



# Pharmacists' perceived barriers and facilitators as immunisers: Mapping COM-B model to support intervention development

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## Abstract

**Introduction:** Pharmacists were involved in the education and facilitation of vaccine administration, including more recent roles in vaccine administration. Yet there is a lack of reviews about pharmacists' motivation as immunisers to improve understanding of the possible gaps in the uptake of the professional roles.

**Objective:** This review aimed to identify perceived barriers and facilitators of pharmacists as immunisers and mapped across the Capability, Opportunity, and Motivation Model of Behavior (COM-B).

**Methods:** A total of 5429 articles were identified in four databases from inception until December 2022. Studies exploring pharmacists' perceptions and attitudes toward their role in vaccine administration were included. Using thematic analysis, the findings were mapped onto the COM-B model components. All findings are reported following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guideline.

**Results:** Twenty-six studies were included in the review. Themes of facilitators and barriers were identified in components of physical capability (training and certificate program), psychological capability (knowledge and awareness), physical opportunity (time and space), social opportunity (support from patients, staff, and general practitioners), reflective motivation (cost and expansion of role) and automatic motivation (legislation and reimbursement).

**Conclusion:** By integrating these findings into the COM-B framework, a holistic roadmap can assist policymakers in aligning strategies for effective pharmacist-led vaccinations.

## KEYWORDS

COM-B, immuniser, intervention, pharmacist, vaccination

## 1 | INTRODUCTION

Vaccinations are proven as a cost-effective health investment for controlling and reducing occurrence of infectious diseases.<sup>1</sup> By far,

vaccinations have been remarkably successful in preventing approximately 2–3 million deaths from diphtheria, tetanus, pertussis, and measles each year.<sup>1,2</sup> Despite presence of national vaccination program, underutilisation of vaccines remains a significant

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public health concern.<sup>3,4</sup> The coverage for many vaccines is still too low thus the need for continued monitoring of immunization program performance to detect potential gaps and identify appropriate solutions.<sup>5</sup>

Vaccines have been traditionally provided in general practitioner (GPs) clinics, public health clinics, and hospitals. However, they often missed the hard-to-reach populations due to accessibility, waiting and traveling time, and resistance from parents to vaccinate their children.<sup>6-8</sup> To improve vaccination rates, the introduction of training to nontraditional vaccination providers, such as pharmacists, may potentially be a solution to safely deliver vaccines in their practice settings.<sup>9</sup> Over the years, pharmacists have expanded their scope of practice from merely dispensing to other pharmaceutical care services.<sup>10</sup> Accessible in various healthcare practice sites (including community pharmacies, inpatient, ambulatory clinics, and nursing care facilities) makes pharmacists ideally positioned to deliver immunization as educators, facilitators, and administrators of vaccines.<sup>11,12</sup>

Pharmacist-led vaccination has been implemented in the United Kingdom, United States of America (USA), Ireland, and Portugal.<sup>13</sup> The pharmacists were trained in aspects of knowledge, skills, and vaccines to ensure their clinical competency in providing vaccination services.<sup>14</sup> Implementation of such programs has shown huge benefits in increased public awareness, accessibility, and rates of adult vaccination.<sup>14,15</sup> This has impacted public health officials in the United States to recognize community pharmacists as immunisers.<sup>15</sup> Similarly, legislation was passed in nine Canadian provinces to expand the scope of pharmacy practice to include the administration of vaccinations which was well accepted by the public and health care providers.<sup>15,16</sup>

An important factor that will help in advancing the roles of pharmacists as immunisers would be to understand their needs and expectations. Utilizing the Capability, Opportunity, Motivation, and Behavior (COM-B) model for behavior change, this study aims to fill a critical gap in the current literature by investigating the attitudes and perceptions of pharmacists as immunisers, particularly within the Asian region, where limited understanding exists, despite existing research delving into pharmacist-led vaccination from the viewpoints of the public and other healthcare professionals.<sup>12,14,15</sup> This paper reviewed the literature to assess the perception and attitude of pharmacists towards vaccine administration in their practice settings. The COM-B model offers a structured approach for investigating pharmacists' attitudes and perceptions as immunisers. The framework enables exploration of factors such as pharmacists' knowledge, skills, training (Capability), the environment they operate in, resource availability (Opportunity), and their attitudes, beliefs, and incentives (Motivation). The mapping findings of barriers and facilitators from literature will provide comprehensive understanding of the factors influencing pharmacist-led vaccination, facilitating the identification of intervention points to inform policymaker interventions in encouraging pharmacists' participation in vaccination programs.

## 2 | METHODS

### 2.1 | Search strategy

A comprehensive literature search was carried out to identify all relevant studies investigating perceived barriers and facilitators towards pharmacists administering vaccination in community pharmacy settings. The following electronic databases were searched: PubMed, Embase, International Pharmaceutical Abstract, and Cumulative Index to Nursing and Allied Health Literature from inception to December 2022. Key search terms included: "Pharmacist" and "Immuni\*" or "Vaccin\*." All English-published studies were identified and a manual reference review of included studies was screened to include additional studies.

### 2.2 | Study selection

The reference management software tool Endnote was used to manage all the search results exported from the electronic databases searched. Two reviewers independently screened titles and abstracts for inclusion. Full articles were then reviewed using an assessment form to include studies exploring pharmacists' perceptions and attitudes toward their role as vaccinators, where participants could include pharmacists or public. Studies that explored the multifaceted landscape surrounding evolving or novel roles of pharmacists as immunisers, legislative and regulatory frameworks on pharmacists' ability to administer vaccines, and specific barriers and facilitators that impact pharmacists' involvement as immunisers were included. Studies that are not focused on the regular vaccination service specifically provided by pharmacists in their practice sites (such as mass vaccination and vaccination campaigns) were excluded. The reviewers met and came to consensus on all studies included.

