Perception of the application of Artificial Intelligence in Portuguese Otorhinolaryngology

Original Article

Authors

Tiago Chantre
Serviço de Otorrinolaringologia da Unidade Local de Saúde de São José

Inês Alpoim Moreira
Serviço de Otorrinolaringologia da Unidade Local de Saúde de São José

Mariana Oliveira
Serviço de Otorrinolaringologia da Unidade Local de Saúde de São José

Herédio Sousa
Serviço de Otorrinolaringologia da Unidade Local de Saúde de São José

Correspondence:
Tiago Chantre
tiagomendeschantre@gmail.com

Abstract

Introduction - Artificial Intelligence (AI) technologies have made it possible to analyze large databases and subsequently apply this knowledge to solve practical clinical problems.

Objectives - Compare the perception of the application of AI in Otorhinolaryngology, in Portugal, between the general population and healthcare professionals.

Material and Methods - A cross-sectional study was carried out using an anonymous, self-completed online questionnaire. The questionnaire analyzed aspects related to the areas of application of AI, namely diagnosis, clinical decision-making, surgical procedures and monitoring of chronic diseases. Of the 770 adult participants (aged 18 years or over), 249 were excluded for submitting questionnaires with incomplete information, with a total of 521 selected.

Results - Of the participants, 60.8% were female, 66.8% were between 26 and 57 years old and 46.4% were healthcare professionals. Women more often preferred a human being to monitor chronic diseases ($p = 0.024$) and to perform low-life-threatening surgery ($p = 0.003$). Participants from younger (18-25 years) and older (>67 years) age groups preferred humans to perform clinical assessment of signs and symptoms ($p = 0.000$), treatment decision-making ($p = 0.011$) and creation of rehabilitation plans ($p = 0.009$). Healthcare professionals more often preferred humans to perform treatment monitoring ($p = 0.000$) or life-threatening surgeries ($p = 0.004$), compared to the general population.

Conclusions - This study suggests that there are significant differences in the perception of AI application depending on gender, age, and the general population versus healthcare professionals.

Keywords: Artificial intelligence; Otorhinolaryngology; patient perception; healthcare professionals; privacy

Introduction

Artificial intelligence (AI) is a branch of computer science that refers to the ability of computers or machines to solve problems that normally require human intelligence.[1] Science has recently witnessed the ability of AI to manipulate data using algorithms and apply this knowledge to solve practical clinical problems.[2] In 2017, the journal Nature published an article in which an AI technique was able to diagnose skin cancer as efficiently as dermatologists.[3] In 2018, another article claimed that AI had even better diagnostic ability to skin cancer than physicians.[4] In addition, the Food and Drug Administration (FDA) in the USA already authorized the first AI device to diagnose diabetic retinopathy without a physician's help in April 2018.[2]

Medicine has not been integrating AI technology as quickly as it has been advancing. The main difficulties are the question of responsibility, the use of health data (privacy concerns), concerns about cybersecurity, and ethics considerations.[5-6] Furthermore, for there to be a correct application of AI in healthcare, general public trust and health professional support are essential. Although recent efforts have been made, there is limited research exploring patient perceptions on AI application in medicine.[7] In a 2020 study, authors reported that most participants showed confidence in AI providing medical diagnoses, sometimes even over human physicians, but generally expressed concern with surgical AI.[8]

