

Portal *infoCosméticos*: a digital tool to empower consumers and health professionals

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Introduction

Consumers recognize that cosmetic products play a fundamental role for personal hygiene, beauty care and human health, which justifies the considerable increase in their use [1].

Consumer perception of the importance of cosmetic products in consumers' daily lives [2]

- 71% of respondents believe that cosmetics positively impact their quality of life;
- 70% believe they contribute to an improvement in their self-esteem.

(Study conducted by the European Trade Association)



Where do consumers obtain information regarding cosmetic products? [2]



- Play a pivotal role in educating the public on regulation, safety, and efficacy of cosmetic ingredients or products.
- However, there are several **controversial headlines** published all around the world that attempt to explain study results.

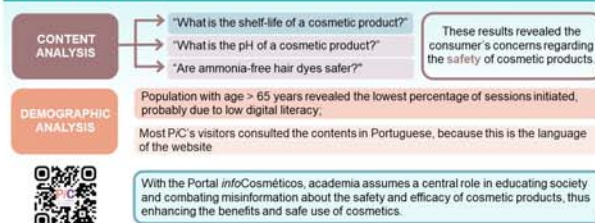
PROBLEM	Even though the information regarding cosmetic products available to the community is vast, it is not always trustworthy.
NEED	Improve consumer's health literacy regarding cosmetic products, so that they can understand health professionals' recommendations and discriminate legitimate from false contents.
SOLUTION	PiC Creation of a website easily accessible with information based on up-to-date scientific literature, analyzed by scholars, to guarantee that the contents are written in an unbiased way.

Materials & Methods

PiC is an educational project that uses clear language, short contents, infographics, and hyperlinks to complementary information sources. The team is composed by students, researchers, university professors, pharmacists, designers, web designers and communication experts.



Conclusions



Acknowledgements

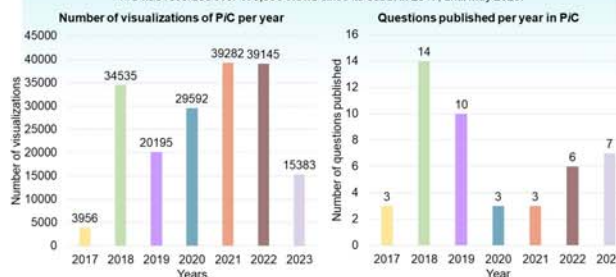
We are grateful to the team of 21 editors, 5 linguistic reviewers, 27 scientific reviewers and 1 designer that create the content of the website. We also acknowledge the patrons who support our mission to combat misinformation about cosmetic products. This work was supported by FCT - Fundação para a Ciência e a Tecnologia, I.P., in the scope of the project UIDP/04378/2020 and UIDB/04378/2020 of the Research Unit on Applied Molecular Biosciences - UCIBIO and the project LA/P/0140/2020 of the Associate Laboratory Institute for Health and Bioeconomy - i4HB.

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Results & Discussion

PiC has recorded over 170,000 views since its debut in 2017, until May 2023.



- In 2018, the number of views increased about 8 times.
- 2021 was one of the years with the fewest questions published, but with a higher number of visits.

This is the result of the PiC's dissemination initiatives carried out intensively during the launch year.

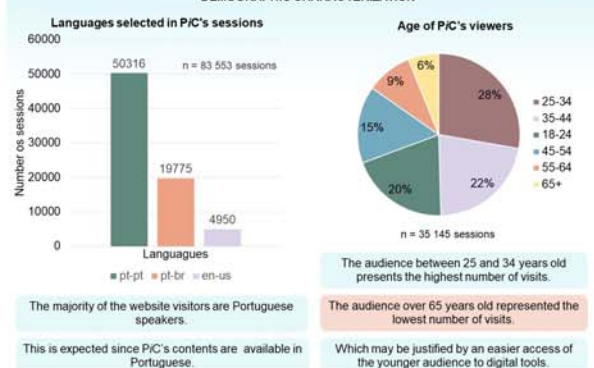
The number of contents published in the different years is uneven due to the in-depth creation and revision processes that take about 5-8 months.