### 2.3 | Data extraction and study appraisal

Three independent reviewers participated in the data extraction process, utilizing a developed standardized collection form. This form was thoroughly piloted with a subset of 5 studies to ensure its reliability and effectiveness in capturing pertinent information. From the selected articles, key study parameters, research designs, and outcomes were meticulously extracted, ensuring a comprehensive and accurate representation of the research findings. In alignment with the COM-B model, mapping facilitators and barriers within the data extraction and study appraisal was meticulously orchestrated, ensuring a comprehensive analysis of each construct:

1. *Capability mapping*: Facilitators and barriers related to the pharmacists' capability to engage in immunization services were identified (such as knowledge, training, and skill development). Relevant information pertaining to the enhancement or hindrance of pharmacists' capabilities was extracted, including the level of training

provided, any reported gaps in knowledge, and the availability of skill-building opportunities.

2. *Opportunity mapping*: Extracted data delved into resource availability, facility accessibility, and collaboration with other healthcare professionals that could enable or constrain pharmacists' involvement in immunization services.
3. *Motivation mapping*: This involved closely analyzing reported attitudes, beliefs, and motivations that either supported or hindered their engagement in immunization services. Extracted data illuminated whether positive attitudes, intrinsic motivation, or external incentives played a role in encouraging or deterring pharmacists from taking on this role.

Throughout these steps, an iterative and systematic approach was followed. Data extracted from each study were cross-referenced against the constructs of the COM-B model, ensuring accuracy and consistency. In cases where facilitators and barriers spanned multiple constructs, their nuanced interactions were carefully dissected to provide a comprehensive understanding of their impact.

### 3 | RESULTS

#### 3.1 | Search results

Out of potential 5429 publications, twenty-six papers met the inclusion criteria (Figure 1).

#### 3.2 | Characteristics of included studies

Twenty-four of the included studies assessed both perceived facilitators and barriers while two studies focused solely on perceived barriers. Five studies adopted mixed methods of qualitative and quantitative surveys.<sup>15,17-20</sup> The 16 studies employed quantitative methods using online surveys,<sup>14,21-29</sup> printed survey,<sup>30</sup> mixed method

of printed and online surveys<sup>31,32</sup> and mailed surveys.<sup>33-35</sup> Only 5 papers were qualitative studies.<sup>36-40</sup>

All 26 included studies were published from the year 2001 onwards. Studies were conducted mostly in the USA with another 6 in Canada,<sup>14,15,20,23,33,36</sup> and 2 in Saudi Arabia.<sup>29,40</sup> One paper was published respectively in the United Kingdom,<sup>18</sup> Australia,<sup>19</sup> Malaysia,<sup>27</sup> and Poland.<sup>28</sup> Responses from nine studies were collected from pharmacists working in different practice sites including independent pharmacies, chain pharmacies, grocery chain pharmacies, mass merchandisers, banners, hospitals, ambulatory care, long-term care, industry, and academia.<sup>23-25,30,33-35,37,38</sup> Sixteen studies were conducted only among the pharmacists who practice in community pharmacies.<sup>14,15,17-22,26-28,31,32,36,39,40</sup>

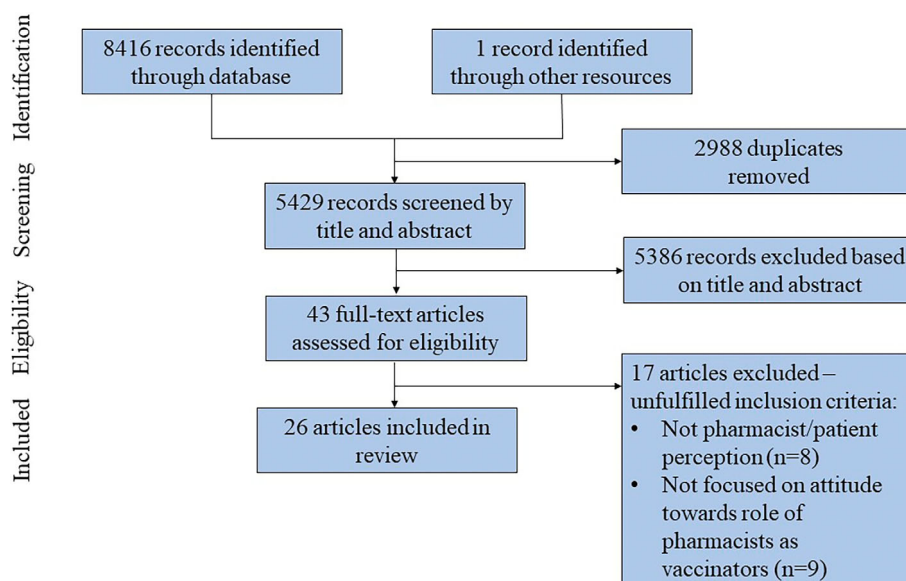
Perceived barriers and facilitators of pharmacists-led vaccination were mapped in the 6 components of the COM-B model (Tables 1 and A1). Although studies evaluated the provision of a variety of vaccines by pharmacists, including tetanus<sup>41</sup> and herpes zoster,<sup>42,43</sup> most studies evaluated the provision of influenza and/or pneumococcal vaccines. All studies reviewed demonstrated an increase in interest among pharmacists to improve vaccine coverage.

