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Influenza and COVID-19 vaccination intention in Portuguese adults from at-risk groups: a mixed-method study

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Abstract

Background Seasonal influenza and COVID-19 vaccines are critical for protecting at-risk populations, yet uptake remains suboptimal in some priority groups. This study aimed to identify psychosocial and structural factors associated with vaccination intention and hesitancy among Portuguese adults from high-risk groups, including older adults, individuals with chronic conditions, healthcare professionals, and pregnant women.

Methods A mixed-methods design was employed. A cross-sectional telephone survey applied to a probabilistic sample ($n=474$) assessed sociodemographic, psychological, and logistical predictors of intention to vaccinate against influenza and COVID-19 among older adults and individuals with chronic illnesses. Semi-structured interviews conducted with vaccine-hesitant healthcare professionals ($n=13$) and pregnant women ($n=10$) explored perceptions and experiences towards vaccination.

Results Survey findings showed moderately high intentions to vaccinate, with higher scores for influenza than COVID-19. Older age, worry, belief in vaccine safety and efficacy, and healthcare provider recommendations were positively associated with vaccination intention. Conversely, concerns about side effects, preference for natural immunity, and work-related barriers were negatively associated with vaccination intention. Interview data revealed ambivalence toward seasonal vaccines, particularly COVID-19, due to perceived rapid development and limited long-term data. Healthcare professionals often distinguished between seasonal and the national vaccination programme vaccines, mentioning low personal risk and side effects as reasons for hesitancy related to seasonal vaccines. Pregnant women emphasized concerns about fetal safety and the importance of clear healthcare providers recommendations.

Conclusions Psychosocial factors, including beliefs about disease severity and vaccine safety, play a central role in vaccination intention. Work-related structural barriers further contribute to hesitancy. These findings underscore the need for targeted communication strategies, healthcare providers engagement and employer-based vaccination programs to address both structural and motivational aspects of vaccination adherence within priority groups.

Keywords Vaccine hesitancy, Influenza, COVID-19, Older adults, Chronic illness, Healthcare professionals, Pregnant women, Portugal, Mixed-methods

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Background

Vaccine hesitancy refers to a delay in acceptance or refusal of vaccination despite the availability of vaccination services. Hesitancy occurs in a continuum that ranges from individuals who accept taking all vaccines, those who may accept vaccines but are unsure whether to take them or may accept some but not others, and those who refuse taking all vaccines [1]. Vaccine hesitancy is known to vary over time and depending on the type of vaccine, representing a state of ambivalence that usually reflects legitimate doubts and concerns about vaccination [2]. The literature reveals that factors such as health literacy, social norms, and having a doctor's recommendation seem to be consistently associated with intention to be vaccinated [2–5]. On the other hand, some of the main reasons cited for hesitating or refusing vaccination include fear of potential adverse effects, distrust of the vaccine's efficacy and safety, and lack of information about vaccines [5–9]. There are also factors such as risk perception, previous vaccination experiences and behaviors (e.g., taking the flu vaccine every year) and trust in the relevant institutions and authorities that can be associated with both vaccine intention and hesitancy, depending on their direction [2, 5–9].

Although vaccine hesitancy is not a new phenomenon, recent data shows considerable declines in vaccine confidence around the world, thus highlighting the importance of understanding the complexity of factors that influence vaccine acceptance and, consequently, vaccination intention and adherence [10, 11]. In the European Union (EU), the consensus on vaccine safety remains high, but perceptions of the importance, safety, and efficacy of vaccines decreased in all EU countries between 2020 and 2022 [12]. Within the EU, Portugal had the highest percentage of agreement across those indicators, a result that had already been observed in 2018 [12, 13]. Likewise, the country has been recognized as one of the few European countries to meet the coverage rate proposed by the World Health Organization for vaccinating older people against influenza [4, 14] and recorded one of the best vaccination coverage rates in the world for the first dose of COVID-19 vaccines [15]. Nonetheless, adherence to seasonal vaccination does not always reach desirable levels in specific target groups. This makes Portugal an interesting case study, as it allows to study factors that may allow to explain the high vaccination acceptance and coverage, while also studying factors that may help explain lower adherence in some high priority at-risk groups.

In Portugal, besides routine immunizations according to the National Immunization Plan (NIP)¹ that applies

to the whole population, it is recommended that certain priority groups get vaccinated against influenza and COVID-19 every year, such as healthcare professionals due to their activity and pregnant women due to their condition, although this is not required/mandatory [16]. However, despite the existing recommendation, it is known that the vaccination rate in these groups is lower than the vaccination coverage target of 75% and that figures have been declining. Data collected in the 2024/2025 vaccination season indicated that only 49.7% of healthcare professionals in direct contact with patients had taken the flu vaccine, while in the 2022/2023 season the rate was 52.6% [17, 18]. Concerning pregnant women, the vaccination coverage rate was 64.9% in 2024/2025, also lower than the 69.2% registered in 2022/2023 season [17–19]. This is also reflected in the international literature, where it is evidenced that even though many healthcare professionals show favorable attitudes toward vaccination, this group also has doubts about the efficacy, safety, and need for vaccines. Additionally, some show a level of distrust, especially in more recently developed vaccines, such as the COVID-19 vaccine, due to the speed of the development process [20–22]. As for pregnant women, the most commonly identified barriers to vaccination are related to concerns about the safety of the vaccine for themselves and the fetus, low-risk perception, doubts about the effectiveness of the vaccine, and the lack of recommendations by healthcare professionals [23, 24].

Older adults and people with chronic illnesses are also considered priority groups due to increased risk factors and tend to display higher levels of adherence. Nevertheless, seasonal influenza vaccination coverage rates in older adults in Portugal have declined from 76% in 2021–2022 to 73% in 2022–2023, and to 66% in 2023–2024, although part of this decline may be attributed to a change in the age-based recommendation in 2023–2024 [25]. Also, data from 2023 to 2024 season indicates that COVID-19 vaccination coverage was lower than in previous years and below the target set by the WHO [26]. Studies demonstrate that sociodemographic characteristics (e.g., educational level) and psychosocial variables (e.g., subjective norms) have an impact on seasonal vaccination willingness and vaccine uptake for older people [27, 28], but it is necessary to understand the factors that

¹ The NIP includes: HBV vaccine - against hepatitis B; DTPaHibVIPVHB hexavalent vaccine - against diphtheria, tetanus, whooping cough, invasive

disease by *Haemophilus influenzae* type b, polio, hepatitis B; Pn20 vaccine - against infections due to *Streptococcus pneumoniae* of 20 serotypes; Pentavalent DTPaHibVIP vaccine - against diphtheria, tetanus, whooping cough, invasive disease by *Haemophilus influenzae* type b, polio; Td vaccine - against tetanus and diphtheria; VASPR vaccine - against measles, epidemic mumps and rubella; MenB - against invasive disease by *Neisseria meningitidis* B; MenC vaccine - against invasive disease by *Neisseria meningitidis* C; HPV9 vaccine - against infections by 9 genotypes of human papilloma virus. Currently BCG (vaccine against tuberculosis) is a vaccine that belongs to the national vaccination program for risk groups. Risk assessment and BCG vaccination are carried out in public health centers.

influence the intention to get vaccinated among the different target groups in order to design effective intervention strategies to increase vaccination coverage [8]. This involves identifying the beliefs, motivations, and concerns that influence vaccination decision-making, as well as an in-depth exploration and understanding of the drivers of vaccine hesitancy.