Oh et al. conducted a survey among doctors to assess their attitudes toward medical AI applications. It showed that doctors have positive attitudes toward AI implementation in the healthcare and that most physicians assumed that their roles will not be replaced by AI.[9] Despite agreeing on the usefulness of AI in the medical field, most health professionals lack a full understanding of the principles of AI.[10-11] Different algorithms using AI have been proposed in the field of Otorhinolaryngology. In terms of image-based analysis, images acquired by endoscopes, stroboscopes, computed tomography, magnetic resonance imaging, and multispectral narrow-band imaging can now be interpreted by AI.[12] In voice-based analysis, AI can be used to evaluate vocal fold disorders by analyzing and decoding phonation itself.[13] In medical device-based analyses, AI can also be used to evaluate tissue and blood test results, as well as the outcomes of Otorhinolaryngology-specific tests (e.g., polysomnography or audiometry).[14] AI has also been proposed to support clinical diagnoses and treatments, decision-making, the prediction of prognoses and disease profiling. The aim of this research study is to explore general public and health professionals' perceptions of AI in Otorhinolaryngology, and evaluate relationships between demographic characteristics and disposition toward AI.

Material and Methods

Survey Development

We conducted a cross-sectional study using a self-completed online questionnaire (Annex 1). This questionnaire was carried out using the Qualitrics® platform and the answers were recorded with the IP address of the device used and subsequently validated. A literature review was first performed to identify the survey items, which should provide an estimate of individual attitudes and beliefs towards the use of AI in healthcare practice. The 9-item questionnaire examined aspects related to the application areas for AI in Otorhinolaryngology, namely diagnostics, decision making, surgical procedures and monitoring of different pathologies (Annex 1). For each question, participants had to choose on a scale from 0 to 10 (where proximity to 0 represents AI and proximity to 10 represents the human) which healthcare provider they would prefer. The study was performed in accordance with the ethical standards of the institutional research committee and with the Declaration of Helsinki.

Sample

The participants were opportunistically recruited over a 4-week period beginning May 2023. The eligibility criteria for participation

were as follows: (1) 18 years or older, (2) able to understand the information describing the study, and (3) able to provide consent. Patients were divided into different generations according to age: Generation Z (18-25 years), Generation Y or Millennials (26-41 years), Generation X (42-57 years), Baby Boomers (58-67 years), Silent Generation (>67 years). The participants were previously informed about the aims of the questionnaire, and they voluntarily participated. Participants anonymity was ensured, and the responses were identified by participant identification numbers only.

Statistical Analysis

All the surveys after completed were entered into a database in Microsoft Excel (Microsoft Corporation). Descriptive statistics were used to describe the sample by gender, age, nationality and profession. Multivariate regressions were used as appropriate to identify associations between demographic factors and responses. The results were deemed statistically significant if p<0.05; 95% of confidence interval. Statistical analysis was performed using SPSS (SPSS 15.0 for Windows, IBM Co., Chicago, Il, USA).

Results

The survey was answered by 770 participants over a period of 1 month. Data was collected from only 521 questionnaires as 249 had incomplete information. Demographics of the participants are outlined in Table 1. Most of the sample (60.8%) were female, Portuguese (97.9%) and between 26 and 57 years old (66.8%). Moreover, nearly half of the respondents were health professionals (46.4%). The full breakdown of the questions and answers are given in Table 2. In general, the answers to the questionnaire approached the middle of the scale (from 0 to 10). Health monitoring and chronic disease monitoring (Questions 1 and 2, respectively) are the only items where AI was preferred over human healthcare providers. On the other hand, deciding on treatment and performing life-threatening surgeries (Questions 5 and 7, respectively), were the items in which the preference for human healthcare providers was most pronounced. On average, women significantly more often prefer a human to perform health monitoring (Question 1), chronic disease monitoring (Question 2) and to perform no/low-life threatening surgery (Question 8), when compared to men (Table 3). Both in terms of clinical assessment of signs and symptoms (Question 1), treatment decision (Question 5) and rehabilitation plans

Table 1
Demographic characteristics of the participants (n = 521)

		Frequency	Percent
Gender	Female	317	60.8%
	Male	204	39.2%
	Other	0	0%
Age (years)	18-25	76	14.6%
	26-41	124	23.8%
	42-57	224	43.0%
	58-67	64	12.4%
	>67	33	6.3%
Nationality	Portuguese	510	97.9%
	Other	11	2.1%
Health Professional	Yes	242	46.4%
	No	279	53.6%

