the infographic.
9. The arrangement of graphical elements provides a natural visual continuity, aiding in the comprehension of the information.
10. I am dissatisfied with the overall usability of the infographic.

6 Results and discussion

Following the usability tests and the developed post-test questionnaires, the main results and their respective analysis are presented.

Regarding the effectiveness of communication achieved in the tests, it was found that both the isolated text and the infographic exhibited a success rate of 100%, demonstrating that both were equally effective in transmitting information.

However, notable differences emerged when analyzing efficiency. The infographic allowed for quicker task completion, particularly for participants with lower literacy levels.

The infographic was unanimously identified by participants in the post-test questionnaire as the easier format to comprehend. One participant's assertion that "a picture is worth a thousand words" reinforces the argument that visualization facilitates content assimilation. Moreover, the speed in locating information was another advantage highlighted by participants, who reported that the images and graphic layout led directly to the desired content, in contrast to the isolated text, which required more extensive reading.

These results align with the literature review conducted, which emphasizes the difficulties associated with excessive text and the benefits of graphical elements in enhancing information clarity (Houts et al., 2006; Mayer, 2009; Lagassé, 2011; Medina, 2008). Additionally, the perspectives of Colle (2004) and Arroyo (2013) on the ability of infographics to synthesize and present information clearly and understandably reinforce the observation that infographics surpass the limitations of isolated text.

Finally, satisfaction with the infographic design was assessed using the SUS, achieving an average score of 96.875, placing it in category A according to Sauro's scale (2011), reflecting a high level of satisfaction and usability. This finding validates the effectiveness of the guidelines employed in the creation of the infographic. The positive experience of the participants confirms that the design choices, based on previous studies (Cairo, 2013; Lankow et al., 2012; Krum, 2013; Knaflic, 2015; Arcia et al., 2016; Luth et al., 2013; Murray et al., 2017; Tselentis et al., 2012; Hartley, 2004; Ling & van Schaik, 2007; Lonsdale, 2014; Williams & Spyridakis, 1992; Arslan & Toy, 2015), were successful in providing accessible and aesthetically pleasing communication.

7 Conclusions

This article aimed to demonstrate how infographics can significantly contribute to improving risk communication in public health through infographic design practices that enhance citizens' understanding of health information. The results indicated that infographics are a more efficient and satisfying tool for communicating complex information, surpassing isolated text in terms of clarity and speed of comprehension, particularly among individuals with lower literacy levels.

The high score obtained in the SUS evaluation, reflecting a substantial degree of satisfaction with the infographic, validated the effectiveness of the developed design guidelines. These guidelines, based on principles established in the literature review (Cairo, 2013; Lankow et al., 2012; Krum, 2013; Knaflic, 2015; Arcia et al., 2016; Luth et al., 2013; Murray et al., 2017; Tselentis et al., 2012; Hartley, 2004; Ling & van Schaik, 2007; Lonsdale, 2014; Williams & Spyridakis, 1992; Arslan & Toy, 2015), proved to be practical and applicable in real-world contexts, confirming that the adoption of best design practices can significantly enhance the readability and comprehension of health communication.

This study reinforces the use of infographics as an effective approach to risk communication, suggesting that their implementation in official communications can facilitate the dissemination of critical information during public health crises.

The developed guidelines provide a significant practical contribution to professionals in the fields of communication and health, offering a set of validated recommendations that can be adopted to ensure more effective and clear communication with citizens.

Finally, it is suggested that future studies apply these guidelines in different contexts, expanding their application to areas beyond health. Additional studies conducted with diverse target audiences in real situations would also be valuable to strengthen the applicability of the proposed guidelines.

Acknowledgment

This work was founded by the Portuguese Foundation for Science and Technology (FCT) under the reference 2022.06008.PTDC and the reference UIDP/04057/2020.

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Submission date/*Artigo recebido em*: 11/10/2024
Approvement date/*Artigo aprovado em*: 13/2/2025