This study aim was to assess theoretically-grounded factors associated with the intention to be vaccinated and vaccination hesitancy against seasonal influenza and COVID-19 among members of groups facing higher risks due to the potential severe outcomes from these vaccine-preventable diseases. The specific objectives were two-fold: 1) to investigate associations between seasonal vaccination intention - i.e., influenza and COVID-19 - with theoretically supported psychological and sociodemographic factors in priority groups for seasonal vaccination; 2) to explore the perceptions and vaccination experiences on seasonal vaccination among vaccine-hesitant individuals, namely among healthcare professionals and pregnant women, as despite they are central to seasonal vaccination efforts and influential in shaping vaccination behaviors, adherence to seasonal vaccination remains lower than desirable in these two groups.

Method

Study overview

A convergent mixed-method study, comprising a cross-sectional survey and semi-structured interviews, was carried out. The first part (survey) had a quantitative nature and was based on a survey administered by telephone. The second part (interviews) consisted of a qualitative study with healthcare professionals and pregnant women. This design was chosen to provide a comprehensive understanding of intentions and hesitancy toward seasonal vaccination. Quantitative data allowed for the assessment of vaccination intentions and associated factors across a representative sample, while the qualitative component offered deeper insight into the contextual, and psychological dimensions underlying decision-making processes. This design enabled not only the measurement of patterns and associations but also the interpretation of the meanings and experiences that shape them among key groups (i.e., pregnant women and healthcare professionals).

The study was approved by the Ethics Committee of the Lisbon School of Nursing (process number 6143/2023) and all participants gave their informed consent before taking part. Participation in the studies was entirely voluntary, and no incentives were provided.

Part 1: survey

Participants

Participants were selected at random from a generated list of mobile phone numbers registered in Portugal (probability sampling). As virtually the entire adult population in Portugal has a mobile phone [29], this random selection strategy ensures a good representation of the Portuguese population. Inclusion criteria comprised residing in mainland Portugal,² being at least 18 years old, and belonging to a risk group for seasonal vaccination [i.e., fulfilling one or more of the following: being over 60 years old, being overweight, having a chronic illness (e.g., diabetes), having received a transplant, undergoing chemotherapy/radiotherapy treatments for cancer, being treated for an autoimmune disease, being pregnant]. The final sample was composed by 474 people.

Instruments

The questionnaire included two sections, one about the influenza vaccine and another about the COVID-19 vaccine.

Intention to be vaccinated against the flu and COVID-19 (dependent variables) were assessed at the beginning of each section by asking participants to rate their agreement level with the sentence “I intend to be vaccinated against [flu/COVID-19] before next winter”, on a scale ranging from 0 (“totally disagree”) to 10 (“totally agree”).

Also on a scale ranging from 0 (“totally disagree”) to 10 (“totally agree”), the following items assessed different theoretically-relevant psychological constructs regarding vaccination, including *general attitude* towards vaccination (“Vaccines are important to prevent diseases”), *worry* (“I am worried about getting the [flu/COVID-19]”), *perceived benefits* (“Getting the [flu/COVID-19] vaccine is important for my health”; “I believe that getting the [flu/COVID-19] vaccine is safe”), *perceived barriers* (“I worry about the side effects the [flu/COVID-19] vaccine may cause”; “I would rather get [the flu/COVID-19] than take the vaccine”), *social norms* (“My family and friends want me to get the [flu/COVID-19] vaccine”; “If the [flu/COVID-19] vaccine is recommended by my doctor, I will

² Mainland Portugal (excluding the two autonomous regions—the Azores and Madeira Islands) is officially divided into five administrative regions (NUTS II regions): North, Centre, Lisbon Metropolitan Area, Alentejo, and Algarve. The North and Centre are the country’s most industrialized regions and characterized by more colder temperatures throughout the year, compared to other regions. The Lisbon Metropolitan Area, which includes Portugal’s capital city and its surrounding municipalities, is a coastal and highly urbanized region with a strong concentration of services and financial activities, including the core governmental services, and characterized by mild temperatures, across the year. The Alentejo, located in the central-southern part of the country, is predominantly rural, characterized by extensive agricultural areas and low population density, and characterized by more seasonally extreme high and low temperatures, compared to other regions. Finally, the Algarve, situated along the southern coast, is characterized by a service-oriented economy largely driven by tourism and characterized by amene and warmer temperatures, compared to other regions.

get it”), *cepticism* (“The risks associated with COVID-19 have been exaggerated”) and *anticipated regret* (“I will regret if I don’t get the vaccine and end up getting [the flu/COVID-19]”). *Knowledge* about where to get vaccinated (“I know where I should go to get the flu vaccine”), and access dimension of *vaccination literacy* (“It is easy to find information about recommended vaccines for me and my family”) were also assessed.

Participants were also presented with a list of common *logistical barriers* (e.g., “It is difficult to get an appointment”, “I can’t take time off work”) and were asked to say if any of them made their vaccination process difficult (yes/no). The final section included questions on *sociodemographic* variables (i.e., sex, age, education level, nationality, place of residence, being a health professional), and *perceived health status* (“On a scale where 0 means ‘very poor’ and 10 means ‘very good’, how would you describe your health?”).

Procedure

The telephone survey was carried out between June and July 2023, by a specialized polling center, through a Computer-Assisted Telephone Interviewing (CATI). Respondents were informed about the purpose of the study, data protection and ethical issues, namely that all data was anonymous and would be kept in compliance with the applicable data protection legislation, that responses would be analyzed in an aggregate way, and that participation was voluntary and hence participants could choose not to answer to specific questions and withdraw from the study at any time. After respondents provided their consent to take part in the study, a few screening questions were made to assess their eligibility. The first screening question asked if participants were 60 years old or older. Those who replied no, were asked if they were over 18 years old and had any of the following conditions: diabetes, obesity or underweight, chronic lung disease, neurological disease with suppression of respiratory function, chronic liver disease, cardiovascular disease, chronic kidney disease, if they had a transplant, if they had an active cancer or were undergoing chemotherapy or radiotherapy at the time, if they were undergoing treatment for autoimmune diseases (such as rheumatoid arthritis, lupus, multiple sclerosis, HIV, or certain inflammatory bowel diseases), or if they were pregnant. If they replied yes to any of the screening questions, the survey was applied, otherwise they were informed they did not meet the eligibility criteria for participation and were thanked for their collaboration. The survey took approximately 10 min to complete.