TOP 10 OF THE MOST VIEWED QUESTIONS

Questions	Period since publication (in days)	Number of visualizations*	Average of visits per day	Categories			
				R	S&E	I	CP
What is the shelf-life of a cosmetic product?	1729	11 056	6.4	●	●		
What is the pH of a cosmetic product?	1769	10 810	6.1		●		
Are ammonia-free hair dyes safer?	1293	8 872	6.9		●		
What is the composition of a shampoo?	1902	5 754	3.0				●
How can I identify the function of a cosmetic ingredient?	1742	4561	2.4			●	
What information can I get from the labeling of a cosmetic product?	1957	4208	2.2	●			
Are preservatives known as parabens allowed in cosmetic products?	1742	3242	1.9		●	●	
What is the function of alpha-hydroxy acids in cosmetic products?	1293	3 211	2.5			●	
What is the difference between a shampoo and a shower gel?	1293	2 800	2.2				●
How is the market supervision of cosmetics performed?	1957	2 763	1.4	●			

Footnotes: *since June 2017 (debut of PiC) until 29th May 2023; ● category; R: Regulation; S&E: Safety and Efficacy; I: Ingredients; CP: Cosmetic Products.

DEMOGRAPHIC CHARACTERIZATION



Portal *infoCosméticos*: a digital tool to empower consumers and health professionals

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Abstract (Maximum of 200 words)

Nowadays, the information regarding cosmetic products available to the community is vast, although not always trustworthy. The Pharmaceutical Technology Laboratory of the Faculty of Pharmacy of the University of Porto (FFUP) launched the Portal *infoCosméticos* aiming to provide professionals involved in cosmetic advice with reliable information, supported by up-to-date scientific evidence, while empowering Portuguese-speaking consumers to make better-informed choices. Pre and post-graduates of the master's degree in Pharmaceutical Sciences are responsible for developing contents, which are submitted to a linguistic review by students of the Faculty of Arts and Humanities. Firstly, a relevant question is identified, following a comprehensive search on the topic and the creation of an infographic. The scientific validation is carried out by national and international scholars, and the national regulatory authority, INFARMED. Since it was released in 2017, the website has hit more than 170,000 visualizations, covering topics related to regulatory affairs, safety and efficacy, cosmetic ingredients and cosmetic products. The most accessed topics by digital users were disclosed by monitoring the visualizations of each question with *Google Analytics*, considering the publication date. According to the records, consumers seem to be more concerned about the safety of cosmetics and interested to know more about their composition.

Keywords: cosmetology; literacy; consumers; healthcare professionals; pharmaceutical sciences, cosmetics

Introduction

Cosmetic products are essential in people's everyday lives, and encompass both hygiene and skincare products, such as body moisturizers, soaps, and toothpastes, and beauty products, namely makeup, hair dyes and perfumes [1-4]. Additionally, cosmetic products are also crucial in the prevention of microbial infections of external body regions, caries development and mitigation of symptoms of several dermatological conditions [5, 6].

The cosmetic industry is a growing economic sector worldwide, with the European cosmetics and personal care market valued at 80 billion euros in 2021 [7]. The recent outbreak of the COVID-19 epidemic had a huge impact on people's lives and businesses, affecting global consumer's awareness about the importance of cosmetic products [8]. Overall, although the interest in makeup products has decreased, the opposite was observed for skincare products [9]. Skincare continues to be the dominant force in the cosmetics industry in Europe, capturing more than 27% of the European cosmetics market in 2019 [10]. A study conducted by the European Trade Association, which aimed to assess consumer perception of the importance of cosmetic products in consumers' daily lives, revealed that 71% of respondents believe that cosmetics positively impact their quality of life, and 70% believe they contribute to an improvement in their self-esteem. Thus, the fact that consumers recognize that cosmetic products play a fundamental role not only for personal hygiene, but also for human health, justifies the considerable increase in their use [3].

A wide variety of cosmetics distribution channels, such as department stores, door-to-door sales, one-brand shops, home shopping, hospitals and skin care facilities are emerging in order to respond differently to customers' demands [8]. Hence, consumers obtain information about cosmetic products not only from consulting labels and information leaflets, but also through recommendations offered by health professionals, beauty professionals, sales assistants, family