The sample size and response rate of the studies varied from the nature of the methodology. Most of the studies had sample sizes between 200 to 1000,<sup>20,23,26,27,29,33,35,37</sup> with 7 studies employing less than 100<sup>18,19,21,30,38-40</sup> and 4 studies included more than 1000 respondents.<sup>22,24,28,34</sup> Only 6 studies stated participants' age at the mean of 42 years (range 20-80 years, SD ± 2.26).<sup>15,20,25,30,33,38</sup>

#### 3.3 | Pharmacists' perceptions in the role of immunization

##### 3.3.1 | Expansion of role as immuniser

Pharmacists' willingness to vaccinate in their practice settings was assessed in 10 studies<sup>14,20,22-24,27,28,34,35,39</sup> which generally demonstrated positive attitudes in the uptake of a new role as



**FIGURE 1** Summative flow diagram for selection of studies.

**TABLE 1** Mapped perceived barriers and facilitators into the COM-B model.

	Physical capability	Psychological capability	Physical opportunity	Social opportunity	Reflective motivation	Automatic motivation
<b>Facilitators</b>	<ul style="list-style-type: none"> <li>Confident in vaccine administration</li> <li>Need for certificate program and training</li> </ul>	<ul style="list-style-type: none"> <li>Education/ training needs in vaccination</li> <li>Seek for more information about vaccine</li> <li>Acquired information from reliable sources</li> <li>Promotion of vaccine availability and capabilities to public</li> </ul>	<ul style="list-style-type: none"> <li>Physical facilities readiness</li> <li>Good procedures/ guidelines available</li> <li>Access to health and vaccine records</li> </ul>	<ul style="list-style-type: none"> <li>Referrals received from other health providers/ facilities</li> <li>Efforts to minimize and avoid conflict with local GP</li> <li>Communication and support from GP</li> <li>Support from patients</li> <li>Support from health departments</li> <li>Support from owner/ management</li> <li>Support from staff</li> </ul>	<ul style="list-style-type: none"> <li>Increased demands from patients</li> <li>Cost of immunization</li> <li>Seek training opportunities</li> <li>Expansion of new role/ service</li> <li>Perceived benefits to patients</li> <li>Pharmacists' personal interest</li> </ul>	<ul style="list-style-type: none"> <li>Adequate remuneration</li> <li>Mediation by local health board to work closely with GP</li> <li>Publicly funded vaccines</li> <li>Need of vaccine program in pharmacy</li> <li>Legislations</li> </ul>
<b>Barriers</b>	<ul style="list-style-type: none"> <li>Lack of training and education</li> <li>Lack of self confidence in capability</li> <li>Lack of patient's confidence in pharmacists' ability</li> <li>Lack of certificate program</li> </ul>	<ul style="list-style-type: none"> <li>Lack of knowledge</li> <li>Poor patient awareness of service provision</li> </ul>	<ul style="list-style-type: none"> <li>Limited space, not up to satisfactory pharmacy facilities</li> <li>Difficulty in keeping track of patients' vaccine status</li> <li>Availability of vaccination service</li> <li>Insufficient staff</li> <li>Limited time</li> <li>Inadequate supplies of vaccine/logistics requirements</li> <li>No protocols available</li> </ul>	<ul style="list-style-type: none"> <li>Lack of support from physician and staff</li> <li>Disorganized local health board</li> <li>Procedural delay</li> <li>Fear of jeopardizing relationship with local healthcare providers</li> <li>Lack of support from owner/management</li> <li>Vaccination service near pharmacy practice setting</li> </ul>	<ul style="list-style-type: none"> <li>Patients' concerns (privacy issues, cost, safety, time, consent, resistant)</li> <li>Lack of request about vaccine information</li> <li>Insufficient patient demands</li> <li>Not pharmacist's role</li> <li>Unwilling to vaccinate</li> <li>Poor intention to promote vaccination</li> <li>Sensitivity of subject</li> </ul>	<ul style="list-style-type: none"> <li>Rules and legislations</li> <li>Lack of legal liability</li> <li>Lack of reimbursement</li> <li>Lack of universal influenza program</li> </ul>

immuniser.<sup>14,15,20,22,23,27</sup> Pharmacists who have been administering influenza vaccines were shown keen to continue the service and expand to other forms of vaccinations.<sup>19</sup> Pharmacists also played the role of an educator to inform patients about the benefits and risks of vaccinations and used these encounters as an opportunity to ask about patients' vaccine status.<sup>15</sup> There were evidence of increasing patient demands for vaccination services in community pharmacies<sup>20,37</sup> as well as referrals from other health providers.<sup>15,23</sup> Some studies have also reported a lack of interest<sup>37</sup> and awareness<sup>18,19,37</sup> among patients towards pharmacists as immunisers, likely due to limited understanding and misconceptions about vaccine administration.<sup>25,38</sup> From a macro context, the promotion of pharmacists in vaccination provision was supported from chain management and professional associations (pharmacy, nursing, and medical).<sup>20</sup> However, pharmacists were careful to avoid any conflict from the local GPs that would damage the long-term business relationships between them.<sup>18</sup>

### 3.3.2 | Training and certificate program

Formal certificate program and professional training were heavily discussed in most studies and regarded as one of the main factors in influencing vaccine provision by pharmacists. Pharmacists reported a lack of knowledge as their concerns to providing vaccination services.<sup>14,17,18,21–23,25,27,33–35,39</sup> This was echoed from the lack of training and education in incorporating vaccination services at their practice location.<sup>14,17,20,22,27,28,33,34,39,40</sup> In many successful stories of pharmacy vaccination implementation, the self-confidence among pharmacists was found to be a strong contributing factor<sup>14,33</sup> which included confidence in administering vaccines<sup>20,24,27,30,33</sup> and handling of adverse events.<sup>20,24,30</sup> Thus, the need to educate pharmacists about vaccination was shown linked to higher level of comfort in administering vaccine.<sup>14,30</sup>

### 3.3.3 | Physical environment and facilities

The presence and readiness of facilities were found to be both facilitators and barriers to pharmacist-led vaccinations. This included space,<sup>14,18,20,22,23,28,33–35,37–40</sup> storage facilities,<sup>15,20,25,37</sup> pharmacy logistics,<sup>38</sup> guidelines,<sup>31,38</sup> procedures<sup>23,39</sup> and access to records.<sup>33,40</sup> Other barriers include difficulty in keeping track of patients' vaccine status<sup>26,27,31,32,40</sup> and the utilization of electronic systems for screening.<sup>15,25,40</sup> Entrusting pharmacists responsible for monitoring patients' vaccination status capitalized on their specialized knowledge, accessibility to health records, and patient-centered approach.<sup>15</sup> In an increasingly complex and interconnected healthcare landscape, where patients may receive care from multiple providers and visit different healthcare facilities, pharmacists are pivotal in ensuring continuity and coherence in vaccination management, ultimately contributing to enhanced patient well-being, safety, and effective healthcare coordination.