Table 2
Participants' perception on Artificial Intelligence in Otorhinolaryngology

Questionnaire	Mean Answer (scale 0-10)	Standard Deviation
Q1 - What is your preference over the healthcare provider when it comes to **health monitoring?**	4.29	3,40
Q2 - What is your preference in relation to the healthcare provider when it comes to **monitoring chronic disease**?	4.04	3.35
Q3 - What is your preference over the healthcare provider regarding **clinical assessment of signs and symptoms?**	7.97	2.45
Q4 - What is your preference in relation to the healthcare provider when it comes to evaluating the results of **laboratory tests and imaging tests?**	6.53	3.23
Q5 - What is your preference over the healthcare provider when it comes to **treatment decision?**	8.46	2.34
Q6 - What is your preference over the healthcare provider when it comes to **treatment monitoring?**	6.54	3.21
Q7 - What is your preference over the healthcare provider when it comes to **perform a life-threatening surgery?**	8.03	2.72
Q8 - What is your preference over the healthcare provider when it comes to **perform a no/ low life-threatening surgery?**	6.36	3.29
Q9 - What is your preference of the healthcare provider when it comes to **rehabilitation?**	6.86	3.03

Table 3
Significance map detailing the significance of the relationships between the responses and the panel of demographic characteristics

	Gender	Age	Health Professional
Health monitoring	p=0.015	p=0.166	p=0.137
Chronic Disease monitoring	p=0.024	p=0.671	p=0.272
Assessment of Signs/Symptoms	p=0.496	p=0.000	p=0.416
Diagnostics	p=0.059	p=0.273	p= 0.307
Treatment decision	p= 0.310	p=0.011	p= 0.267
Treatment monitoring	p=0.158	p=0.256	p=0.000
Life-threatening Surgery	p= 0.126	p= 0.104	p= 0.004
No/low life-threatening Surgery	p= 0.003	p= 0.060	p= 0.070
Reabilitation	p= 0.078	p= 0.009	p=0.296

■ Significantly prefers Human as Healthcare Provider   ■ No statistically significant relationship

(Question 9), the age groups representing the youngest (18-25 years old) and oldest (>67 years old) participants more often prefer humans to perform these tasks. The difference between general public and health professionals perception on AI in Otorhinolaryngology is shown in Figure 1. The only statistically significant differences between groups concern questions 6 and 7. Health professionals, more often prefer a human healthcare provider for treatment monitoring (7.18 ± 2.85) when compared with the general public (5.97 ± 3.40). In what concerns life-threatening surgery, health professionals showed (8.32 ± 2.53) greater preference for human healthcare providers than the general public (7.78 ± 2.86).