Data analysis

Responses were analyzed using IBM SPSS 28 (IBM Corp. Released 2020. IBM SPSS Statistics for Windows, Version

28.0.1.1). The sample was described through descriptive statistics. T-tests for independent samples and one-way ANOVA were used to examine associations between sociodemographic variables and the intention to get vaccinated. Intention to be vaccinated variables were also recoded into three categories following the same procedure as in Sherman et al. [30] (i.e., very unlikely to get vaccinated [vaccine refusal; values 0–2]); uncertain about getting vaccinated [vaccine hesitancy; values 3–7]; very likely to get vaccinated [vaccine adherence; values 8–10]), and the Chi-square Test for Independence was used to examine their associations with sociodemographic variables. Hierarchical multiple linear regression analysis was conducted to identify which sociodemographic, health-related, psychological, and logistic variables predicted the intention to get vaccinated against influenza and COVID-19. The significance level considered was $p = .05$.

Part 2: interviews

Participants

Healthcare professionals were recruited through a snowball sampling technique via professional non-profit organizations, namely the Portuguese Society of Lifestyle Medicine and the Portuguese Association of Primary Healthcare Nurses. The study was also disseminated through the research team’s personal and professional networks, who were also asked to further share the study with other healthcare professionals.

Pregnant women were recruited through nine organizations: two pre- and post-natal care centers, a perinatal care center, two private and one non-profit social solidarity institution dedicated to supporting pregnant women, a non-profit human rights association for pregnancy and childbirth, one private social solidarity institution dedicated to family planning and intervention, and one platform with free educational content and events on parenting and family well-being. Participants were also encouraged to share the questionnaire with other pregnant women they knew.

The inclusion criteria considered in this study were: belonging to one of the target groups (i.e., pregnant women or healthcare professionals), being 18 years old or older, speaking Portuguese or English, living in Portugal, and showing vaccine hesitancy. To verify this last criterion, those willing to take part in the study were asked whether they had ever postponed or refused vaccination, and whether they intended to get vaccinated against influenza and COVID-19, according to the recommendations for 2023/2024. If the answer to the first question was “yes” and/or to the second question was “no” or “I haven’t decided yet”, individuals were selected to take part in the study. A total of 23 people took part in study 2, which consisted of semi-structured interviews with

healthcare professionals ($n=13$) and pregnant women ($n=10$).

Instruments

The interview scripts were based on the topics included in the Manual on Behavioral and Social Factors of Vaccination published by the WHO [31]. These included questions regarding: (1) their perceptions around vaccine benefits and concerns; (2) whether they considered COVID-19 pandemic had an impact on their attitudes towards vaccines; (3) what factors they considered to have an impact on their decision-making regarding vaccination (including being a healthcare professional or being pregnant), and (4) what they thought could help them choosing to be vaccinated (including what key messages could be included in communication specifically targeting healthcare professionals/pregnant women).

Procedure

The recruitment started in June 2023. Those who showed interest in participating were asked to fill out a short form to ensure they fulfilled the eligibility criteria and to provide their contact information for the scheduling of the interviews. Participants were contacted individually by telephone or email to schedule the interview and were asked to complete the consent form and a brief sociodemographic questionnaire. Online video, semi-structured interviews, were carried out between September and

December 2023, through Microsoft Teams platform or Zoom (for one participant), with the exception of one participant whose camera did not work (in this case the interview was only made through audio). At the beginning of each interview, permission to record the audio for transcription purposes was requested and information about the objectives of the study, as well as about its voluntary, anonymous, and confidential nature were reminded. The average length of the interviews was approximately 26 min.

Data analysis

Interviews were transcribed using the NVIVO program. Thematic analysis [32] was followed for analyzing the data in MaxQDA software. Data were analyzed according to the principles of thematic analysis, since it is a qualitative analytic method that provides a systematic approach for identifying, analyzing, and reporting patterns of meaning (themes) across a qualitative dataset. A bottom-up approach to coding was followed, with no codes/themes being established a priori. After a first step of familiarization with the data through transcribing the interviews verbatim and reading the transcripts several times, initial codes were created to capture relevant aspects in the data. Initial codes were then examined for identifying patterns in the data – i.e., similar information shared by several participants, if not all – and were grouped to form broader categories/initial themes. To ensure the consistency of the analysis, a codebook of themes and codes was developed, providing definitions and illustrative examples for each one. Initially generated themes and corresponding codes were revised at this stage to ensure the themes captured the most relevant features of the data while maintaining its nuances. The main analysis was performed by one of the authors (JH), who is a trained psychologist holding a Master Degree in Social Psychology of Health, with previous experience in doing qualitative research. All codings were then validated by other two, more senior authors (CG and RF), who hold PhDs in Health Psychology and Psychology, respectively, and who have extensive experience in doing qualitative research. These discussions allowed to further refine the coding structure and reach consensus on the coding applied and on the final main themes: general perceptions about vaccination; specific perceptions about Influenza and COVID-19 vaccination; motivating factors; accessibility. Quotes from participants are used to illustrate the identified themes.

Results

Part 1: survey

The sample consisted of 474 older adults and individuals with chronic illnesses, aged between 18 and 97 years ($M = 62.62$; $SD = 13.9$). As can be seen in Tables 1 and 52.1%

Table 1 Survey participants' characteristics ($N=474$)

	<i>n</i>	%
Sex		-
Male	227	47.9
Female	247	52.1
Age, years ($M=62.62$; $SD=13.9$)		-
Educational level		-
Unfinished first cycle of basic education (4th grade)	19	4.0
First cycle of basic education (4th grade)	77	16.2
Second cycle of basic education (6th grade)	43	9.1
Third cycle of basic education (9th grade)	74	15.6
Secondary education (12th grade)	133	28.1
Higher education (university degree)	128	27.0
Nationality		-
Portuguese	461	97.3
Other	13	2.7
Area of residence		-
North	120	25.3
Center	112	23.6
Lisbon Metropolitan Area	185	39.0
Alentejo	35	7.4
Algarve	22	4.6
Health Professional		-
Yes	26	5.5
No	448	94.5

of participants were female [the same proportion found in the general population [33], 28.1% had completed secondary education, 39.0% lived in the Lisbon Metropolitan Area, and 97.3% were Portuguese.

The intention to get vaccinated against influenza was moderately high ($M=6.66$; $SD=4.09$) and slightly higher than the intention to get vaccinated against COVID-19 ($M=6.24$; $SD=4.07$) (see Supplementary Tables 1 and Supplementary Table 2). Adults aged 35–44 years showed higher refusal levels for both the vaccine against influenza ($\chi^2_{(14, 474)}=33.04, p=.003$) and COVID-19 ($\chi^2_{(14, 469)}=27.43, p=.017$). On the other hand, people in the 75–84 age group showed a significantly higher intention and lower refusal to get vaccinated against both viruses. Vaccination intentions against influenza were also higher in the North region ($M=7.50$; $SD=3.71$) as compared to the Algarve ($M=5.14$; $SD=4.09$), $p<.03$, but no differences across regions were registered for COVID-19. No significant differences by gender, level of education or nationality were found in the intention to take both seasonal vaccines.

Summary results of the multiple linear regression predicting influenza and COVID-19 vaccination intentions are shown in Tables 2 and 3. For the former, the final model was statistically significant ($F_{(21, 452)}=13.98$; $p<.001$), and accounted for 36.6% of the explained variance. Results showed that being concerned about getting the virus ($\beta=0.379, p<.001$) and believing the vaccine is important to one’s health ($\beta=0.239, p<.001$) positively and significantly impacted participants’ intention to get vaccinated against influenza. In contrast, knowing where to go to be vaccinated ($\beta= -0.195, p<.001$), having had side effects ($\beta= -0.138$; $p<.001$), preferring to get the flu instead of being vaccinated ($\beta= -0.124$; $p=.008$), and having to miss work to be vaccinated ($\beta= -0.107, p=.007$) negatively predicted the intention to get vaccinated.

For COVID-19 vaccination, the final model was also statistically significant ($F_{(23, 449)}=12.29$; $p<.001$), accounting for 35.5% of the explained variance. Besides being of older age ($\beta=0.120$; $p=.003$), the vaccine being recommended by the doctor ($\beta=0.259$; $p<.001$), believing that taking the booster shot for COVID-19 is safe ($\beta=0.198$; $p<.001$), having taken the flu vaccine ($\beta=0.187$; $p<.001$),

Table 2 Full linear regression model analyzing associations with vaccination intention against flu (adjusted $R^2=36.6$)

	Mean	SD	95% CI	β	p-value	% of variance explained
Bloc 1: Sociodemographic variables						
Sex (reference category: male)	-	-	-	0.037	0.325	0.13
Age	62.57	14.08	[61.41, 63.73]	0.061	0.145	0.28
Bloc 2: Health-related variables						
Perceived health status	7.01	2.02	[6.84, 7.18]	-0.007	0.859	0.00
Having taken vaccine against COVID-19	-	-	-	0.002	0.962	0.00
Bloc 3: Beliefs regarding flu and flu vaccine						
Vaccines are important to prevent diseases	9.20	1.46	[9.05, 9.31]	0.024	0.548	0.05
I am worried about getting the flu	7.11	3.04	[6.81, 7.37]	0.379	<0.001	10.37
Getting flu vaccine is important for my health	7.47	3.24	[7.09, 7.69]	0.239	<0.001	2.92
I believe that getting the flu vaccine is safe	8.22	2.67	[7.90, 8.40]	0.031	0.454	0.07
I worry about the side effects the flu vaccine may cause	5.48	3.61	[5.21, 5.86]	-0.138	<0.001	1.66
I would rather get the flu than take the vaccine	4.20	4.06	[3.90, 4.63]	-0.138	<0.001	1.56
My family and friends want me to get the flu vaccine	5.90	4.01	[5.56, 6.28]	0.084	0.029	0.64
I will regret if I don't get the vaccine and end up getting the flu	6.50	3.78	[6.11, 6.81]	0.058	0.245	0.18
If the flu vaccine is recommended by my doctor, I will get it	8.46	2.78	[8.15, 8.66]	0.114	0.018	0.76
Bloc 4: Knowledge and vaccination literacy						
I know where I should go to get the flu vaccine	9.28	1.98	[9.08, 9.44]	-0.195	<0.001	1.88
It is easy to find information about recommended vaccines for me and my family	7.81	2.89	[7.57, 8.05]	0.035	0.345	0.12
Bloc 5: Logistic barriers/convenience (reference category: no)						
It is difficult to get an appointment	-	-	-	0.043	0.282	0.15
The vaccine is not always available	-	-	-	0.072	0.062	0.46
It is difficult for me to get to the vaccination site	-	-	-	-0.022	0.573	0.04
The vaccination schedule is not convenient	-	-	-	-0.028	0.467	0.07
The waiting time is long	-	-	-	-0.013	0.754	0.01
I cannot miss work	-	-	-	-0.107	0.007	0.98

Table 3 Full linear regression model analyzing associations with vaccination intention against COVID-19 (adjusted R² = 36.6)

	Mean	SD	95% CI	β	p-value	% of variance explained
Bloc 1: Sociodemographic variables						
Sex (reference category: male)	-	-	-	0.040	0.290	0.15
Age	62.57	14.08	[60.63, 63.34]	0.120	0.003	1.23
Bloc 2: Health-related variables						
Perceived health status	7.01	2.02	[6.83, 7.21]	0.011	0.764	0.01
Having taken vaccine against flu	-	-	-	0.187	<0.001	2.96
Bloc 3: Beliefs regarding flu and flu vaccine						
Vaccines are important to prevent diseases	9.20	1.42	[9.05, 9.32]	0.077	0.042	0.56
I am worried about getting COVID-19	7.58	3.29	[7.31, 7.92]	0.041	0.300	0.14
The risks associated with COVID-19 have been exaggerated	6.01	3.36	[5.79, 6.40]	-0.033	0.403	0.10
Getting COVID-19 vaccine is important for my health	7.65	3.27	[7.29, 7.91]	0.042	0.281	0.16
Getting COVID-19 vaccine helps to protect my family	8.04	3.10	[7.70, 8.28]	0.087	0.038	0.59
I believe that getting the COVID-19 vaccine is safe	7.81	3.09	[7.52, 8.10]	0.198	<0.001	2.96
I worry about the side effects the COVID-19 vaccine may cause	6.19	3.47	[5.84, 6.48]	-0.028	0.461	0.07
I would rather get COVID-19 than take the vaccine	3.59	4.00	[3.23, 3.97]	-0.281	<0.001	6.81
My family and friends want me to get the COVID-19 vaccine	6.16	3.96	[5.87, 6.60]	0.038	0.334	0.13
I will regret if I don't get the vaccine and end up getting COVID-19	6.95	3.71	[6.60, 7.29]	0.105	0.007	1.00
If the COVID-19 vaccine is recommended by my doctor, I will get it	8.28	2.99	[7.91, 8.48]	0.259	<0.001	5.76
Bloc 4: Knowledge and vaccination literacy						
I know where I should go to get the COVID-19 vaccine	9.17	2.06	[8.98, 9.36]	-0.028	0.487	0.07
It is easy to find information about recommended vaccines for me and my family	7.81	2.89	[7.52, 8.06]	0.025	0.510	0.06
Bloc 5: Logistic barriers/convenience (reference category: no)						
It is difficult to get an appointment	-	-	-	0.047	0.244	0.18
The vaccine is not always available	-	-	-	0.055	0.151	0.28
It is difficult for me to get to the vaccination site	-	-	-	0.007	0.857	0.00
The vaccination schedule is not convenient	-	-	-	0.003	0.935	0.00
The waiting time is long	-	-	-	0.000	1.00	0.00
I cannot miss work	-	-	-	-0.105	0.010	0.92

that one may regret not being vaccinated ($\beta=0.105$; $p=.007$), that vaccines are important to prevent diseases ($\beta=0.077$; $p=.042$), and one's family members ($\beta=0.087$; $p=.038$) positively and significantly impacted participants' intention to get vaccinated against COVID-19. Once again, preferring to get COVID-19 instead of being vaccinated ($\beta= -0.281$; $p<.001$) and having to miss work to be vaccinated ($\beta= -0.105$; $p=.010$) were negatively associated with the intention to get vaccinated.

In the hierarchical regression analyses, variables were entered in sequential blocks to examine their incremental contribution to explaining intention to receive the influenza and the COVID-19 vaccines. The first block, which included sociodemographic characteristics (age and sex), accounted for a small but statistically significant portion of the variance (for influenza vaccination: Adjusted R² = 0.031; $p<.001$; for COVID-19 vaccination: Adjusted R² = 0.040; $p<.001$). The addition of Block 2, which included prior COVID-19 vaccination status and self-rated health, led to a minor increase in explained variance in influenza

vaccination intention (Adjusted R² = 0.035), but this change was not statistically significant ($p=.115$), whereas prior vaccination against influenza and self-rated health led to a significant increase in explained variance in COVID-19 intention (Adjusted R² = 0.137; $p<.001$). Block 3, which included general vaccination beliefs and attitudes toward influenza and COVID-19 vaccination, resulted in the most substantial increase, raising the Adjusted R² to 0.358 ($p<.001$) in the case of influenza vaccination and to 0.351 for COVID-19 ($p<.001$). This indicates that psychosocial factors were strongly associated with vaccination intention. In the final step, the inclusion of logistic barriers related to vaccination (Block 4) led to a modest, non-significant increase, both for influenza vaccination (Adjusted R² = 0.366, $p=.090$), and for COVID-19 (Adjusted R² = 0.355, $p=.090$), suggesting that these additional variables did not contribute meaningfully beyond general vaccination attitudes and beliefs. The overall model fit improved with each step, although only the changes introduced in Block 1, in Block 2 (only

for COVID-19) and especially Block 3, reached statistical significance for both vaccines.

Part 2: interviews

Healthcare professionals

The first group of participants included 13 vaccine hesitant healthcare professionals of Portuguese nationality, aged between 27 and 66 ($M = 42$; $SD = 13.54$). The majority were women ($n = 10$) and almost all the participants were nurses, except for a nutritionist (working in a hospital, an at-risk setting), a pharmacist, and a doctor. In terms of vaccination, five had taken the influenza vaccine a few times and five had been fully vaccinated against COVID-19, with one or more booster doses. Please see Table 4 for additional sociodemographic and health-related characterization.

Perceptions about vaccination In general, the participants considered vaccination to be effective and extremely important in terms of individual and community protection, achieved through the control of several communicable diseases. However, it was possible to discern a distinction made by the participants between the vaccines recommended in the National Immunization Program (NIP) and seasonal vaccination. This was reflected in their decision-making process, which was guided by habit regarding vaccines that have been available for longer and more deliberate for recent and/or seasonal vaccines, the latter being the main cause of hesitancy among participants.

“These new vaccines that are coming out [referring to the COVID-19 vaccine], I’m always a bit reticent because they’re new. We don’t really know what consequences they might have in the future, whereas these vaccines that we’re currently using as part of the National Vaccination Plan, we’ve been using them for many years.” (Participant P11).

Influenza vaccination Only two participants said they took the influenza vaccine every year, to protect themselves given the high exposure they have in their professional practice. Another participant shared that she had taken the vaccine for the first time that year for the same reason, but also because of a greater risk perception associated with her age. At the same time, two participants said they had only taken the influenza vaccine once, partly because of an allergic reaction and of the side effects experience, which they considered worse than the influenza symptoms.

“I’ve only had the flu vaccine once. It was in a hospital setting, at a time when there was a lot of flu going around — it was during the outbreak of swine flu,

the H1N1 flu. But the truth is, I actually ended up feeling even worse.” (Participant P13).

The remainder said they did not consider taking this vaccine necessary because of their young age, because they were healthy, and because of the preventive behaviors they followed (e.g., wearing a mask).

“The truth is that, for example, if my tetanus vaccine were overdue, I would get it. But, for instance, when it comes to the flu vaccine, I usually end up not getting it — in general, I don’t tend to get the flu shot. I am a healthcare professional, but I think it’s more important for vulnerable and at-risk groups, such as older people or those with comorbidities or other relevant health conditions. Since I’m young, don’t have any associated illnesses, and thankfully don’t tend to get sick, I usually end up not getting the flu vaccine” (Participant P2).

COVID-19 vaccination All participants were initially vaccinated against COVID-19 for self-protection during their clinical practice, the protection of their family and friends, the perception of professional duty (i.e., setting an example as reference figures), and a sense of obligation created by the governmental restrictions. However, there was a considerable level of ambiguity concerning this vaccine, mainly due to the speed of the production process, the fact that its long-term effects are still unknown, and the adverse effects reported after vaccination by people close to them, by patients, or themselves. Even with this apprehension, half of the participants thought that the vaccine’s effectiveness was reinforced by its fundamental role in stopping the pandemic and that the benefits outweighed the risks.

“Of course, with the COVID vaccine, many people were very worried, myself included, because I thought at the time that the vaccine had been manufactured very quickly (...) In the long term we don’t know what this can still lead to.” (Participant P5).

Similar to the reasons reported for not taking the influenza vaccine, almost all participants said they did not intend to continue taking the COVID-19 vaccine because of their low-risk perception, which was associated with their younger age and good health status, and the decrease in prevalence and severity of cases, as well as the side effects experienced after taking the vaccine — especially when it affected their ability to work.

“I took both Pfizer shots, I don’t regret it because it [the virus] was unknown and our biggest enemy is what we don’t see. I didn’t take the booster. And if

Table 4 Sociodemographic characteristics of qualitative study participants (health professionals, n = 13; pregnant women = 10)

Health Professionals												
Age	Gender	Marital status	Educational level	Nationality	Health status (0 – Very bad, 10 – Very good)	Chronic illness	Vaccination up-to-date	Influenza vaccination	COVID-19 vaccination	+65 in the household	Minors in the household	
P1	47	Female	Civil partnership	Master's degree	Portuguese	8	No	Yes	Sometimes	Complete + boosters	Yes	Yes
P2	35	Female	Married	Master's degree	Portuguese	9	No	Yes	Never	Complete + boosters	No	Yes
P3	44	Female	Married	Master's degree	Portuguese	-	No	Yes	Never	Complete	No	Yes
P4	-	Female	Married	Master's degree	Portuguese	-	No	Yes	Sometimes	Complete + boosters	No	Yes
P5	30	Female	-	-	Portuguese	-	-	-	-	-	-	-
P6	63	Female	Married	PhD	Portuguese	-	No	Yes	Never	Complete + boosters	No	No
P7	-	Female	Civil partnership	Bachelor's degree	Portuguese	3	No	Yes	Never	Incomplete	No	Yes
P8	29	Female	Single	Master's degree	Portuguese	7	No	Yes	Never	Complete + boosters	Yes	No
P9	-	Female	-	-	Portuguese	-	-	-	-	-	-	-
P10	38	Female	Civil partnership	Bachelor's degree	Portuguese	9	Yes*	Yes	Sometimes	Complete	No	Yes
P11	27	Male	Single	Master's degree	Portuguese	7	No	Yes	Never	Complete	No	No
P12	66	Male	Divorced/separated	Bachelor's degree	Portuguese	8	No	Yes	Sometimes	Complete	No	No
P13	41	Male	Married	Master's degree	Portuguese	10	No	Yes	Sometimes	Complete	No	Yes
Pregnant women												
Age	Marital status	Educational level	Nationality	Chronic illness	Vaccination up-to-date	Influenza vaccination	COVID-19 vaccination	+65 in the household	Minors in the household			
G1	-	Single	Bachelor's degree	Mozambican	No	Yes	Sometimes	Never	Yes	No	Yes	
G2	-	-	-	-	-	-	-	-	-	-	-	
G3	28	Single	High school	Yes*	Yes	Never	Incomplete	No	Yes	No	Yes	
G4	-	Married	High school	No	Yes	Annually	Complete + boosters	No	Yes	No	Yes	
G5	-	Married	Bachelor's degree	-	No	Never	Complete	No	Yes	No	Yes	
G6	24	Single	High school	No	Yes	Sometimes	Complete + boosters	No	Yes	No	Yes	
G7	29	Married	Master's degree	Yes*	Yes	Never	Complete + boosters	No	No	No	No	
G8	29	Married	Master's degree	No	Yes	Sometimes	Complete + boosters	No	No	No	No	
G9	40	Married	Master's degree	No	Yes	Never	Complete + boosters	No	Yes	No	Yes	
G10	32	Married	PhD	No	Yes	Sometimes	Complete + boosters	No	No	No	No	

you ask me if I'm willing to receive one next year? At the moment, I'd say no." (Participant P13).

Motivating factors and accessibility When asked what factors might motivate them to start taking the seasonal vaccination systematically, participants mostly mentioned deteriorating health and older age.

"Only if I started to get sicker, more prone to infections, and my colds became more and more difficult to overcome. Maybe then I'd think about getting the vaccine." (Participant 9).

In addition, some participants highlighted the need for the dissemination of more scientific studies on the effects of the COVID-19 vaccine and providing more information on the benefits, risks, importance, efficacy, and side effects of seasonal vaccination.

"But, for instance, instead of having a QR code just for scheduling — which is already accessible through our emails and the staff intranet — it might be interesting to include a link to information about the vaccine. Even something like a brief information sheet that summarizes the risks and benefits, with validated information and bibliographic references. I think that would definitely be something that would make me — if the information presented there were favorable — more likely to get vaccinated." (Participant P8).

Finally, it should be noted that all participants considered the vaccination process to be convenient and accessible since it was carried out in the workplace. Except for one participant who said that the dates and times available could be extended, to make the process even easier for those who have work shifts, no one else revealed any difficulties in this regard.

"Yes, in the workplace, in that regard, no — they make things quite easy. Even at the care home, they always ask me if I'm interested in getting the vaccine. There really isn't any kind of barrier to access — no, none at all." (Participant P7).

Pregnant women

The second group included 10 women between the ages of 24 and 40 ($M=30.33$; $SD=5.39$), five of whom were still pregnant at the time of the interview (Table 4). The remaining women, who had had their babies between the time of recruitment and the time of the interview, were asked to refer back to the period of pregnancy to answer the questions. The babies of these women were 1 or 2 months old at the time of the interview. For most

participants ($n=8$) this was their first pregnancy. One of the other two was pregnant with her fourth child and the other was pregnant with her third child. Four participants were Portuguese, while the others were from Angola, Guinea-Bissau, Mozambique, and Brazil. In terms of vaccination, four had taken the influenza vaccine a few times and six had been fully vaccinated against COVID-19, with one or more booster doses.

Perceptions about vaccination In general, this group of participants believed that vaccination was important for the safety of the population in terms of protection against communicable diseases. Some participants even gave examples of outbreaks that were controlled in the past and the impact they had on people's lives to illustrate the effectiveness of vaccines.

"People have become more aware of the importance of vaccination. It's not just about going and getting a 'shot' and that's it, right? If vaccines didn't exist, probably many more people would die, and we would be much more limited — we wouldn't be able to do what we do." (Participant G8).

However, despite this mostly positive perception, it was possible to identify a gradient of hesitancy regarding some vaccines. There seemed to be a distinction between the vaccines included in the National Immunization Program and seasonal vaccines, the former being seen as more familiar and associated with a perception of greater safety. Even so, some participants shared that their main concern before taking vaccines during pregnancy was the potential impact on the fetus, a consideration they put to healthcare professionals before making the decision.

"The nurse explained to me that it was safe and that I wouldn't feel anything. And that it wouldn't hurt either the mother or the child." (Participant G3).

Influenza vaccination With the exception of one pregnant woman, none of the participants had taken the influenza vaccine during their pregnancy. Given their characteristics (e.g., younger age, being healthy), the flu was not perceived as being a risk to these women. For this reason, they believed there was no need to take the vaccine, which they believed was meant for older people and people with health conditions.

"I have never taken the flu vaccine, because, in fact, I have always associated it with being for very... specific people — that is, older people, or people who have certain illnesses, this or that." (Participant G7).

Two pregnant women also mentioned side effects as a factor preventing them from being vaccinated: one said she would not consider it after a bad experience and the other was afraid of developing flu symptoms after taking the vaccine during pregnancy.

“It’s usually a normal reaction when we take vaccines to have an adverse reaction. At the moment, being pregnant, I can’t take anything. I can only take paracetamol, which takes away the pain and doesn’t do anything else. So to risk taking the flu vaccine and developing flu or something like that... doesn’t make me feel comfortable at all.” (Participant G7).

COVID-19 vaccination The COVID-19 vaccine was the source of the most uncertainty among nearly all participants, both before and during pregnancy. This was mostly related to the speed of the production process. Associated with that, the participants considered that there were still few studies available on the vaccine, that there had been little clarification about it, and that the long-term effects were still unknown. One participant mentioned the role of the media as a cause for alarm and two participants spoke of economic interests as a cause for distrust regarding the vaccine. Furthermore, two participants mentioned serious side effects after taking the vaccine, which they attributed to it.

“Because even at research level, there was no certainty about the vaccines themselves. There were still no results. I think it’s one of the vaccines I’ve looked into the most.” (Participant G1).

Even so, almost all participants said they had taken the initial vaccination against COVID-19 despite their resistance. Some said they had done so to contribute to the common effort of achieving group immunity. Others mentioned a sense of obligation that arose from the pressure placed on the Portuguese population to be vaccinated to contain the pandemic and the restrictions that existed for those who were not vaccinated (e.g., not being able to enter certain establishments).

Motivating factors and accessibility When asked about their motivations for getting vaccinated during pregnancy, all the participants, without exception, mentioned the baby’s protection, which would be especially important during their first months of life (post-partum). Additionally, almost all the participants mentioned their protection against diseases, both in the short and long-term, and as a way of strengthening their immune system.

“Now we can’t just think about ourselves, we have to think that there’s another little person in the world.

Whenever possible it is best to protect and prevent.” (Participant G6).

Participants were unanimous in their opinion that more information should be made available to pregnant women about the benefits, side effects, and risks of taking and not taking vaccines. In line with this result, almost all participants focused on the relationship with the healthcare professionals who accompanied them during their pregnancy, especially their communication style and willingness to listen to them and answer their questions.

“People should get vaccinated, but first they should feel confident about the step they are taking. And that safety involves information.” (Participant G5).