members or friends [11]. Furthermore, as a result of the epidemic scenario, it became essential to expand the e-commerce sector through online advertising in beauty markets [9]. Consequently, the adoption of marketing and advertising strategies increased, supported by the use of digital platforms. In this sense, digital content creators play a decisive role in broadcasting information to consumers, influencing their decision-making when purchasing cosmetic products, and managing expectations regarding health and aesthetic results. The media also play a pivotal role in educating the public on a wide range of topics, including the regulation, safety, and efficacy of cosmetic ingredients or products. There are several controversial headlines published all around the world that attempt to explain study results, often in alarmist and sensationalist ways (Figure 1). For example, the recent news on a study reporting nail polish dryers can result in DNA changes that may be carcinogenic does not fairly frame the findings of this same work. To do this, it would be required to make it clear in the title and/or subtitle that this study was conducted on mouse cells rather than on humans or based on the observation of people using this type of gadget. As a result, rather than reflecting an assessment of the risk to which the consumer is exposed, its conclusions represent the identification of a hazard that should be considered together with the exposure to that hazard [12]. The news about "potentially dangerous" lipsticks is the result of an alert issued by a consumer protection association. Even though the FDA's position reported that there is no evidence that mineral oil derivatives are ingested from lipstick portions that come into contact with the lips, the news suggests avoiding safe and permitted ingredients in these products, as well as reducing the frequency of their use [13]. According to the article, preservatives used in the substitution of parabens may not always be safer. However, the text does not mention either the existence of a list of preservatives with approved usage in cosmetics (Annex V of European Regulation n.º 1223/2009), or that there are maximum concentration limits for use established in that same annex [14]. Another magazine article suggests the best ammonia-free hair dyes, criticizing this ingredient without mentioning that it is allowed within the concentrations defined in the legislation [15].

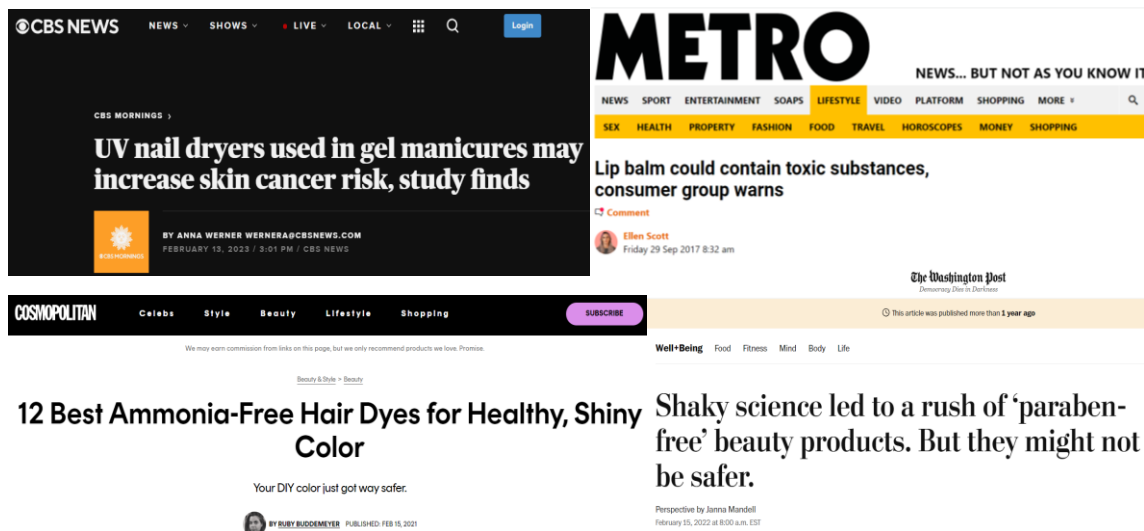


Figure 1: Alarmist news covered by various media, all over the world.

The improvement of health literacy regarding cosmetic products is fundamental, especially considering the vast amount of information regarding cosmetology openly available online. Consumers need to acquire the knowledge that allows them not only to understand health professionals' recommendations, but also to discriminate legitimate from false contents [16, 17]. Little is known about consumers' level of knowledge regarding cosmetics' function, safety and good use practices [18]. In any case, the best way to empower consumers to make an informed decision stems from the adoption of strategies and the availability of tools that allows them to clarify doubts and myths about cosmetic products in a clear, objective way, supported by current scientific evidence.