Comparison between General Public and Health Professionals perception on Artificial Intelligence in Otorhinolaryngology
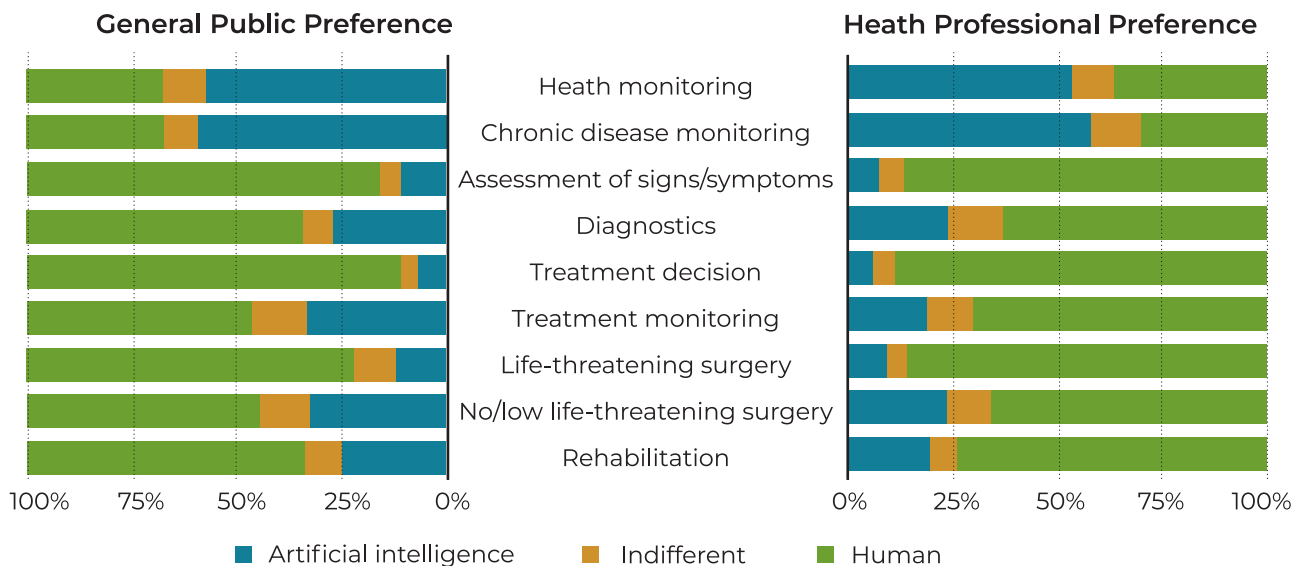
Discussion

AI techniques can potentially assist physicians, namely Otorhinolaryngologists, to take better clinical decisions or even perform some tasks autonomously or semi-autonomously. The successful integration of AI technology into routine clinical practice, depends not only on numerous technological progresses, but also whether the general public and health professionals can accept and trust it.

This study suggests a certain openness towards AI applications in Otorhinolaryngology. Our findings aligns with recent research showing that general public perception and optimism of AI as a whole has risen markedly.[15] As it was described by Stai et al., most participants showed confidence in AI providing health monitoring or chronic disease monitoring, even more than humans.[8] Many patients could feel that an AI gives them additional certainty in their diagnosis.[16] Our study is also in agreement with literature when it comes to healthcare provider preference to perform surgery, particularly life-threatening surgery.[8] Most participants preferred human healthcare providers to perform life-threatening surgery. Stai et al. hypothesized that being male seems to align with a narrative of higher tolerance to risk taking, and thus explain the relationship

between these demographic variables and the preference for AI.[8] In our research, men significantly more often prefer AI technology to perform health monitoring, chronic disease monitoring and to perform no/low-life threatening surgery, than women.

The distribution by generations that was carried out in this study not only has the function of dividing age groups, but also of showing different patterns of access to technology. While Generation Z was born with the regular use of computer technology at home, Baby Boomers began contact, in many cases, when they were over 40 years old. There are also intermediate cases, such as Millennials who began to regularly use technology in their adolescence. We hypothesized that the statistically significant preference of participants over 67 years of age for the human component is due to a late start to regular technology use. However, this hypothesis does not allow us to explain why Generation Z also prefers human health care providers. A certain emotional dependence on the authority presented by the human factor in health care may be the reason to this finding. Radiologists were the first health professionals to be exposed to the AI revolution and they already agree that

AI could be a useful assistant.[2] This positive attitude was perceptible both in Europe[17] and abroad[18]. Among medical specialities, general practitioners view of AI may be the more skeptical, as they claimed that AI would not improve the efficiency of their work or reduce the administrative burden.[19] In our findings, health professionals have an overall positive opinion on AI. However, when compared to general public, health professionals, more often prefer a human healthcare provider for treatment monitoring and to performer life-threatening surgery.