Furthermore, the importance of having a doctor’s recommendation for vaccination was mentioned by all the participants. This seemed to be one of the main motivating factors for vaccination, due to the trust that the participants placed in these professionals. Conversely, the absence of a recommendation seemed to play a decisive role in these women’s hesitation and/or low adherence to vaccination, with several participants mentioning they had never been informed about the recommendation to take seasonal vaccination. In three cases, the issue was raised, but the healthcare professionals in question did not consider these vaccines to be necessary and advised the participants against it.

“If they [healthcare professionals] had told me that it was really important to take it [the vaccine] and that it would make a difference, I would have it.” (Participant G8).

Similarly to the group of healthcare professionals, it should be noted that participants did not mention any logistical barriers to scheduling vaccines or in terms of accessibility to administration sites (e.g., transportation). One participant reported constraints in scheduling the seasonal vaccination because she was unable to contact her health center, but the others considered this process to be easy.

Discussion

Having helped to control several infectious diseases, vaccination stands as a core tool to protect public health. Although vaccine hesitancy is not a new phenomenon, it has been increasing worldwide [34]. Recent reports show that vaccine confidence declined across the EU between 2020 and 2022, but Portugal stood out for maintaining its known trend of high vaccination levels [12, 13]. Nevertheless, adherence to seasonal vaccination in priority groups is not always optimal. Hence, this study main

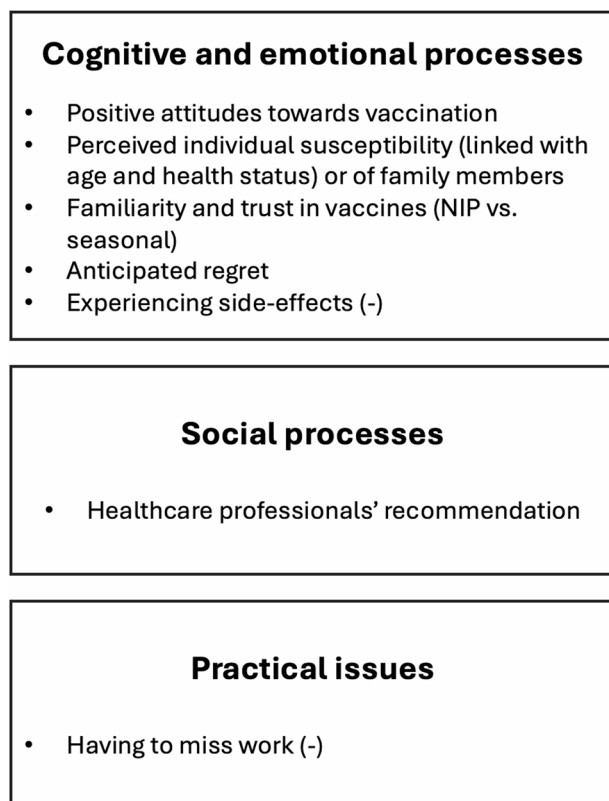


Fig. 1 Main factors associated with seasonal vaccination intentions. *Note.* (-) means that it is inversely associated with vaccination intentions

objectives were to determine sociodemographic and psychological factors associated with seasonal vaccine intention (i.e., influenza and COVID-19) among priority groups, including older adults and individuals with chronic conditions, and to further explore the perceptions and vaccination experiences among vaccine-hesitant healthcare professionals and pregnant women about seasonal vaccination. The main factors identified in both streams of the study are synthesized in Fig. 1.

Results from the quantitative part revealed that, on average, participants had a moderately high intention to get vaccinated against COVID-19, which was slightly higher for influenza. This is supported by the seasonal vaccination coverage reports showing lower-than-usual vaccination rates for people over 60 and a higher uptake for the influenza vaccine in comparison with COVID-19 [26]. This may reflect participants' ongoing uncertainty and ambivalence about COVID-19 vaccine that was apparent in the interviews with both healthcare professionals and pregnant women, rooted in concerns about its rapid development, limited long-term evidence and experiences with side effects. At the same time, an age pattern was detected, where younger people showed higher refusal, likely related to lower perceived risk by those who are younger and have a good health status, as highlighted in the interviews. On the contrary, older

people showed higher intention and lower likely refusal to get vaccinated. This age gap is amply reflected in the literature for both vaccines [5, 28] and was also highlighted as one of the most significant challenges in a recent European report about vaccine confidence in the EU [12].

Besides age, the country region was also found to be associated with levels of vaccination intention for influenza, with higher intention in the North region and lower intention and greater hesitancy in the Algarve region. This is in line with results from a previous study showing high-hesitancy clusters in the southwest of the country, namely in Algarve, that has been linked with a higher proportion of migrants in the region [35]. Vaccination status was also relevant in the case of COVID-19 vaccination, with having taken the flu vaccine before being positively associated with intention to take the COVID-19 vaccine, similarly to results from other studies [30].

With regard to factors associated with the intention to get vaccinated against influenza, beliefs regarding the disease and vaccine were the most relevant. Being concerned about getting the flu and the belief that the vaccine was important for own health were positive predictors. This is in line with results from previous studies [7], indicating that health concerns are a main motivator for vaccination intention. In fact, several studies have found that risk perception and positive attitudes regarding vaccination are key determinants of vaccine acceptance and refusal [2, 7, 8]. On the other hand, expressing worry about vaccine side effects and preferring to have the disease rather than taking the vaccine, which were two vaccination barriers commonly referred in the interviews, were also negatively associated with vaccination intentions against flu in the survey data. This suggests that some people may underestimate the risks of natural infection while overestimating the risk associated with suffering from side-effects from vaccination [36].

Knowing where to go to be vaccinated was associated with a lower intention to be vaccinated, which is apparently surprising, and suggests that is not a lack of information about vaccination sites that is responsible for increased vaccination hesitancy. This is consistent with results of previous studies showing that knowledge is not sufficient for changing vaccination behaviour [37]. It also reinforces the notion that efforts to mitigate vaccination hesitancy have to go beyond providing information and education, and address the beliefs and motivations behind vaccination intentions. Not being able to miss work in order to be vaccinated was also negatively associated with vaccination intentions, underlining the relevance of addressing structural barriers related to working conditions, such as inflexible work schedules or lack of paid time off in order to improve vaccination rates. For example, employer-based vaccination programs or

policies, as mentioned in the interviews with healthcare professionals, could be considered for increasing adherence in specific population groups [38, 39].

Similar to previous studies on reasons to get vaccinated [40, 41], family protection was also found to be positively associated with vaccination intention against COVID-19. Other's protection, and in particular the protection of the fetus/baby, was a major concern and motivator for pregnant women who participated in the interviews. Moreover, being concerned about being infected and considering the vaccine to be safe were associated with the intention to be vaccinated, which is in line with the results from a study on vaccine hesitancy in older Portuguese adults [42]. Having a doctor's recommendation to get vaccinated was also a positive predictor of participants' intention to get vaccinated against COVID-19, and this was a crucial factor in deciding to be vaccinated, mentioned by all pregnant women. It has been widely shown that trust is an important factor in individuals' vaccination decision-making and that healthcare professionals are one of the most influential and trusted sources of guidance on this topic [35, 43]. Conversely, preferring to get COVID-19 instead of being vaccinated was the only negative predictor of vaccination intention, which is in line with results from previous studies showing less likelihood of being vaccinated when natural immunity is favored [44].

While the qualitative part revealed overall positive attitudes regarding the effectiveness and importance of vaccination, there were also some concerns about safety and uncertainty about the need for seasonal vaccines. The COVID-19 vaccine was singled out due to a perceived fast production process and lack of testing, whereas it was argued that the influenza vaccine was unnecessary for participants due to younger age or good health status. Aside from these aspects, participants in both groups considered the vaccination process to be convenient and accessible.

The healthcare professionals who were interviewed made a clear distinction between seasonal vaccination and the vaccines recommended in the National Immunization Program. This was manifested by the fact that the majority of participants chose not to take the vaccine against influenza (but followed the NVP), which corresponds with the low seasonal vaccination uptake found in the literature for these professionals (e.g., [21, 45]). Some made this choice to avoid side effects or because they do not feel at risk because of their young age, adherence to preventive behaviors, and good health conditions. This may be a recurring issue within this professional group, as other studies show that healthcare professionals often do not consider themselves at risk of contracting this disease and think, therefore, that there is no need to take the vaccine [20, 46, 47].

Eventhough all interview participants had received primovaccination against COVID-19, there was a considerable level of ambivalence concerning this vaccine. It is not surprising that those who are unsure about the vaccine's safety are more likely to refuse it [48] and other studies support our finding that some healthcare professionals show concern about it [47], leading to lower vaccination intention. Highly trained healthcare professionals are less likely to have misconceptions about vaccine safety and risks [49], which might provide clues into our participant's training needs and shed light on future interventions to counter vaccine hesitancy within this group.

The group of pregnant women/new mothers also seemed to differentiate between seasonal vaccination and other vaccines. Once again, this was linked to the fact that most participants did not feel the need to get vaccinated against influenza and COVID-19 due to their good health condition and their young age. Other studies point in this direction by showing that low-risk perception and disease severity were identified as vaccination barriers for pregnant women [50], as well as an association between worse health status and higher seasonal vaccination acceptance and uptake [51, 52]. Simultaneously, participants acknowledged that their main concern before making the decision was the potential impact of the vaccines on the fetus and the occurrence of side effects. That is supported by the literature, which shows that one of the most commonly cited concerns among this population group is the impact that vaccination might have on the mother and, more importantly, on the unborn baby [24, 50–53]. Within this context, the COVID-19 vaccine seemed to be the one to generate the most hesitancy. As for the group of healthcare professionals, the ambivalence participants felt was mostly related to the fast production process and the perceived lack of studies about vaccine safety, both of which have been previously associated with low vaccine acceptance, intention, and uptake [51, 52, 54]. In accordance with this result, receiving information about this topic seems to increase vaccine coverage [55] and, on the contrary, inadequate knowledge about the benefits of vaccination and when they are needed, has been reported as a barrier to vaccination [56]. These aspects are often at the root of vaccine hesitancy and our findings precisely reflect this, since most participants believed that more information was needed about vaccine benefits, side effects, and risks for pregnant women to make informed decisions. In line with this, participants expressed how decisive it was for them to receive the recommendation to vaccinate from a healthcare professional. Having a doctor's recommendation (or lack thereof) is usually one of the most reported predictors of vaccination during pregnancy [24, 50, 53, 56, 57], once more reinforcing the influence that these

professionals have as trusted sources of information for pregnant women's decisions.

The present research has some limitations. First, although the survey followed a probabilistic sampling procedure, the inclusion criteria addressed at-risk groups for which seasonal vaccination was recommended, and hence the results cannot be generalized beyond these groups. Second, the survey followed a cross-sectional design, and hence any conclusions on causality are unwarranted. Third, although behavioural intentions are an important predictor of behaviour, especially in the case of single action behaviours such as vaccination, there is a known gap between intentions and actual behaviour [58]. Hence, whenever possible, future studies should seek to make use of longitudinal designs, measuring behavioural predictors before and assessing actual behaviour at a latter point in time. Fourth, although pregnant women and healthcare professionals were chosen for the qualitative phase of the study due to their pivotal role in seasonal vaccination efforts and in influencing vaccine-related decision-making, while having lower than desirable levels of vaccination adherence, an in-depth exploration of the experiences and perceptions of other groups (e.g., older adults) could have provided additional insights into vaccination barriers and enhanced the transferability of the findings. Lastly, in the interviews, half of the participants in the pregnant women's group had their babies before the data collection time, making it necessary to ask them to recall back to the time when they were pregnant, which may potentially lead to some recall bias.

Despite the above limitations, to our knowledge, this is the first study conducted in Portugal on intention and hesitancy for seasonal vaccination with target groups in the aftermath of the COVID-19 pandemic, a country that can be considered a case study of success, in terms of vaccination rates. Addressing and overcoming vaccine hesitancy requires a complex understanding of the barriers and facilitators of vaccination intention, which can only be achieved by exploring people's beliefs and motivations. As such, this mixed-methods study represents a crucial stepping stone to implementing effective interventions to reduce vaccine hesitancy and increase vaccine uptake in priority groups. This is especially relevant in the face of the wave of decreasing confidence in vaccines that has been sweeping Europe in recent years and the lower seasonal vaccination coverage reported in Portugal for some of the target groups in 2023–2024.

Conclusion

In the wake of dwindling vaccine confidence in Europe and recent lower seasonal vaccination uptake in certain target groups in Portugal, this study identified relevant sociodemographic and psychosocial factors associated with seasonal vaccination intention in a sample of older

adults and people with chronic conditions. Simultaneously, it explored the perceptions that healthcare professionals and pregnant women/new mothers had about seasonal vaccination, reasons for vaccine hesitancy, and motivating factors to get vaccinated. By employing a mixed-methods approach, the present research contributes to understanding vaccine hesitancy and factors associated with the intention to be vaccinated, which can enable the development of targeted and more effective interventions to increase vaccination uptake in these priority groups.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12889-025-25591-y>.

Supplementary Material 1. Supplementary Table 1. Intention to be vaccinated against influenza, according to sociodemographic variables. Supplementary Table 2. Intention to be vaccinated against COVID-19, according to sociodemographic variables.

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Authors' contributions

Cristina Godinho: Conceptualisation, Methodology, Formal analysis, Writing – review & editing, Supervision, Project administration; Rita Francisco: Conceptualisation, Methodology, Writing – review & editing; Rui Gaspar: Conceptualisation, Methodology, Writing – review & editing; Joana Henriques: Investigation, Formal analysis, Writing - Original Draft; Andreia Costa: Methodology; Writing - Review & Editing; Project administration; João António: Data Curation; Diana Costa: Methodology; Teresa Fernandes: Methodology; Miguel Arriaga: Methodology.

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Data availability

The datasets analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was approved by the Ethics Council of the Lisbon School of Nursing, with the Reference number: 3089/2023. All study procedures were in accordance with the 1964 Helsinki declaration and its later amendments. Participants were informed about the study goals and procedures, and confidentiality and anonymity were ensured prior to participation. Informed consent was obtained from all participants prior to data collection.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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