Currently, there are several institutional and industry platforms available to provide scientifically accurate information regarding cosmetic products to consumers. For example, in 2008, Cosmetics Info' website was launched, a database containing science and safety information on cosmetics products, funded by the members of The Personal Care Products Council (PCPC) [19]. The British Cosmetic, Toiletry and Perfumery Association (CTPA) also launched the consumer information website "The Facts About", which focuses on cosmetic science, safety, ingredients and regulation. Recently, Cosmetics Europe launched COSMILE Europe, a

European cosmetic ingredient database which helps European citizens easily find information on cosmetic ingredients [20]. Nonetheless, there is no platform available to the consumer with information based on up-to-date scientific literature, carefully analyzed by scholars, in order to guarantee that the contents are written in an unbiased way. Thereby, the Pharmaceutical Technology Laboratory of the Faculty of Pharmacy, University of Porto (FFUP), supported on the in-house academic knowledge and experience, launched the "Portal *infoCosméticos*" (PiC). This user-friendly website was designed to promote literacy regarding cosmetic ingredients and products, and to provide answers to consumers' most frequent questions in a scientifically correct and neutral way. PiC's main mission is to provide information that empowers both consumers to make safe and informed cosmetic choices, and health professionals, as an assistant tool in cosmetic counselling, providing validated information supported by up-to-date scientific evidence. In this paper, the methodology used in the elaboration of the contents is explained, as well as the data regarding the consultation of the website.

Materials and Methods

PiC is an educational project that uses clear language, succinct content and infographics conceptualized by students, researchers, university professors, pharmacists, designers, web designers and communication experts.

Initially, a collection of the most pertinent and controversial topics related to the cosmetology field is performed by consulting blogs, social media and social networks. The first step consists of assigning a question to a team member, recent graduate or student of the Integrated Master in Pharmaceutical Sciences enrolled in this project, who is responsible for developing the published contents. Subsequently, the texts are submitted to a linguistic revision process carried out by students of the Master in Linguistics of the Faculty of Arts of the University of Porto. Simultaneously, the designer proceeds with the creation of the respective infographics. On this website, the questions are subdivided into four distinct categories: safety and efficacy, regulation,

ingredients, and cosmetic products. The answer to the assigned question and the respective infographic are sent to scholars holding a PhD, from national and international universities, with teaching and research experience in Cosmetology and related areas such as Dermatology, Toxicology, Regulatory Affairs, Pharmaceutical Technology, among others, and by professionals from the National Authority of Medicines and Health Products (INFARMED), responsible for supervising cosmetic products in Portugal. When the appointed scientific reviewer completes the task, the editors must make the necessary changes and, finally, the P/C coordinator performs the harmonization of the prepared content (Figure 2).

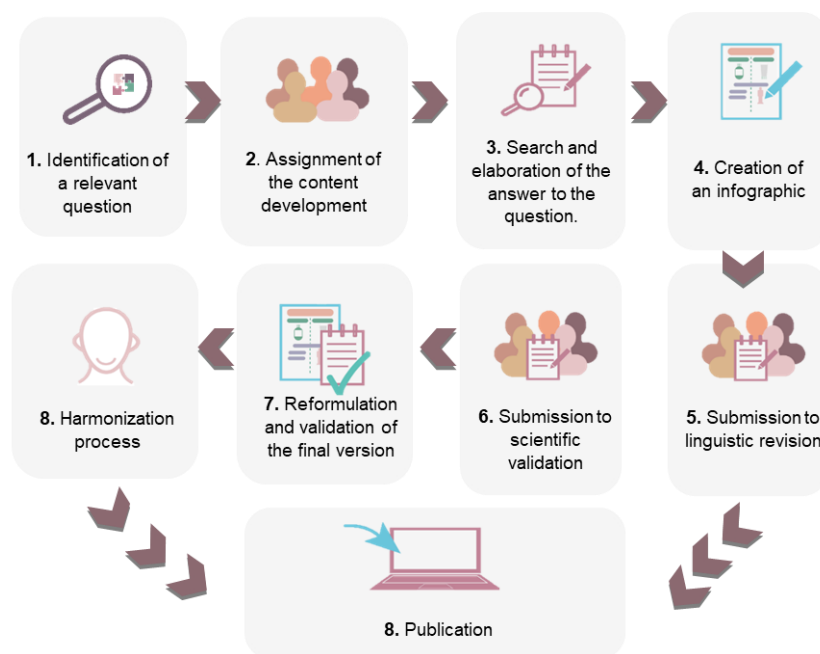


Figure 2: Summary diagram of the elaboration process of the answers to the named questions, from their genesis to publication. Based on the scheme presented at the international congress "COLAMIQC 2023"

This scientific review process takes an average of 3 to 5 months. Each of the published issues includes hyperlinks to complementary information sources that not only help the understanding of the published content, but also allow consumers or professionals who want to deepen their knowledge on a particular topic to access reliable sources quickly and directly. On the website, the P/C's current collaborators are displayed, from editors to scientific and linguistic reviewers,

as well as institutional partners. The website is associated with Google Analytics tool, that allows the analysis of demographic, geographic and preferred content from P*IC*'s visitors.

Results and discussion

P*IC* has recorded over 170,000 views since its debut in 2017, until March 2023 (Figure 3). The purpose of P*IC*'s first year of operation was to increase awareness of this new tool throughout the community. As a result, there was an approximately 8-fold increase in views in the following year. In 2019 and 2020, which were partially covered by the COVID-19 pandemic scenario, a decrease in the number of visits to the website was denoted. However, in 2021 views not only recovered, but exceeded those of 2019, and remained at about the same number in 2022. Until May 2023, there were already registered a little less than half of the visits recorded in 2022.

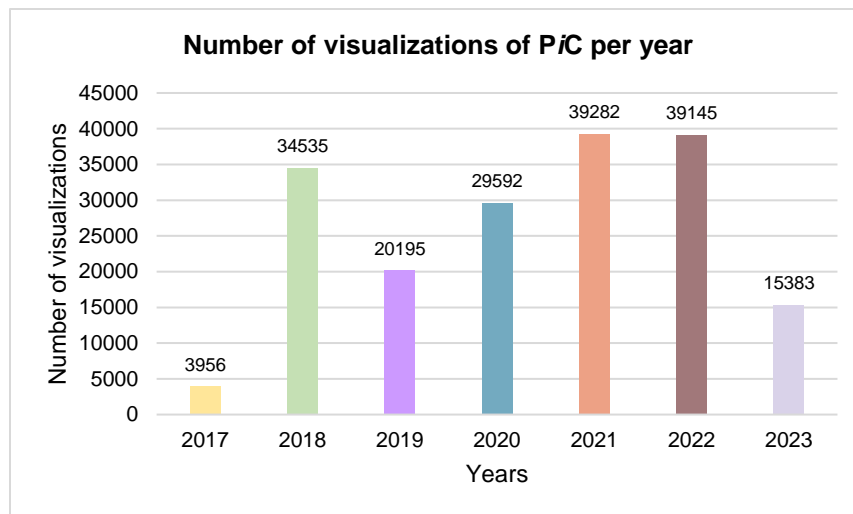


Figure 3: Number of views of Portal *infoCosméticos* contents, per year, since its debut.

To date, 46 questions have been published across the 4 categories addressed on the website: cosmetic products, ingredients, regulation, and safety and efficacy. The year with a higher number of questions published was 2018, followed by 2019, with 14 and 10 questions published, respectively (Figure 4). However, these years did not match the years with the highest number of visits (Figure 3). On the other hand, 2021, one of the years with a lower number of new articles published (3 questions published), corresponds to the year with the highest number of recorded

views. This means that a higher number of published questions does not necessarily translate into a higher number of views.

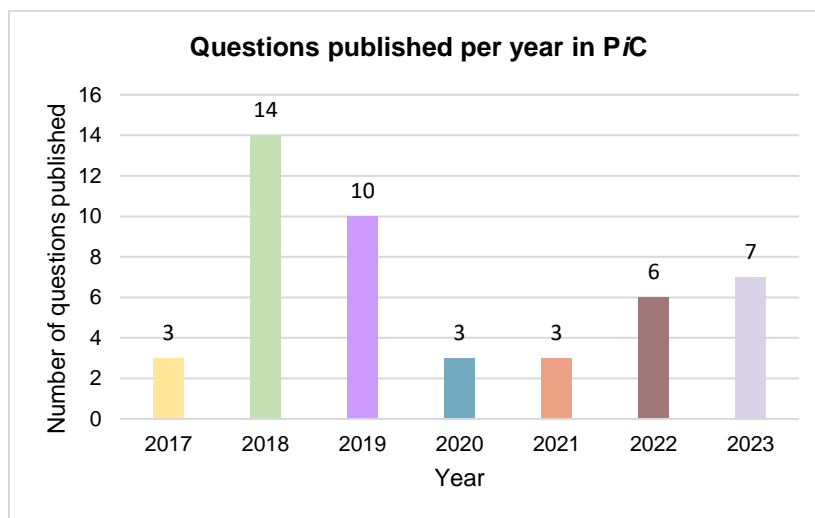


Figure 4: Questions published in Portal *infoCosméticos*, per year, since its debut until 29th May, 2023.

All the questions that have been posted thus far on the Portal *infoCosméticos* are included in TABLE I, along with the categories and subcategories that they fall under. According to the main categories, the tabs relating to "Safety and Efficacy" and "Cosmetic Products" are the ones with the most questions published - 14 questions in each - followed by the category "Cosmetic Ingredients", with 9 questions published, and "Regulation", with 8.

TABLE I: Questions published in Portal *infoCosméticos* until May 2023, by category.

Questions	Categories			
	Regulation	Safety and Efficacy	Ingredients	Cosmetic Products
Are cosmetic products and ingredients tested on animals?	•			
What inorganic sunscreen's filters can be found in cosmetic products?	•		•	
What is the shelf life of a cosmetic product?	•			
Are nanomaterials allowed in cosmetic products?	•	•		

How are cosmetic products circulating on the market supervised?	•		
What information can I get from the labeling of a cosmetic product?	•		
What are the main changes introduced by the European regulation that fully entered into force in 2013?	•		
Is the place where I buy the cosmetic product relevant to its safety?	•		
How should cosmetic products be stored?		•	
Are the preservatives used as an alternative to parabens safe?		•	
What does the "non-comedogenic" claim on cosmetic products mean?		•	
Is applying gel polish or gel varnish to the nails responsible for increasing the risk of skin cancer?		•	
Are organic cosmetics safer?		•	
What are the main allergens contained in cosmetic products?		•	
Can lipsticks be hazardous to human health?		•	•
Are ammonia-free hair dyes safer?		•	•
Are nanomaterials safe for use in cosmetic products?		•	•
Are exfoliating scrubs with polyethylene (microplastic) beads dangerous?		•	
What is the ideal pH of a cosmetic product?		•	
Is sodium lauryl sulfate, a common ingredient in shampoos, toxic?		•	
Who should I inform about the undesirable effects associated with the use of cosmetic products?		•	
Is the use of formaldehyde in cosmetic products safe?		•	
What are the typical constituents of a nail polish?		•	
What are the main ingredients of a sunscreen?		•	•
What are the ingredients responsible for the color of hair dyes?		•	
What types of ingredients are used in cosmetic products?		•	
What is the function of alpha-hydroxy acids in cosmetic products?		•	
Are preservatives known as parabens allowed in cosmetic products?	•	•	
How can I identify the function of a cosmetic ingredient?		•	
What are sulfate-free shampoos?		•	
Do baby cosmetics have "perfume"?			•
What is the difference between a shampoo and a shower gel?			•
What is keratin straightening?			•
Do hair products have a Sun Protection Factor?			•
What are the differences between a matte lipstick and a glossy lipstick?			•

What is the composition of a self-tanning product?	●	●
What are the ingredients of an anti-cellulite?	●	●
How to recycle cosmetic product packaging?		●
What is the constitution of an aftershave?		●
What is a serum?		●
What is a cosmetic product?		●
What types of hair dyes are there?		●
What is a 'salt-free shampoo'?		●
What is the composition of an after-sun product?		●
Is more effective a sunscreen with protection against UVA or UVB radiation?		●

Footnotes: ● principal category; • subcategory

Additionally, *Google Analytics* allows to perceive the most popular questions at any given time and, thus unveiling the most relevant subject to readers. The top 10 most viewed questions from *PiC* since its debut up to May 2023 were compiled (TABLE II). When comparing the number of questions in each category that rank in the top 10 with the corresponding number of views, it is clear that *PiC*'s audience is more interested in the categories of "Safety and Effectiveness," with a combined total of 21,400 views, and "Regulation," where 3 questions rank in the top 10 with a combined total of 18,027 views. Therefore, it appears that consumers are increasingly looking for science-based and reliable information regarding the safety associated with the use of cosmetic products and/or ingredients for their everyday life. Furthermore, consumers also want to understand basic concepts about the regulation of cosmetic products, whether they relate to the information on labels, such as shelf life, or about the credibility of the different market channels. Questions included in the "Ingredients" and "Cosmetic Products" categories also appear in this top 10, with a total of 9,296 and 8,524 views, respectively. Hereupon, it is evidenced the interest in understanding not only the composition and function of cosmetic products, but also of specific ingredients.

Considering the publication date, the question "Are ammonia-free hair dyes safer?" was the most accessed, with 6.9 average of visualizations per day, followed by "What is the shelf-life of

a cosmetic product?” and “What is the pH of a cosmetic product”, with 6.4 and 6.1 average visits per day, respectively.

TABLE II: Top 10 of the most viewed questions published in Portal *infoCosméticos*.

Questions	Period since publication (in days)	Number of visualizations*	Average of visits per day	Categories			
				Regulation	Safety and Efficacy	Ingredients	Cosmetic products
What is the shelf-life of a cosmetic product?	1729	11 056	6.4	●	●		
What is the pH of a cosmetic product?	1769	10 810	6.1		●		
Are ammonia-free hair dyes safer?	1293	8 872	6.9		●		
What is the composition of a shampoo?	1902	5 754	3.0				●
How can I identify the function of a cosmetic ingredient?	1742	4561	2.4			●	
What information can I get from the labeling of a cosmetic product?	1957	4208	2.2	●			
Are preservatives known as parabens allowed in cosmetic products?	1742	3242	1.9		●	●	
What is the function of alpha-hydroxy acids in cosmetic products?	1293	3 211	2.5			●	
What is the difference between a shampoo and a shower gel?	1293	2 800	2.2				●
How is the market supervision of cosmetics performed?	1957	2 763	1.4	●			

Footnotes: *since June 2023 (debut of PiC) until 29th May 2023; ● principal category; • subcategory

PiC has sought to enlighten consumers regarding the headline news published about cosmetics. Several PiC's contents specifically address concerns raised by alarmistic news (TABLE III). Regarding the possibility that the application of gel polish on the nails contributes to an increase in skin cancer, after a careful collection and analysis of all the scientific evidence published so far, it was concluded that there is no cause/effect relationship between the intensity and short time of exposure to radiation of the equipment used to harden the varnish and the development of cancer [21]. When it comes to the claim that lipsticks are harmful to human health, it has been demonstrated that all mineral oils are properly regulated by the European Commission (Europe) and INFARMED (entity responsible for the regulation of cosmetic products in Portugal), thus

ensuring the safety of the general public [22]. P/C also sought to demystify the misinformation regarding ammonia in hair dyes by explaining the opinion of the Cosmetic Ingredient Review's expert committee, which states this ingredient is safe if it is included in hair colouring products, in accordance with current recommendations [23]. This website also clarifies the bad reputation attributed to parabens and preservatives used to replace this group of ingredients, hence bringing awareness to the existence of Annex V of Regulation (EC) No 1223/2009. This annex includes all the preservatives that can be used in cosmetic products, as well as their maximum concentrations and conditions of use [24, 25].

TABLE III: Questions published in P/C answering the controversial headlines mentioned in Figure 1.

Questions	Number of visualizations	Categories			
		Regulation	Safety and Efficacy	Ingredients	Cosmetic Products
Applying gel nails/gel varnish is responsible for increasing the risk of skin cancer?	1506		●		
Can lipsticks be dangerous for human health?	725				●
Are ammonia-free hair dyes safer?	8 872		●		
Are the preservatives used as an alternative to parabens safe?	15		●		
Are preservatives known as parabens allowed in cosmetic products?	4561		●	●	

Footnotes: *since June 2023 (debut of P/C) until 29th May 2023; ● principal category; • subcategory

Google Analytics also provides information about the public who access the Portal *infoCosméticos*. Unsurprisingly, the majority of the website visitors are Portuguese speakers (Figure 5). In fact, the Portuguese-speaking community was the intended target audience for this website. Albeit in more residual numbers, there are also visitors whose sessions are held in English, via their browser's automatic translation feature. Even though the main language of P/C is intentionally Portuguese, so that the message can be properly understood by Portuguese individuals, in particular by those with lower language literacy, it is also important to provide

content in English, so that consumers, health and beauty professionals from other countries can use this tool.