To our knowledge, this is the first study to show the perception of the general public and health professionals in the application of AI in Portuguese Otorhinolaryngology. However, the interpretation of the results of our research must consider the following limitations. First, this is a cross-sectional questionnaire study that provides only momentary perceptions on AI, rather than how these may change over time. The fact that participants were recruited manly from Portuguese population may limit the generalizability of the findings. Also, as our survey was based on an online questionnaire, we left out those who were unable to read or use computer tools. Other limitations to mention in the study are the fact that the questionnaire used is not validated to obtain the perception of the application of AI in Otorhinolaryngology. Furthermore, it would be important in future studies to individually analyze the perception of the application of AI in the different sub-specialties within Otorhinolaryngology. Another limitation concerns the fact that the categorization of health professionals between different areas was not carried out, meaning that the perception of Otorhinolaryngology doctors in comparison to the general public was not part of the objectives of this study.

Conclusions

With increasing research on implementing AI in healthcare, more attention is given to general public and health professionals perception and acceptability of this type of technology. This study has demonstrated that there are significant variations in AI perception, depending on gender, age and profession. There is a need for greater awareness among the public and health professionals for ensuring the acceptability of AI research and its successful integration into clinical practice in future.

Conflicts of Interest
The authors declare that there is no conflict of interests regarding the publication of this paper.

Data Confidentiality
The authors declare having followed the protocols in use at their working center regarding patients' data publication.

Protection of humans and animals
The authors declare that the procedures were followed according to the regulations established by the Clinical Research and Ethics Committee and to the 2013 Helsinki Declaration of the World Medical Association.

Availability of scientific data
There are no datasets available, publicly related to this work.

References
1. Aggarwal R, Farag S, Martin G, Ashrafian H, Darzi A. Patient perceptions on data sharing and applying artificial intelligence to health care data: cross-sectional survey. J Med Internet Res. 2021 Aug 26;23(8):e26162. doi: 10.2196/26162.
2. Lai MC, Brian M, Mamzer MF. Perceptions of artificial intelligence in healthcare: findings from a qualitative survey study among actors in France. J Transl Med. 2020 Jan 9;18(1):14. doi: 10.1186/s12967-019-02204-y.

3. Esteva A, Kuprel B, Novoa RA, Ko J, Swetter SM, Blau HM. et al. Dermatologist-level classification of skin cancer with deep neural networks. Nature. 2017 Feb 2;542(7639):115-118. doi: 10.1038/nature21056.

4. Haenssle HA, Fink C, Schneiderbauer R, Toberer F, Buhl T, Blum A. et al. Man against machine: diagnostic performance of a deep learning convolutional neural network for dermoscopic melanoma recognition in comparison to 58 dermatologists. Ann Oncol. 2018 Aug 1;29(8):1836-1842. doi: 10.1093/annonc/mdy166.

5. Price WN 2nd, Cohen IG. Privacy in the age of medical big data. Nat Med. 2019 Jan;25(1):37-43. doi: 10.1038/s41591-018-0272-7

6. Martinez-Martin N, Insel TR, Dagum P, Greely HT, Cho MK. Data mining for health: staking out the ethical territory of digital phenotyping. NPJ Digit Med. 2018;1:68. doi: 10.1038/s41746-018-0075-8.

7. Ongena YP, Haan M, Yakar D, Kwee TC. Patients' views on the implementation of artificial intelligence in radiology: development and validation of a standardized questionnaire. Eur Radiol. 2020 Feb;30(2):1033-1040. doi: 10.1007/s00330-019-06486-0.

8. Stai B, Heller N, McSweeney S, Rickman J, Blake P, Vasdev R. et al. Public perceptions of artificial intelligence and robotics in medicine. J Endourol. 2020 Oct;34(10):1041-1048. doi: 10.1089/end.2020.0137.

9. Oh S, Kim JH, Choi SW, Lee HJ, Hong J, Kwon SH. Physician confidence In artificial intelligence: an online mobile survey. J Med Internet Res. 2019 Mar 25;21(3):e12422. doi: 10.2196/12422.