### 3.3.4 | Cost

Two studies found that appropriate financial incentives and streamlined compensation systems supported pharmacists to actively engage in administering vaccinations.<sup>20,30</sup> Conversely, other studies disclosed that pharmacists faced logistic difficulties in billing<sup>32,34</sup> as well as obtaining reimbursement from major third-party payers,<sup>22</sup> which primarily impacted the independent pharmacies.<sup>35</sup> The recurring themes of the cost of vaccination and insurance coverage formed a complex triad of factors that collectively shape the landscape of pharmacist-led vaccination services.<sup>24,26,30,32,36,38</sup> The financial considerations influenced patients' decisions, either serving as motivators or potential barriers in their quest to access and benefit from pharmacist-led vaccination programs.

### 3.3.5 | Time

The consensus across studies perceived time as the pivotal factor for the provision of pharmacy-based vaccination services underscoring the intricate interplay between efficiency, workload, and the potential for expansion in this domain. Two studies revealed that time constraints were affected by large prescription volume and competing workflow in the pharmacies, in a way where pharmacists must strike a delicate balance in managing their responsibilities while concurrently delivering high-quality vaccination services.<sup>30,36</sup> The studies highlighted the symbiotic relationship between resource availability, staff engagement, and the scope for vaccination expansion, suggesting that proactive investment in training and fostering a vaccination-friendly ecosystem could yield substantial dividends in terms of service accessibility and patient outcomes.<sup>19,25,26,37,38,40</sup> Another study reported that pharmacists were generally more agreeable to provide vaccination services only at daytime working hours.<sup>23</sup>

### 3.3.6 | Legislation

Available vaccine information for providers from the local and state health departments was perceived as a facilitator, in addition to the ability to new laws and policy adaptation.<sup>31</sup> Legal liability was identified as a significant barrier on pharmacists practicing in both chain and independent pharmacies.<sup>14,22,34,35,39</sup>

### 3.3.7 | Perceived benefits

Pharmacist-provided immunisations have shown to improve access to patient care<sup>24,31</sup> and role advancement among pharmacists.<sup>27,29,35,37</sup> Responses collected from these studies also showed benefits in promotion of public health<sup>28,37</sup> and consumers' convenience.<sup>24,39,40</sup> However, there was no significant agreement in pharmacists' professional satisfaction or image, increased profit in vaccine provision, and perceived impact.<sup>24,34,37</sup>

## 4 | DISCUSSION

This study's findings demonstrated the multifaceted landscape of facilitators and barriers that shape the role of pharmacists as immunisers. It emphasizes the pivotal position of pharmacists as trusted frontline practitioners in the primary healthcare system,<sup>43-46</sup> rooted in their extensive involvement in successful value-added services including medication review<sup>47,48</sup> and health screening services such as blood pressure,<sup>49,50</sup> blood glucose,<sup>50</sup> cholesterol,<sup>49,51</sup> smoking cessation,<sup>50,52</sup> weight management<sup>49,50,53</sup> and harm reduction programs.<sup>54-57</sup> Champions from successful implementation can act as a reference for local pharmacy boards and stakeholders to advance their vaccination scope of practice.<sup>12,58,59</sup> Furthermore, there is a huge opportunity for pharmacists to augment the service alongside GP due to its convenient locations, long opening hours, and preference of patients for the pharmacy environment.<sup>46,60,61</sup> The inclination of pharmacists to assume the role of immunization should not be driven by a pursuit of monetary incentives or an intent to encroach upon the professional purview of fellow healthcare providers. Rather, it is grounded in cultivating a synergistic and cooperative ethos within an integrated healthcare paradigm, with the overarching objective of amplifying patient access to this essential healthcare service.

Even though pharmacist-led vaccination services have achieved widespread success, various challenges continue to exist. While the public viewed pharmacist as qualified immunisers,<sup>44,61-63</sup> their confidence relied largely on the competence and knowledge of pharmacists in providing vaccination services.<sup>43</sup> Findings of this review echoed the notion that pharmacists must develop the necessary competence and be adequately trained to implement the service. Besides the support from professional organizations in advocating for service provision, learning objectives aligned with the planned vaccination service should be clearly defined. This includes and is not limited to, assessing an individual's vaccination status, identifying appropriate vaccines considering an individual's age and health status, handling, storage, and administration of vaccines, monitoring for adverse events, and managing emergency complications in compliance with legal and regulatory standards.<sup>64-71</sup> By providing academic diplomas that match the level of training, the credibility of the qualifications can be enhanced through endorsements from universities. At the system level, a nationwide roll-out of a certificate program will expedite pharmacists to acquire the needed skills and knowledge to start vaccination administration at their practice sites.<sup>64-66</sup> In the United States, practicing pharmacists and pharmacy students are formally trained through recognized programs as vaccine experts and have become routinely accepted as an important role of the pharmacist.<sup>67</sup>

Addressing environmental factors, such as physical space and proper vaccine storage, is crucial to facilitate pharmacists' engagement in immunization services.<sup>68,69</sup> Time management emerged as a vital factor, encouraging considerations such as appointment-based vaccination services and patient education.<sup>72</sup> The mapped COM-B model highlighted minimal system-level support in regulatory consistency and patient vaccination data accessibility.<sup>69,73</sup> Several countries have adopted various solutions although a complete immunization registry system with all stakeholders (healthcare professionals, patients, payers) involved is yet to be identified.<sup>74-77</sup> Access to health records is essential

for pharmacists to confirm patient vaccination and health status, as well as appropriate measures to guarantee safe vaccine administration.

There are several limitations to this review. Most of the studies included were conducted in developed Western countries where pharmacist-led vaccination was implemented. Thus, extrapolation of implementation strategies may be challenging without a proper policy put in place. Gray literature, including unpublished reports, policy briefs, and implementation documents, has been excluded from this review due to the absence of existing implementations and corresponding policy briefs in the subject area. In addition, variations between population and practice characteristics may influence the trends observed. Despite these limitations, the review provided meaningful answers to the "why," "how," and "what" facilitates pharmacist-led vaccination.

## 5 | CONCLUSION

Despite facing obstacles like limited support from other healthcare providers and inadequate training, community pharmacists show potential in enhancing immunization rates due to their accessible and convenient role as immunisers. This underscores the necessity for collaborative efforts among healthcare professionals, organizations, and the public to ensure proficient pharmacy-based vaccination services. By incorporating these insights into the COM-B framework, a comprehensive roadmap emerges to guide policymakers in aligning strategies for effective pharmacist-led vaccinations.

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### CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

### DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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## APPENDIX A

TABLE A1 Mapped barriers and facilitators on COM-B model.

Author (year) location	Study design/sample size (n)	Physical capability	Psychological capability	Physical opportunity	Social opportunity	Reflective motivation	Automatic motivation	Remarks
Capurso KA (2006) USA <sup>30</sup>	Quantitative: questionnaire (n = 43)	<ul style="list-style-type: none"> <li>37.1% were certified immunisers</li> <li>44.2% were comfortable administering vaccines</li> <li>53.5% believed able to handle vaccination-related problems (e.g. needle stick injury)</li> </ul>	<ul style="list-style-type: none"> <li>83.7% believed training would be beneficial</li> </ul>	<ul style="list-style-type: none"> <li>58.1% agreed limited time to provide vaccination</li> </ul>		<ul style="list-style-type: none"> <li>48.8% patients agreed cost of immunization was main factor for vaccination uptake</li> <li>65.1% patients had concerns about privacy issue</li> <li>9.3% had concerns to handle risk of adverse reactions</li> </ul>	<ul style="list-style-type: none"> <li>60.5% were comfortable with billing procedures</li> </ul>	No inclusion/ exclusion criteria mentioned; No limitations reported.
Della PG (2020) Italy <sup>17</sup>	Qualitative: semi structured telephone interview Quantitative: questionnaire (n = 352)		<ul style="list-style-type: none"> <li>94.8% interested in receiving further information about vaccinations</li> <li>59% acquired information from scientific journals (69.6%), mass-media/internet (41.3%) and educational activities (27.4%)</li> </ul>	<ul style="list-style-type: none"> <li>50.4% deemed lack of time for collecting data on vaccination</li> </ul>		<ul style="list-style-type: none"> <li>11.9% received often or always receive request for vaccination information</li> <li>59.2% deemed collecting data on immunization are not pharmacists' task</li> <li>On scale 1–10, 91.7% believed that they could play a prominent role in the educational interventions on vaccinations (mean 6.7) and 75.3% believed that they should be more engaged in these interventions (mean 6.4)</li> </ul>		No inclusion/ exclusion criteria mentioned.
Edwards N (2015) Canada <sup>14</sup>	Quantitative: online questionnaire (n = 495)	<ul style="list-style-type: none"> <li>Perceived need for formal certification and professional training: 99% of willing and 83% of unwilling</li> <li>Lack of training about indications/contraindications</li> <li>Lack of beliefs about capabilities</li> </ul>	<ul style="list-style-type: none"> <li>Lack of provider knowledge</li> <li>12% perceived undergraduate education inadequate as preparation them for vaccination</li> </ul>	<ul style="list-style-type: none"> <li>Not having enough space</li> <li>Time constraint for professional development</li> </ul>	<ul style="list-style-type: none"> <li>Lack of support from physician and staff</li> </ul>	<ul style="list-style-type: none"> <li>68% felt that pharmacy practice should expand to include immunization</li> <li>51% personal willingness to vaccinate</li> <li>29% pharmacists willing to vaccinate</li> </ul>	<ul style="list-style-type: none"> <li>Lack of reimbursement</li> <li>Lack of legal liability</li> </ul>	Percentage not reported in some results. Duration of study not reported.
Evans AM (2016) UK <sup>18</sup>	Qualitative: semi-structured interview Quantitative: data analysis (n = 16)		<ul style="list-style-type: none"> <li>9 perceived poor patient awareness on pharmacy influenza vaccination</li> </ul>	<ul style="list-style-type: none"> <li>10 commented on procedural delays, particularly in patient group direction</li> <li>4 perceived disorganized local health board leading to poor service</li> <li>1 reported not having enough hours</li> </ul>	<ul style="list-style-type: none"> <li>8 reported workload as an important determinant of the number of vaccinations reported positive response from GPs to the pharmacy service and encouraged people to use it</li> </ul>	<ul style="list-style-type: none"> <li>8 reported prioritizing vaccination over other services</li> </ul>	<ul style="list-style-type: none"> <li>local health board provided medication to work closely with GPs</li> </ul>	Important confounding variables considered

(Continues)

TABLE A 1 (Continued)

Author (year) location	Study design/sample size (n)	Physical capability	Psychological capability	Physical opportunity	Social opportunity	Reflective motivation	Automatic motivation	Remarks
Foong EA (2017) Canada <sup>3,6</sup>	Qualitative: Online public consultation (n = 265)	<ul style="list-style-type: none"> <li>6 with overall negative response indicated lack of training or expertise</li> </ul>	<ul style="list-style-type: none"> <li>29 with overall positive response and 38 with overall negative response identified workload/ workflow concerns</li> </ul>	<ul style="list-style-type: none"> <li>Availability of vaccination outside working hours</li> <li>Structured approach to ensure the pharmacy had facilities and processes that support vaccination service</li> <li>4 reported difficulties with securing adequate supplies of vaccine</li> </ul>	<ul style="list-style-type: none"> <li>Efforts to minimize and avoid conflict with local GPs (2 reported detrimental impact with GP relationships from vaccination service)</li> </ul>	<ul style="list-style-type: none"> <li>88 with overall positive response perceived benefits to patient</li> <li>51 with overall positive response perceived benefits to pharmacy profession</li> <li>29 with overall negative response concerned about patient safety</li> <li>15 with overall negative response perceived it was not consistent with scope of practice</li> </ul>	<ul style="list-style-type: none"> <li>51 with overall positive response reported lack of prescribing rights</li> <li>38 with overall positive response have reimbursement concerns</li> </ul>	<p>Variations were not assessed in online public consultation; Due to the open consultation format, responses were not structured and they varied in content and focus; therefore primary outcome cannot be determined; The consultation invited a convenience sample, and response bias might exist, as those who felt strongly for or against might have been more likely to respond than those who were indifferent.</p>
Gianfredi V (2018) Umbria <sup>21</sup>	Quantitative: questionnaire (n = 72)	<ul style="list-style-type: none"> <li>54.17% reported insufficient knowledge related to influenza vaccine</li> <li>65.22% who consulted scientific publication or institutional reports /web pages reported a higher degree of knowledges (p = 0.012)</li> </ul>	<ul style="list-style-type: none"> <li>Lack of patient awareness about vaccination service in pharmacy</li> </ul>	<ul style="list-style-type: none"> <li>90.7% pharmacies had consultation areas and 89.7% of the areas were suitable for vaccination services</li> <li>Issues on stock availability and logistic requirements</li> <li>Time constraints</li> <li>Insufficient staff</li> </ul>	<ul style="list-style-type: none"> <li>26.9% agreed that they experienced support from the local general practices</li> <li>Fear of jeopardizing relationship with GP</li> </ul>	<ul style="list-style-type: none"> <li>25% would recommend the vaccination</li> <li>18.06% intended to promote vaccine during the next campaign.</li> <li>Receiving request for information is associated with the attitude to recommend vaccination (p = 0.0006)</li> </ul>	<ul style="list-style-type: none"> <li>No specific inclusion/exclusion criteria mentioned; Although the questionnaire is self-administered, they conducted an online survey that is associated with a lower social desirability bias compared with traditional version.</li> </ul>	<p>Potential bias from voluntary self-administered baseline and exit surveys to pharmacists who chose to provide pharmacist vaccination services.</p>
Hattingh HL (2016) Australia <sup>19</sup>	Qualitative: semi-structured telephone interview Quantitative: mailed questionnaire and pharmacy computer record (n = 86)	<ul style="list-style-type: none"> <li>Lack of patient awareness about vaccination service in pharmacy</li> </ul>	<ul style="list-style-type: none"> <li>90.7% pharmacies had consultation areas and 89.7% of the areas were suitable for vaccination services</li> <li>Issues on stock availability and logistic requirements</li> <li>Time constraints</li> <li>Insufficient staff</li> </ul>	<ul style="list-style-type: none"> <li>26.9% agreed that they experienced support from the local general practices</li> <li>Fear of jeopardizing relationship with GP</li> </ul>	<ul style="list-style-type: none"> <li>88 with overall positive response perceived benefits to patient</li> <li>51 with overall positive response perceived benefits to pharmacy profession</li> <li>29 with overall negative response concerned about patient safety</li> <li>15 with overall negative response perceived it was not consistent with scope of practice</li> </ul>	<ul style="list-style-type: none"> <li>51 with overall positive response reported lack of prescribing rights</li> <li>38 with overall positive response have reimbursement concerns</li> </ul>	<p>Potential bias from voluntary self-administered baseline and exit surveys to pharmacists who chose to provide pharmacist vaccination services.</p>	

TABLE A1 (Continued)

Author (year) location	Study design/sample size (n)	Physical capability	Psychological capability	Physical opportunity	Social opportunity	Reflective motivation	Automatic motivation	Remarks
Isenor JE (2018) Canada <sup>33</sup>	Quantitative: mailed questionnaire (n = 168)	<ul style="list-style-type: none"> <li>93% indicated completion of injection training program, of which &gt;90% felt confident in immunization provision</li> <li>Continued and ongoing training including vaccine information and practical issues including needle size, gauge, and landmarking</li> </ul>	<ul style="list-style-type: none"> <li>Promotion to the public about the availability of vaccines in pharmacies and the capabilities of the pharmacists</li> <li>Respondents requested more information on managing adverse events following immunization and immunisations for special populations (immunocompromised individuals and travelers)</li> <li>20% reported lack of vaccine knowledge</li> <li>vaccine, unsure of required vaccine and its safety in different populations</li> </ul>	<ul style="list-style-type: none"> <li>23% indicated lack of space for administration</li> <li>Adequate staffing, space, refrigerators and other supplies and equipment</li> <li>Access to health and vaccine records</li> </ul>	<ul style="list-style-type: none"> <li>97% reported support from patients</li> <li>70% reported support from local physician and health department</li> <li>Referrals received from 85% physicians, 43% nurses and 32% public health facilities</li> </ul>	<ul style="list-style-type: none"> <li>Positive attitude on expansion of role as immuniser</li> <li>93% indicated that they currently administer vaccines in their practice</li> </ul>	<ul style="list-style-type: none"> <li>66% reported lack of reimbursement</li> <li>44% reported lack of a universal influenza program</li> <li>Publicly funded vaccines free of charge</li> </ul>	<p>Lesser responses were collected from community pharmacists than anticipation. It is possible that managers and owners may perform different immunizing behaviors and have different concerns) than staff pharmacists; however, the literature unable to determine what these differences may be.</p>
Islam JY (2017) USA <sup>38</sup>	Quantitative: questionnaire (n = 40)	<ul style="list-style-type: none"> <li>10% adolescents and 13% adults indicated staff training as a factor</li> </ul>	<ul style="list-style-type: none"> <li>10% indicated lack of beliefs about capabilities</li> <li>Patient awareness in 63% adolescents and 60% adults</li> </ul>	<ul style="list-style-type: none"> <li>28% adolescents and 35% adults reported time constraints</li> <li>10% adolescents and 23% adults indicated improved pharmacy logistics</li> <li>31% adolescents and 38% adults reported clear guidelines for vaccination</li> <li>5% adolescents and 43% adults reported unsatisfactory facilities</li> </ul>	<ul style="list-style-type: none"> <li>8% adolescents and 16% adults indicated lack of staff support</li> <li>18% adolescents and 5% adults indicated doctors' communication and support as a factor</li> </ul>	<ul style="list-style-type: none"> <li>Patients' concerns:                             <ul style="list-style-type: none"> <li>vaccination in 53% adolescents and 15% adults</li> <li>adverse drug reactions in 20% adolescents and 20% adults</li> <li>cost in 15% adolescents and 25% adults</li> <li>misconceptions in 18% adolescents and 18% adults</li> <li>parent consent in 18% adolescents</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>28% adolescents and 78% adults felt that there is lack of reimbursement</li> <li>51% adolescents indicated legislation as a factor</li> </ul>	<p>Inconsistent inclusion criteria: Small sample size (5 pharmacists per state) to estimate statewide practices. Results may not be an accurate representation of pharmacy practice in US states.</p>
Kamal KM (2003) USA <sup>44</sup>	Quantitative: mailed questionnaire (n = 1266)	<ul style="list-style-type: none"> <li>Pharmacist's concern: level of training (4.6 ± 1.9)</li> </ul>	<ul style="list-style-type: none"> <li>Pharmacist's concern: level of knowledge (3.9 ± 1.8)</li> <li>Patient's concern: information on immunization (3.09 ± 1.7)</li> </ul>	<ul style="list-style-type: none"> <li>Pharmacist's concern: Not having enough space (4.75 ± 2.1)</li> <li>Time constraints (5.56 ± 1.6)</li> </ul>	<ul style="list-style-type: none"> <li>Pharmacist's concern: criticisms from other immunization providers (4.08 ± 1.5)</li> <li>availability of physician who agrees (4.5 ± 1.8)</li> <li>support of physicians in the neighborhood (4.32 ± 1.8)</li> <li>staff support (4.91 ± 1.8)</li> <li>owner/management support (4.03 ± 2.1)</li> </ul>	<ul style="list-style-type: none"> <li>Patients' concerns:                             <ul style="list-style-type: none"> <li>cost (4.59 ± 1.8)</li> <li>insurance coverage (4.99 ± 1.8)</li> <li>waiting time (3.7 ± 1.8)</li> <li>no interest (3.85 ± 1.8)</li> <li>On scale 1-7, pharmacists willingness to vaccinate:                                     <ul style="list-style-type: none"> <li>adult (4.4 ± 2.6)</li> <li>child (3.9 ± 2.7)</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Pharmacist's concern:                             <ul style="list-style-type: none"> <li>level of reimbursement (4.91 ± 1.7)</li> <li>State legislation (4.39 ± 2.2) and technical requirements (4.22 ± 1.9)</li> <li>Concerns about legal liability (5.17 ± 1.8)</li> </ul> </li> </ul>	<p>Low response rate causing possibility of underreporting of results; The data were not adjusted for differences between sample and population characteristics; These variations become larger when smaller subgroups are analyzed.</p>

(Continues)

TABLE A1 (Continued)

Author (year) location	Study design/sample size (n)	Physical capability	Psychological capability	Physical opportunity	Social opportunity	Reflective motivation	Automatic motivation	Remarks
Kelling SE (2016) USA <sup>37</sup>	Qualitative: Face-to-face interview Questionnaire (n = 105)		<ul style="list-style-type: none"> <li>37.10% identified increased demands from patients</li> </ul>	<ul style="list-style-type: none"> <li>19.40% identified insufficient space</li> <li>17.10% identified appropriate space as facilitator</li> <li>23.50% identified time constraints</li> <li>16.30% identified insufficient staff</li> </ul>	<ul style="list-style-type: none"> <li>23.5% identified no interest among pharmacy staff</li> <li>14.30% identified appropriate amount of staff</li> <li>13.30% identified change in attitudes or beliefs of owner or pharmacist at that pharmacy</li> <li>29.60% identified doctors' offices administering vaccines</li> </ul>	<ul style="list-style-type: none"> <li>42.90% agreed It advances the role of the pharmacist</li> <li>Patients' concerns: <ul style="list-style-type: none"> <li>patients not wanting vaccines (17.30%)</li> <li>patients not needing vaccines (13.30%)</li> </ul> </li> </ul>		<p>Inconsistent inclusion criteria and recruiting strategies; inappropriate selection of participants; Potential response bias without valid and reliable measure; Important variables not considered.</p>
Kummer GL (2008) USA <sup>22</sup>	Descriptive. nonexperimental. cross-sectional online questionnaire	<ul style="list-style-type: none"> <li>5 active, 15 inactive and 381 non immunisers (34% of total respondents) perceived level of knowledge/training as barrier</li> </ul>	<ul style="list-style-type: none"> <li>5 active, 15 inactive and 381 non immunisers (34% of total respondents) perceived level of knowledge/training as barrier</li> </ul>	<ul style="list-style-type: none"> <li>34 active, 41 inactive and 267 non immunisers (29%) identified availability of space</li> <li>58 active, 15 inactive and 92 non immunisers (14%) identified availability of vaccine</li> <li>71 active, 57 inactive and 545 non immunisers (57%) identified time constraints</li> </ul>	<ul style="list-style-type: none"> <li>20 active, 20 inactive and 70 non immunisers (9.3%) identified criticisms from other immunization providers</li> <li>33 active, 31 inactive and 138 non immunisers (17.1%) identified lack of support from physician</li> <li>30 active, 38 inactive and 203 non immunisers (23%) identified lack of staff support</li> <li>12 active, 35 inactive and 165 non immunisers (18%) identified lack of owner/management support</li> </ul>	<ul style="list-style-type: none"> <li>The majority of all pharmacists who completed certificate training willing to provide all additional vaccines mentioned to adult patients</li> </ul>	<ul style="list-style-type: none"> <li>32 active, 34 inactive and 223 non immunisers (24.5%) concerned about level of reimbursement</li> <li>Of those who vaccinate (n = 223) <ul style="list-style-type: none"> <li>90 active and 60 inactive immunisers identified inability to obtain reimbursement for major third-party</li> <li>81 active and 57 inactive immunisers identified inability to obtain reimbursement from Medicaid</li> <li>47 active, 22 inactive and 67 non immunisers (11.5% of total respondents) identified state's rule on pharmacist-administered immunisations</li> <li>Of those who vaccinate (n = 223): <ul style="list-style-type: none"> <li>53 active and 29 inactive immunisers identified options of immunisations pharmacists may administer</li> <li>79 active and 33 inactive immunisers reported rule that pharmacists are prohibited from administering</li> </ul> </li> </ul> </li> </ul>	<p>Individuals could potentially have completed the survey multiple times; The survey was administered before the end of the influenza administration season, the number of pharmacist-administered influenza vaccinations reported may be lower than the actual total given; Important confounding variables not considered.</p>