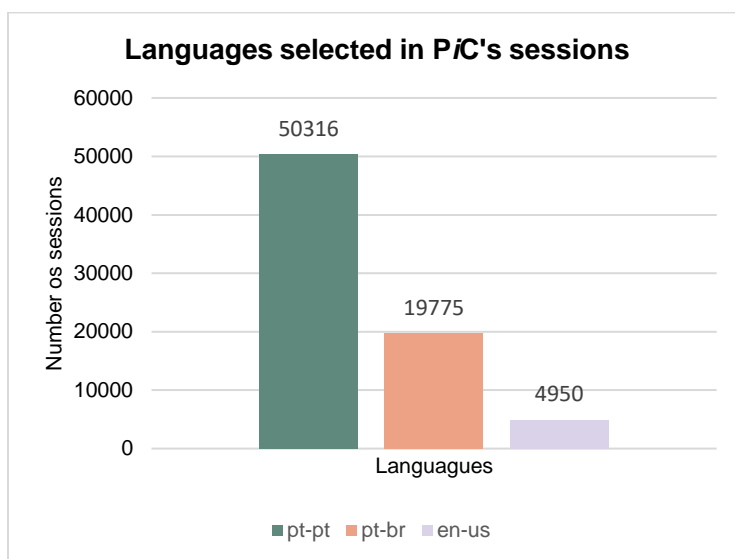


Figure 5: Top 3 most commonly used languages when visiting the Portal *infoCosmeticos*.

The audience between 25 and 34 years old presents the highest number of sessions in PiC, followed by those between 35 and 44 years old, and those between 18 and 24 years old (Figure 6). On the other hand, the audience over 65 years old displays the lowest number of sessions initiated at PiC. Accordingly, content dissemination by traditional media (such as radio, TV or the press), or even adoption of other strategies that allow individuals in this age group to access the information by providing, i.e. audio versions of the questions (for the visually impaired) may improve the awareness of the published contents among the older population. Furthermore, promotion in health service providers, namely pharmacies and health centers, is crucial not only to inform health professionals about PiC as a manageable tool to access reliable information

about cosmetic products, but also to encourage users to consult this platform by sharing the information.

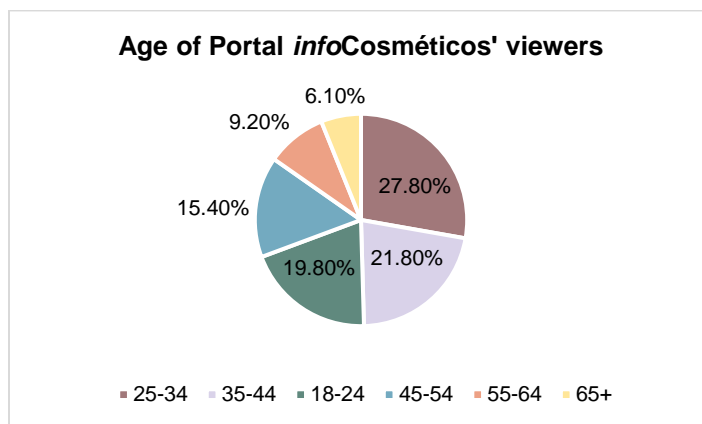


Figure 6: Age range of the viewers of Portal *infoCosméticos* until May 2023.

With the aim to publicize the existence of this platform across different age groups, PiC is not only present in academics media but also in mass media digital platforms, mainly relating to health and beauty, and occasionally in newspapers and Portuguese TV channels. PiC's promotion was also performed at scientific congresses both nationally, such as the 13th National Pharmacy Congress and Cosmetinov (2018), and internationally, such as COLAMIQC (2023). In this case, the goal was to make health and beauty professionals aware of the existence of a platform that can be useful for a quick and efficient resolution of questions that arise in the scope of skin care and counselling.

Conclusion.

Cosmetic products are an important part of people's daily lives. As a result of people's growing awareness regarding the importance of cosmetics for public health, the cosmetic industry has grown globally at an exponential rate. Although there is a plethora of information related to cosmetic products, much of it is neither supported by reliable scientific basis, nor free from commercial interests. PiC, conceived and created by the Laboratory of Pharmaceutical

Technology at FFUP, differs from blogs and websites about cosmetics because there is no other digital platform in Portuguese that provides clear, simple, objective, unbiased, scientifically proven contents, validated by scholars who are experts in Cosmetology. Through the data analysis performed by Google Analytics tool, it is clear among the 46 questions published at Portal *infoCosméticos* that the question “What is the shelf-life of a cosmetic product?” was the most visited question, followed by the “What is the pH of a cosmetic product?”, although “Are ammonia-free hair dyes safer?” was the most visited question considering the period of publication. These results reveal the consumer’s concerns regarding the safety of cosmetic products. According to the demographic and geographic analysis provided by Google Analytics, it was found that the population with the lowest percentage of sessions initiated on the website was the segment over 65 years, and that most website visitors consult the contents in Portuguese. With Portal *infoCosméticos*, Academia assumes a pivotal role in the education of the society concerning cosmetic products safety and efficacy, thus enhancing the benefits and safe use of cosmetics.

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Conflict of Interest Statement.

None.

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