10. Castagno S, Khalifa M. Perceptions of artificial intelligence among healthcare staff: a qualitative survey study. Front Artif Intell. 2020 Oct 21:3:578983. doi: 10.3389/frai.2020.578983.

11. Abdullah R, Fakieh B. Health care employees' perceptions of the use of artificial intelligence applications: survey study. J Med Internet Res. 2020 May 14;22(5):e17620. doi: 10.2196/17620.

12. Wu Q, Wang X, Liang G, Luo X, Zhou M, Deng H. et al. Advances in image-based artificial intelligence in otorhinolaryngology-head and neck surgery: a systematic review. Otolaryngol Head Neck Surg. 2023 Nov;169(5):1132-1142. doi: 10.1002/ohn.391.

13. Powell ME, Rodriguez Cancio M, Young D, Nock W, Abdelmessih B, Zeller A. et al. Decoding phonation with artificial intelligence (DeP AI): proof of concept. Laryngoscope Investig Otolaryngol. 2019 Mar 25;4(3):328-334. doi: 10.1002/lio2.259.

14. Tama BA, Kim DH, Kim G, Kim SW, Lee S. Recent advances in the application of artificial intelligence in otorhinolaryngology-head and neck surgery. Clin Exp Otorhinolaryngol. 2020 Nov;13(4):326-339. doi: 10.21053/ceo.2020.00654.

15. Fast E, Horvitz E. Long-term trends in the public perception of artificial intelligence. AAAI [Internet]. 2017 Feb.12 [cited 2023 Aug.3];31(1). Available from: https://ojs.aaai.org/index.php/AAAI/article/view/10635

16. Parker PA, Alba F, Fellman B, Urbauer DL, Li Y, Karam JÁ. et al. Illness uncertainty and quality of life of patients with small renal tumors undergoing watchful waiting: a 2-year prospective study. Eur Urol. 2013 Jun;63(6):1122-7. doi: 10.1016/j.eururo.2013.01.034.

17. SFR-IA Group; CERF; French Radiology Community. Artificial intelligence and medical imaging 2018: French Radiology Community White Paper. Diagn Interv Imaging. 2018 Nov;99(11):727-742. doi: 10.1016/j.diii.2018.10.003.

18. Thrall JH, Li X, Li Q, Cruz C, Do S, Dreyer K. et al. Artificial intelligence and machine learning In radiology: opportunities, challenges, pitfalls, and criteria for success. J Am Coll Radiol. 2018 Mar;15(3 Pt B):504-508. doi: 10.1016/j.jacr.2017.12.026.

19. Blease C, Kaptchuk TJ, Bernstein MH, Mandl KD, Halamka JD, DesRoches CM. Artificial intelligence and the future of primary care: exploratory qualitative study of UK general practitioners' views. J Med Internet Res. 2019 Mar 20;21(3):e12802. doi: 10.2196/12802.

Gender Female ☐ Male ☐ Other ☐

Age (years) ☐ **Nationality** ☐

Health Professional Yes ☐ No ☐

Question 1
What is your preference over the healthcare provider when it comes to **health monitoring?**

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Question 2
What is your preference in relation to the healthcare provider when it comes to **monitoring chronic disease?**

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Question 3
What is your preference over the healthcare provider regarding **clinical assessment of signs and symptoms?**

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Question 4
What is your preference in relation to the healthcare provider when it comes to evaluating the results of **laboratory tests and imaging tests?**

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Question 5
What is your preference over the healthcare provider when it comes to **treatment decision?**

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Question 6
What is your preference over the healthcare provider when it comes to **treatment monitoring?**

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Question 7
What is your preference over the healthcare provider when it comes to **perform a life-threatening surgery?**

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Question 8
What is your preference over the healthcare provider when it comes to **perform a no/ low life-threatening surgery?**

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Question 9
What is your preference of the healthcare provider when it comes to **rehabilitation?**

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |