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Research Article

French Pharmacy Students' Knowledge, Perceptions, Attitudes, and Practices Towards the Extension of Pharmacists' Vaccination Missions: A National Cross-Sectional Survey

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Abstract

Background/Objectives: French community pharmacists have been given new missions on vaccination since 2019, with now the ability to administer and prescribe vaccines to people aged 11 and over. The main objective of the study was to assess the perceptions and attitudes of pharmacy students on the new missions of pharmacists in vaccination. **Methods:** We conducted a national survey using self-administered questionnaire and targeting the final-year pharmacy students from the 24 pharmacy faculties in France, from September 5th to December 1st, 2023. Three themes were explored: vaccination in general, initial training on vaccination, and pharmacists' new vaccination missions. Association between the initial training and students' attitudes towards these new missions was assessed using Fisher's exact tests. **Results**: Overall, 231 students from 18 faculties answered the survey. A large majority of the students (n=228, 98.7%) were favorable to vaccination in general. Most students were in favor of pharmacists administering (n=224, 97.0%) and prescribing (n=212, 91.8%) vaccines. However, few students expressed reservation about the extension of these vaccination missions (administration: n=7, prescription: n=19), the reasons being the fear of carrying the act, the insufficient remuneration and the risks of conflicts with other healthcare providers. Students' willingness to promote vaccination once graduated was significantly associated with their satisfaction with their initial training ($p<0.0001$). **Conclusions:** This national survey shows the enthusiasm of students for assuming these new missions. It highlights the strong association between the initial training and motivation to engage in these missions. Results of this study might help adapting these training to students' needs.

Keywords: Administration; Pharmacists' Missions; Prescription; Students; Vaccination

Introduction

Vaccination is a preventive measure that has led to considerable progress in the fight against infectious diseases and in reducing their spread. According to the World Health Organization, vaccination prevents 3.5 to 5 million deaths worldwide each year from diphtheria, tetanus, whooping cough, influenza and measles alone [1]. However, the history of vaccination has not been without various challenges. In France, population acceptance of vaccination was at its lowest level in 2010, with 61.5% of the population in favor, compared to 91.3% in 2000 [2]. According to a study by the London School of Hygiene Tropical Medicine published in 2016 and conducted in 67 countries, 41% of French people surveyed had particularly negative opinion about the safety of vaccines, compared with a global average of 13%, placing France at the forefront of countries expressing distrust of vaccination [3]. This negative perception resulted in low vaccination coverages in France, particularly prior to the law relating to the mandatory 11 vaccines in 2018 (e.g. 80.3% for Measles, Mumps and Rubella (MMR) vaccine at age two [4], and 49.7% for influenza at age 65 and over in 2017 [5]). These low vaccine coverages were far from the target of 95% set by the 2009 Public Health law for the general population for all vaccine-preventable diseases, excepted for influenza, at 75% for at-risk populations (e.g., people aged 65 years and over, pregnant women) [6].

In order to better understand this mistrust and find solutions to increase vaccination coverage, a wide-ranging public consultation on vaccination was set up in France in 2016, bringing together all the parties involved in vaccination (e.g., institutional representatives, healthcare providers, patient associations) [7]. It resulted in a proposition to extend the scope of healthcare providers authorized to administer vaccines in order to facilitate access to vaccination. Notably, it has been suggested to introduce seasonal flu vaccinations by pharmacists as realized in other European countries (e.g., United Kingdom since 2002 and Portugal since 2007) [8]. In France, the extension of flu vaccination to pharmacists was seen as a major measure aiming to ease the vaccination process and thus increase the vaccination coverage.

As a result, after a conclusive two-year experiment, all trained French pharmacists have been authorized to administer flu vaccine since 2019 [https://www.legifrance.gouv.fr/loda/id/JORFTEXT000033680665]. Subsequently, in the context of a health emergency, qualified pharmacists and students have been authorized to administer anti-COVID vaccinations since March 2021 [https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000043216584#:~:text=%2D1310%20…-,D%C3%A9cret%20n%C2%B0%202021%2D248%20du%204%20mars%202021%20modifiant,l%27%C3%A9tat%20d%27urgence%20sanitaire]. Due to the substantial involvement of pharmacists in vaccination since 2019, the recommendations of the French National Authority for Health of January 2022 have been implemented [9, 10], with (i) the extension of the list of vaccines that can be administered by pharmacists since April 2022 [https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000045638979; https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000045638858; https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000045638970] and (ii) the authorization of pharmacists to prescribe vaccines since August 2023 [https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000046791754; https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000047948973]. Concomitantly, vaccination training has been introduced since 2019 in the curriculum of the mandatory initial training and the voluntary continuing professional development. Thus, qualified pharmacists having received a special training are now authorized to prescribe and to administer all the 23 vaccines listed in the current vaccination calendar for people aged 11 and over, in accordance with the recommendations. The only exception relates to the prescription of live vaccines for immunocompromised people. The procedure of administration of one vaccine by the pharmacist is currently remunered 7.50 euros, and 9.60 euros when the pharmacist also prescribes the vaccine [https://www.ameli.fr/meurthe-et-moselle/pharmacien/sante-prevention/vaccination/vaccination-par-pharmacien-officine]. In addition, third-cycle pharmacy students are authorized to administer all the 23 vaccines listed in the current vaccination calendar, under the supervision of a trained pharmacist.

In this context of considerable changes of the pharmacists' missions in vaccination over the last five years, only few data are available on French pharmacists' attitudes towards these new missions. They only focus on the administration of influenza [11], anti-COVID [12], and anti-papillomavirus [13] vaccines and targeted practicing pharmacists, most of them having not received training on vaccines as part of their initial university curriculum. It would then seem worthwhile to look more specifically at how future pharmacists perceive these new missions in terms of both administration and prescription of all the 23 vaccines and their initial vaccination training, to explore their interest, readiness, confidence and motivation to ensure these new missions.

The main objective of the study was to assess the perceptions and attitudes of final-year pharmacy students on the new missions of pharmacists in vaccination in France. The secondary objective was to evaluate the impact of the initial university training and students' willingness to continue training on attitudes towards the new missions in vaccination.

Methods

Study Design and Population

This study was a national cross-sectional exploratory survey conducted between September 5th, 2023 and December 1st, 2023. It used a self-administered and internet-based questionnaire hosted on Google Form® and targeted students in the community

curriculum of the final-year (6th) of pharmacy, from all the 24 pharmacy faculties in France. Around 1,500 students are registered in the community curriculum of the 6th year of pharmacy each year in France. Participation was voluntary and not compensated. The survey was completely anonymous at all stages, and as this research was not interventional, ethical approval was not required according to the French legislation.

Questionnaire Conception

The questionnaire was developed by a pharmacist, specialized in health promotion (MD), based on literature review, and revised by two pharmacists, specialized in public health and vaccination (MS, NT). It was pilot tested with seven pharmacy students to ensure clarity of questions and instructions, ease of navigation, and time for completion. The survey included 20 questions divided into four sections (Supplementary Material S1).

The first section included two questions exploring the students' general attitudes towards vaccination using a four-item Likert scale (from 'not at all favorable' to 'very favorable') and behaviors towards their vaccination status (i.e., 'vaccinated', 'not vaccinated', 'partially vaccinated', or 'I don't know'), for the mandatory vaccines for healthcare students (Diphtheria-tetanus-poliomyelitis (DTP) and Hepatitis B) as well as those recommended, but not mandatory (Pertussis, MMR, COVID-19, human papillomavirus (HPV)).

The second section of the survey included four questions exploring the students' university training on vaccination, their perception of it, and their experience in vaccination during pharmacy internship periods or students' job. Their perception of the university training, as well as their intended future practice of promoting vaccination were investigated using a four-item Likert scale (from 'totally disagree' to 'totally agree').

The third section included eleven questions and explored students' knowledge, perceptions, attitudes, and behaviors towards the extension of pharmacists' vaccination missions to administer and prescribe vaccines, using four-item Likert scales (from 'not at all favorable' to 'very favorable' to and from 'totally disagree' to 'totally agree'). Finally, the survey explored their motivation for ongoing training on vaccination or vaccine promotion.

The students' characteristics collected in the last section of the survey were their age, gender, and faculty of origin (from the 24 in France).

Dissemination of the Questionnaire

An e-mail containing the link to the questionnaire was sent on September 5th, 2023, by the pharmacy students local associations of each faculty, with the support of the national association of French pharmacy students (ANEPF - Association nationale des étudiants en pharmacie de France). Two reminders were then sent, in the first week of October and November 2023, by the deans or the professors responsible for the 6th year of each faculty. The survey was closed on December 1st, 2023.

Statistical Analysis

Data collected were described using medians, interquartile ranges (IQR: first quartile-third quartile), minimum and maximum for quantitative variables, and numbers and percentages for qualitative variables. The association between students' satisfaction with the training they received during their curriculum (Supplementary Material S1 – Q4), their professional experience in the promotion and administration of vaccination (Supplementary Material S1 – Q5), and their willingness to promote vaccination after graduation (Supplementary Material S1 – Q6) were evaluated using Fisher's exact tests. As well, the association between the students' willingness to take part in continuing training on the new vaccination missions after graduation (Supplementary Material S1 – Q16) and their attitudes towards the extension of pharmacists' missions in vaccination (Supplementary Material S1 – Q17) were assessed. A p-value < 0.05 was considered significant.

The data were analyzed using R software, version 4.3.2 (R Foundation for Statistical Computing).

Results

Characteristics of the Respondents

Overall, 231 pharmacy students answered the self-administered questionnaire (15.4% response rate), including 191 (83.8%) females and 37 (16.2%) males. Their median age was 24 (IQR: 23-24), with a minimum of 21 and a maximum of 35. Of the 24 faculties of pharmacy in France, 18 were represented in the survey (Supplementary Table S2). The median number of respondents per faculty were 10.5 (IQR: 6.8-17.3).

Students' General Opinions towards Vaccination

When asked about their vaccination status, almost all respondents were up to date with the mandatory vaccinations for health students, i.e., for the vaccination against hepatitis B (n=222, 96.1%) and DTP (n=228, 98.7%). Considering the recommended vaccinations, 121 (52.4%) respondents were not vaccinated against HPV and 43 (18.6%) were not up to date with the COVID-19 vaccination (Table 1).

Among the 231 respondents, 183 (79.2%) were strongly favorable and 45 (19.5%) favorable to vaccination in general. Three respondents were not in favor of vaccination in general (1.3%), but they were nevertheless up to date with their vaccinations against hepatitis B, DTP, and MMR. Among them, two were not vaccinated against COVID-19 and HPV.

	Vaccinated	Partially vaccinated	Not vaccinated	Don't know
Hepatitis b*, n (%)	222 (96.1%)	4 (1.7%)	0 (0.0%)	5 (2.2%)
Diphtheria, tetanus, poliomyelitis (DTP)*, n (%)	228 (98.7%)	2 (0.9%)	0 (0.0%)	1 (0.4%)
Pertussis, n (%)	222 (96.1%)	3 (1.3%)	1 (0.4%)	5 (2.2%)
Measles-mumps-rubella (MMR), n (%)	228 (98.7%)	0 (0.0%)	0 (0.0%)	3 (1.3%)
COVID-19, n (%)	185 (80.1%)	43 (18.6%)	3 (1.3%)	0 (0.0%)
Human papillomavirus (HPV), n (%)	106 (45.9%)	1 (0.4%)	121 (52.4%)	3 (1.3%)

Table 1: Students' vaccination status for the mandatory (*) and recommended vaccines (n=231).

Pharmacy Students' Initial Training on Vaccination

Figure 1 presents the vaccination aspects students remembered having studied during their six years of pharmacy curriculum. More than 92% of them remembered having covered most aspects of their vaccination training, i.e., vaccines types, mechanisms of action, contraindication, recommendations (including vaccination calendar, and mandatory and recommended vaccines), and administration practice. However, fewer students recall having learned notions of pharmacovigilance and adverse reactions, as well as the healthcare professionals authorized to vaccinate (n=175, 75.8%).

A total of 205 students (88.7%) were satisfied or totally satisfied with their initial university training (Table 2). When students were asked if they would promote vaccination in pharmacy after graduation, 217 (93.9%) strongly agreed or agreed. Their willingness to promote vaccination once graduated was significantly associated with their satisfaction with the initial university training they received ($p<0.0001$).

One hundred and fifty-seven (68.0%) students already had the opportunity to promote vaccination and/or administer vaccines during their professional experiences (Table 2). These students mainly gained experience in promoting and administering vaccines in community pharmacies (n=149, 96.8%), vaccination centers (n=16, 10.4%) and hospital pharmacies (n=3, 2.0%). Students' willingness to promote vaccination once graduated was significantly associated with their experience of promoting and/or administering vaccination ($p<0.0001$).

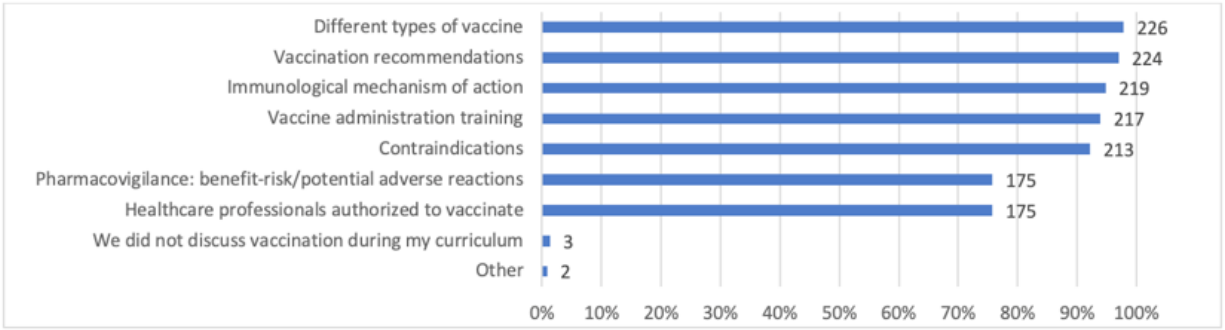

Figure 1: Vaccination aspects covered in the initial training of pharmacy students (n=231).

		Willingness to promote vaccination after graduation n (%)				
		Totally agree	**Agree**	**Disagree / Strongly disagree**	**Depends on the vaccine**	**Total**
Satisfaction with initial vaccination training n (%)	**Totally agree**	77	7	2	2	**88 (38.1%)**
	Agree	73	39	1	4	**117 (50.6%)**
	Disagree / Strongly disagree	13	8	1	4	**26 (11.3%)**
	Total	**163 (70.6%)**	**54 (23.4%)**	**4 (1.70%)**	**10 (4.30%)**	**231 (100.0%)**
Experience of promoting and/or administering vaccination n (%)	**Yes**	125	25	0	7	**157 (68.0%)**
	No	38	29	4	3	**74 (32.0%)**
	Total	**163 (70.6%)**	**54 (23.4%)**	**4 (1.70%)**	**10 (4.30%)**	**231 (100.00%)**

Table 2: Association between (i) students' satisfaction with vaccination initial university training, (ii) their experience of promoting and/or administering vaccination, and their willingness to promote vaccination after graduation (n=231).

Students' knowledge, perceptions, attitudes, and behaviors towards the extension of pharmacists' vaccination missions

Firstly, most students were aware of the list of vaccines that pharmacist can administer in 2023 (n=220, 95.2%). Most students were in favor of pharmacists administering vaccines (n=224, 97.0%) and pharmacists prescribing vaccines (n=212, 91.8%). The most frequently mentioned reasons why students were in favor of pharmacists' new missions were the valorization of the pharmacist's profession (for administration: n=207, 92.4%, for prescription: n=186, 87.7%), the easiest access to vaccination for patients (administration: n=207, 92.4%, prescription: n=190, 89.6%), and the ability to increase the vaccination coverage (administration: n=200, 89.3%, prescription: n=184, 86.8%) (Figure 2). On the other hand, among the 7 and 19 students who gave reasons for not being in favor of administering and prescribing vaccines respectively, the main reasons were the fear of carrying the act (administration: n=4, 57.1%, prescription: n=10, 52.6%), the insufficient remuneration for the administration mission (n=4, 57.1%), and the fear of conflict with other healthcare providers for the prescription mission (n=9, 47.4%) (Figure 3).

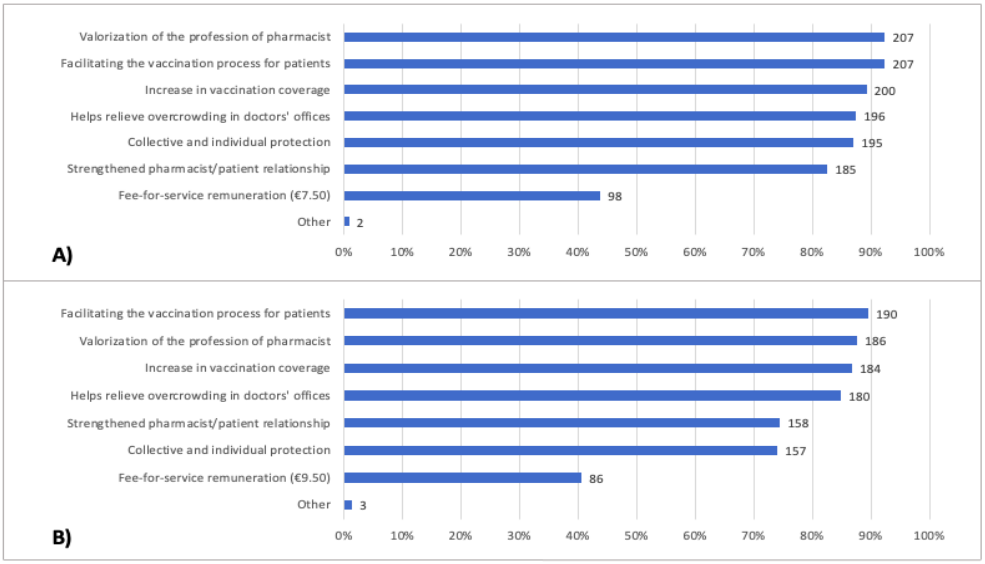

Figure 2: A) Reasons given by students in favor of pharmacists administrating vaccines (n=224) ; B) Reasons given by students in favor of pharmacists prescribing vaccines (n=212).

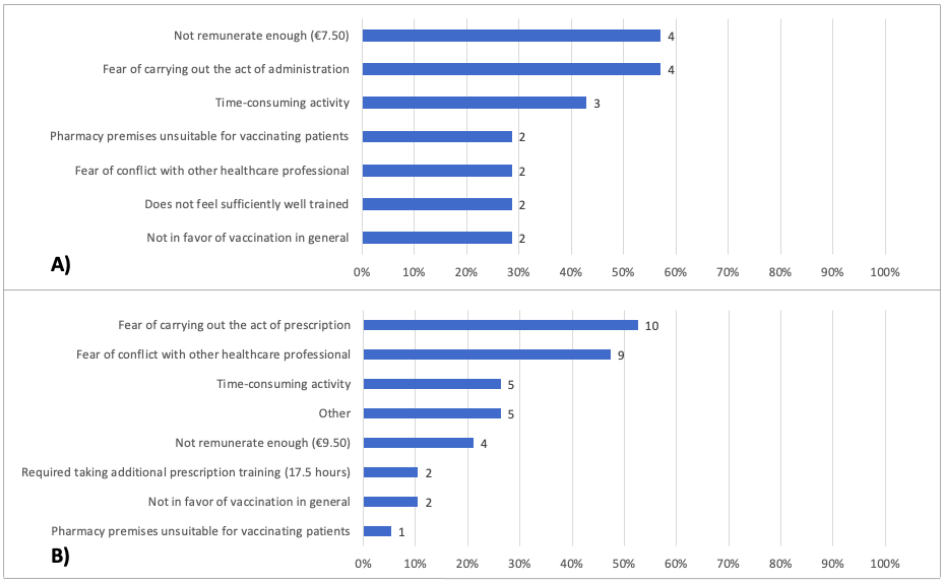

Figure 3: A) Reasons given by students against pharmacists administrating vaccines (n=7) ; B) Reasons given by students against pharmacists prescribing vaccines (n=19).

Almost all the students strongly agreed to vaccinate patients with a prescription from their physician (n=212; 91.8%). Fewer students strongly agreed to vaccinate patients with their own prescription (n=179; 77.5%). However, they had more doubts about vaccinating a patient with a nurse's prescription (strongly agree n=130; 56.3%) (Table 3). Indeed, they expressed reservations about the prescribing of live vaccines by nurses and pharmacists (n=3), highlighting the need to be up to date on vaccine recommendations and contraindications according to each patients' profile (n=3). Influenza and anti-COVID vaccines were the most frequently mentioned vaccines as acceptable for prescribing by all the healthcare providers and then administering by pharmacists (n=7).

Regarding the benefits for the patients, 228 (98.7%) respondents thought the pharmacists' new missions would facilitate the access to vaccination for patients. Moreover, 226 (97.8%) respondents felt that it would reduce territorial inequalities in access to prevention, and that it would increase vaccination coverage among the French population.

A total of 225 students (97.4%) were favorable or very favorable to the extension of pharmacists' vaccination missions (Table 4). When asked about continuing their professional training, 216 (93.5%) respondents declared they were willing to follow training and/or e-learning courses on vaccination and the promotion of vaccination during their professional practice. The willingness to take part in continuing training on vaccination after graduation was significantly associated with the students' attitude towards the extension of pharmacists' vaccination missions ($p<0.001$).

		Prescriber of vaccines n (%)		
		Physician	**Nurse**	**Pharmacist (themselves)**
Level of acceptance of vaccine administration n (%)	**Strongly agree**	212 (91.8%)	130 (56.3%)	179 (77.5%)
	Agree	16 (6.9%)	55 (23.8%)	34 (14.7%)
	Disagree / Strongly disagree	1 (0.4%)	32 (13.9%)	7 (3.0%)
	It depends on the vaccine	2 (0.9%)	14 (6.1%)	11 (4.8%)

Table 3: Level of students' acceptance of vaccine administration, depending on the prescriber (n=231).

		Attitudes towards the extension of pharmacist's vaccination missions n (%)			
		Very favorable	**Favorable**	**Not favorable / Not at all favorable**	**Total**
Willingness to follow training and/or e-learning after graduation n (%)	**Yes**	163	49	4	**216 (93.50%)**
	No	0	1	2	**3 (1.30%)**
	Don't know	8	4	0	**12 (5.20%)**
	Total	**171 (74.0%)**	**54 (23.40%)**	**6 (2.60%)**	**231 (100.00%)**

Table 4: Association between students' willingness to follow training and/or e-learning after graduation and their attitudes towards the extension of pharmacist's new vaccination missions (n=231).

Discussion

Main Results

This national survey was conducted to explore the perceptions and attitudes of future pharmacists on their new missions in vaccination since the role of community pharmacists has been recently strengthened by the authorization to administer and prescribe all vaccines of the vaccination calendar for people aged 11 and over. Of the 24 faculties of pharmacy in France, 18 were represented in this survey, which was completed by 231 students. Almost all students were favorable to vaccination in general (99%) and were up to date with mandatory vaccinations for health students (>96%). Regarding the pharmacist's new vaccination missions, most students were in favor of administering (97%) and prescribing (92%) vaccines in pharmacies, mainly mentioning the valorization of the pharmacist's profession (>88%) and easiest access to vaccination for patients (>90%). Moreover, a large majority of respondents (89%) felt well trained to promote and administer vaccination after graduation. More than half of the students (68%) have already had professional experience in promoting and/or administering vaccines, mainly in community pharmacies (97%), which was significantly associated with their willingness to promote vaccination after graduation ($p<0.0001$). We found that students were eager to continue training in vaccination after they had graduated (>93%), which was associated with their motivation to ensure the pharmacist's new missions in vaccination ($p<0.001$).

Vaccines' Administration by Pharmacists

In a previous study conducted in 2013, 75.3% of French final-year pharmacy students surveyed were in favor of administering vaccines in pharmacies [14]. Students' interest seems to evolve according to the professional and political environment in which they practice because, a decade later, 97% of final-year pharmacy students (who participated in the present survey) were in favor of vaccines administration in pharmacies. Indeed, four years after the generalization of vaccination in pharmacies and the gradual extension of the target patients and vaccines that can be administered by pharmacists, this new mission is no longer a novelty for pharmacists, students, and the population, who are therefore more in favor of it. This has been observed in other countries where the administration of vaccines by pharmacists is very well accepted by pharmacists themselves and the population [15, 16]. Furthermore, the accessibility offered by pharmacies, pharmacists' availability, and their relationship of trust established with patients were often mentioned as factors in favor of vaccination by the pharmacists [11, 17, 18]. Ultimately, providing vaccination in community pharmacies has shown to be effective to increase vaccination coverage, as in England, where flu vaccination coverage among people aged over 65 increased from 59% in 2005 to 76% in 2008, after pharmacists were authorized to vaccinate [17]. Similarly, the French students seemed motivated to extend their vaccination missions arguing the need to facilitate access to vaccination for patients (>90%), to increase vaccination coverage (>87%) and to strengthen pharmacist/patient relationship (>75%). Based on these observations, it is likely that in countries and territories where vaccination by pharmacists is implemented, the population's opportunities to be vaccinated should be increased, particularly for people who are furthest from the healthcare system, hopefully resulting in a reduction of territorial inequalities in access to prevention and an increase of vaccination coverage [15, 17]. However, such impact of French pharmacists on vaccine coverage has yet to be investigated.

Vaccines' Prescription by Pharmacists

Regarding the act of prescribing, in 2013, 67.5% of students surveyed preferred vaccination to be prescribed by physicians [14]. After a substantial change in the law, in 2023, and even though 92% of students were in favor of prescribing vaccines and 89% felt well trained in promoting and administering vaccination, only 78% of French students reported being ready to administer a vaccine following their own prescription. Moreover, some students of our study expressed a fear of practicing the acts of prescribing (n=10) vaccines. It is therefore essential to have a comprehensive, clear, up-to-date training during the pharmacy curriculum to give the students skills and confidence to offer this service after graduation, as highlighted in Australian and Canadian studies [19, 20].

Initial and Continuing Vaccination Training

We can imagine that a vaccination policy authorizing pharmacists to administrate and prescribe vaccines can only be fully effective when the initial training of pharmacy students is complete and comprehensible. Most faculties seem to have covered the basis of vaccination (e.g., immunological mechanism of action, vaccine recommendations). But there are still some very important concepts that don't seem to be systematically covered, or at least students don't remember them as much, such as pharmacovigilance, the handling of adverse reaction and the French vaccination network, particularly the health professionals authorized to prescribe and vaccinate (76%). These are concepts that deserve to be emphasized in the initial training of pharmacy students. It is essential to provide students with up-to-date, scientifically accurate vaccine training, as it has been shown that most health students consider lectures to be the most important source of information on vaccination [21]. It would be interesting to combine this theoretical initial training with less conventional learning methods, as suggested or tried out with pharmacy students, in order to increase their practical skills and confidence in promoting and providing vaccination in pharmacy, e.g., role-playing and communication, mixed reality, interprofessional practice, simulation classes on the technical gesture of administration [11, 20, 22-25]. This enables to give future pharmacists the tools they need to promote over-the-counter vaccination and provide this vaccination service, keeping in mind that this study showed that students' satisfaction with their initial training was significantly associated with their willingness to promote vaccination afterwards ($p<0.0001$). Moreover, the present study highlights the importance of continuing training on vaccination after graduation, with 93.5% of students being eager to take part in vaccination continuing training. It had also been shown that pharmacists in practice consider vaccination continuing training as necessary to improve their theoretical and practical skills [11].

In addition, it was found that students who practiced vaccination as part of their professional experience were more confident and comfortable promoting and providing vaccination [25]. This is in line with the results of our study, where students' work experience in vaccination was significantly associated with promoting vaccination after graduation ($p<0.0001$). So, the very positive attitude of French pharmacy students towards the extension of their vaccination missions and their strong motivation show their very likely commitment on vaccination in the future and could prove the relevance of developing these new missions in other countries.

Strengths and Limitations

The main strengths of this survey are the following. To the best of our knowledge, this is the first national study conducted in France to assess pharmacy students' perceptions and attitudes about the pharmacist's new missions in vaccination. Eighteen faculties are represented in this survey, which therefore provides a degree of territorial representativeness of all French students in their 6th year of pharmacy. Moreover, this survey was conducted between September and December 2023, i.e., right after the authorization of pharmacists to prescribe vaccines in August 2023. Therefore, questions related to vaccines' prescription by pharmacists were concrete and up-to-date with vaccination evolutions, unlike previous studies which questioned the opinion of pharmacists and pharmacy students on the hypothetical vaccines' prescription by pharmacists. However, this study also presents some limitations. Each year in France, about 1,500 students are enrolled in the final year of pharmacy in the community pharmacy curriculum. Therefore, with 231 respondents to our survey, the participation rate was only 15.4%. This rate is law but not surprising for such national survey. In a previous study conducted in 2013 exploring the perception of vaccination among French pharmacy students, the participation rate was at 9.8% [14]. However, our low participation rate leads to a risk of non-representativeness of our sample as a selection bias cannot be excluded and caution must be taken in the generalization of our results.

Conclusion

In conclusion, the French legislation has recently authorized pharmacists to administer and prescribe vaccines. To support pharmacists in these new missions, the initial and continuing training of pharmacy students should regularly evolve to include practical training in both administering and prescribing vaccines. It was important to ensure that these new missions generate interest and motivation among pharmacy students, so they can become driving forces of the vaccination missions in community pharmacy after their graduation. This national survey indeed showed the willingness and enthusiasm of future pharmacists to offer these new services and promote vaccination in community pharmacies, in order to contribute to the country's public health. Multiplying the number of professional offering vaccination should increase opportunities for the population to be vaccinated and might ultimately increase vaccination coverage. However, the coordination between these various health professionals involved in vaccination and the impact of these new legislations on vaccination coverage remains to be investigated.

Supplementary Materials

Students' general opinions towards vaccination

1. Concerning vaccination in general, would you say you are:

- Very favorable, favorable, not very favorable, not at all favorable.

2. Have you been vaccinated against:

- **Hepatitis B:** yes, no, I haven't had all the boosters, I don't know.
- **Diphtheria-tetanus-poliomyelitis (DTP):** yes, no, I haven't had all the boosters, I don't know.
- **Pertussis:** yes, no, I haven't had all my booster shots, I don't know.
- **Measles-mumps-rubella (MMR):** yes, no, I haven't had all my booster shots, I don't know.
- **COVID-19:** yes, no, I haven't had all my booster shots, I don't know.
- **Human papillomavirus (HPV):** yes, no, I haven't had all my booster shots, I don't know.

Pharmacy students' initial training on vaccination

3. During your curriculum, what did you learn about vaccination? (Multiple answers)

- The immunological mechanism of action,
- The different types of vaccines,
- Vaccination recommendations,
- Healthcare professional authorized to vaccinate,
- Vaccine administration training,
- Pharmacovigilance/risk benefit/possible adverse events,
- Contraindications
- Other: (Open answer)
- We did not discuss vaccination during my curriculum.

4. Would you say that you are sufficiently trained to promote and administer vaccination?

- Strongly agree, agree, disagree, strongly disagree.

5. As part of a student job or an internship, have you ever promoted vaccination and/or administered vaccines?

- Yes, No
- If yes: in which structure (vaccination center, pharmacy, etc.) (Open answer)

6. Are you willing to promote vaccination once graduated?

- Strongly agree, agree, disagree, strongly disagree, depends on the vaccine.

Students' knowledge, perceptions, attitudes, and behaviors towards the extension of pharmacists' vaccination missions

7. In 2023, can pharmacists administer vaccines in their pharmacies?

- Yes, only influenza vaccines and COVID-19
- Yes, 16 vaccines in all (influenza, COVID-19, DTP, pertussis, HPV, pneumococcus, Hepatitis A and B, Meningococcus A, B, C, Y and W, Rabies)
- No
- Don't know

8. Have you ever been vaccinated by a pharmacist?

- Yes, No

9. Are you in favor of pharmacists administering vaccines?

- Very favorable, favorable, not very favorable, not at all favorable
- **If not at all favorable/unfavorable, why** (multiple choices): fear of conflict with other healthcare professionals, pharmacy premises unsuitable for vaccinating patients, time-consuming activity for the pharmacist, not remunerated enough (€7.50), fear of carrying the act of administration, not in favor of vaccination in general, does not feel sufficiently well trained, other (Open answer).
- **If very favorable/favorable, why** (multiple choices): valorization of the profession of pharmacist, collective and individual protection, fee-for-service remuneration (€7.50), helps relieve overcrowding in doctors' offices, increase in vaccination coverage, strengthened pharmacist/patient relationship, facilitating the vaccination process for patients, other (Open answer).

10. Are you in favor of pharmacists prescribing vaccines?

- Very favorable, favorable, not very favorable, not at all favorable
- If not at all favorable/unfavorable, why (multiple choices): fear of conflict with other healthcare professionals, requires taking additional prescription training (17.5h), time-consuming activity for the pharmacist, not remunerated enough (€9.50), fear of the act of prescription, not in favor of vaccination in general, other (Open answer).
- If very favorable/favorable, why (multiple choices): valorization of the profession of pharmacist, collective and individual protection, fee-for-service remuneration (€9.50), helps relieve overcrowding in doctors' offices, increase in vaccination coverage, strengthened pharmacist/patient relationship, facilitating the vaccination process for patients, other (Open answer).

11. Would you agree to administer a vaccine to patients in a pharmacy?

- On a doctor's prescription: Strongly agree, agree, disagree, strongly disagree, it depends on the vaccine.
- On a nurse's prescription: Strongly agree, agree, disagree, strongly disagree, depends on the vaccine.
- On your own prescription: Strongly agree, agree, disagree, strongly disagree, depends on the vaccine.

12. Would you advise your loved ones to be vaccinated by a pharmacist?

- Yes, no, depends on the person, depends on the vaccine.

13. Do you think that vaccination in pharmacies (prescription and administration) would facilitate the vaccination process for patients?

- Strongly agree, agree, disagree, strongly disagree.

14. Do you think that vaccination in pharmacies (prescription and administration) would help to reduce territorial inequalities and inequalities in access to healthcare for people who are furthest from the healthcare system?

- Strongly agree, agree, disagree, strongly disagree.

15. Do you think that vaccination in pharmacies (prescription and administration) would increase vaccination coverage in targeted populations?

- Totally agree, agree, disagree, totally disagree.

16. As part of your continuous professional development, would you be willing to attend training and/or e-learning courses on vaccination and its promotion during your professional practice?

- Yes, No, Don't know

17. In general, what do you think of the extension of pharmacists' vaccination missions?

- Very favorable, favorable, not very favorable, not at all favorable

Characteristics of the respondents

18. You are:

- A male
- A female
- Other
- I prefer not to specify.

19. How old are you? (Open answer, only numbers are accepted)

20. What is your faculty of origin?

- Angers
- Clermont-Ferrand
- Dijon
- Grenoble
- Lille
- Limoge
- Lyon
- Marseille
- Montpellier
- Nancy
- Nantes
- Paris Cité
- Poitiers
- Reims
- Rennes
- Strasbourg
- Toulouse
- Tours

Supplementary Material S1: Questionnaire for French students in their final year of pharmacy in the community curriculum.

Characteristics	Respondents (n = 231)
Gender, n (%)	
Female	191 (82.68%)
Male	37 (16.02%)
Does not wish to specify	2 (0.87%)
Other	1 (0.43%)
Age, n (%)	
21	2 (0.87%)
22	13 (5.63%)
23	76 (32.90%)
24	84 (36.36%)
25	31 (13.42%)
26	13 (5.63%)
27	10 (4.33%)
28	1 (0.43%)
35	1 (0.43%)

Faculties, n (%)	
Angers	16 (6.93%)
Clermont-Ferrand	7 (3.03%)
Dijon	9 (3.90%)
Grenoble	18 (7.79%)
Lille	38 (16.45%)
Limoge	4 (1.73%)
Lyon	1 (0.43%)
Marseille	17 (7.36%)
Montpellier	14 (6.06%)
Nancy	20 (8.66%)
Nantes	21 (9.09%)
Paris Cité	9 (3.90%)
Poitiers	10 (4.33%)
Reims	11 (4.76%)
Rennes	5 (2.16%)
Strasbourg	6 (2.60%)
Toulouse	15 (6.49%)
Tours	10 (4.33%)

Table S2: Characteristics of students, their gender, age, and faculty of origin.

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Author Contributions

Conceptualization, M.D., M.S., N.T.; Methodology, M.D., M.S., N.T.; Software, M.D.; Validation, M.S., F.D., N.T.; Formal Analysis, M.D.; Investigation, M.D.; Writing – Original draft, M.D.; Writing – Review & Editing, M.S., F.D., N.T.; Supervision, M.S., F.D., N.T.

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