TABLE A1 (Continued)

Author (year) location	Study design/sample size (n)	Physical capability	Psychological capability	Physical opportunity	Social opportunity	Reflective motivation	Automatic motivation	Remarks
MacDougal D (2016) Canada <sup>15</sup>	Quantitative: mailed questionnaire Qualitative: Focus group (n = 400)	<ul style="list-style-type: none"> <li>93.8% agreed to inform adult patients about the benefits and risks of adult immunization</li> </ul>	<ul style="list-style-type: none"> <li>30% pharmacists agreed while 50.3% pharmacists disagreed they have inadequate storage facilities</li> <li>83% pharmacists agreed it is difficult to keep track of patients' vaccine status</li> </ul>	<ul style="list-style-type: none"> <li>32.2% nurses and 45.7% physicians would not support this change in practice</li> <li>44.6% nurses and 56% physicians would not refer their patients to a pharmacist for vaccination</li> </ul>	<ul style="list-style-type: none"> <li>82.3% pharmacists support vaccination to adult</li> <li>78% pharmacists support vaccination to children &gt; 5 years</li> </ul>	<ul style="list-style-type: none"> <li>52.3% pharmacists reported insufficient reimbursement</li> </ul>	<ul style="list-style-type: none"> <li>68 active and 55 inactive immunisers reported rule that pharmacists are prohibited from administering pneumococcal vaccine to patient without PCP</li> <li>32 active, 31 inactive and 322 non immunisers (32.6%) reported concern about legal liability</li> </ul>	<ul style="list-style-type: none"> <li>Inconsistent inclusion criteria across groups (public &amp; HCP); Results not taking limitations into consideration</li> </ul>
Marra F (2010) Canada <sup>23</sup>	Quantitative: Questionnaire (n = 151)	<ul style="list-style-type: none"> <li>Of 151 pharmacists: 9.9% preferred 8-hour online training program alone</li> <li>14.6% preferred 8-hour clinical practicum</li> <li>55% preferred to take both online training and clinical practicum</li> <li>3.3% need a 2-day online program w/o practicum</li> </ul>	<ul style="list-style-type: none"> <li>61.8% (n = 76/123) not familiar about procedures for reporting adverse events occurring after vaccination with 18.7% (n = 23) not prepared or only somewhat prepared to provide treatment for anaphylaxis</li> </ul>	<ul style="list-style-type: none"> <li>Out of 123 pharmacists: 73.2% reported appropriate space</li> <li>90.2% reported adequate fridge space</li> <li>66.7% reported adequate freezer space</li> <li>97.6% prepared to monitor and log refrigerator temperature twice daily</li> </ul>	<ul style="list-style-type: none"> <li>81.5% (123/151) indicated interest in administering any type of vaccine</li> <li>Of 123 participants, willingness to vaccinate patient of different age group: 97.6% agreed with &gt;18 years old</li> <li>85.4% agreed with 12-17 years old</li> </ul>	<ul style="list-style-type: none"> <li>81.5% (123/151) indicated interest in administering any type of vaccine</li> <li>Of 123 participants, willingness to vaccinate patient of different age group: 97.6% agreed with &gt;18 years old</li> <li>85.4% agreed with 12-17 years old</li> </ul>	<ul style="list-style-type: none"> <li>68 active and 55 inactive immunisers reported rule that pharmacists are prohibited from administering pneumococcal vaccine to patient without PCP</li> <li>32 active, 31 inactive and 322 non immunisers (32.6%) reported concern about legal liability</li> </ul>	<ul style="list-style-type: none"> <li>Inconsistent recruiting strategy; Response bias might exist due to nature of study (self-administered); small sample size might not be accurate representation of the results.</li> </ul>

(Continues)

TABLE A1 (Continued)

Author (year) location	Study design/sample size (n)	Physical capability	Psychological capability	Physical opportunity	Social opportunity	Reflective motivation	Automatic motivation	Remarks
		<ul style="list-style-type: none"> <li>11.3% preferred 2-day practicum alone</li> <li>11.3% preferred 2-day online program combined with a 2-day practicum</li> <li>67.5% (n = 83/123) agreed with current recommendation for certification (i.e., 8-h online program and 8-hour practicum)</li> <li>Of 123 participants, perceived appropriate recertification interval:               <ul style="list-style-type: none"> <li>43.1% agreed with 5 years</li> <li>15.4% agreed with 2 years</li> <li>14.6% agreed with 10 years</li> <li>4.9% agreed with 1 year</li> <li>22% perceived recertification not required</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Level of knowledge/training perceived as barrier               <ul style="list-style-type: none"> <li>chain pharmacy: 45%</li> <li>grocery chain: 18%</li> <li>independent: 29%</li> <li>mass merchandiser: 0%</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>61.8% reported that procedures in place to respond to situations in which refrigeration temperatures feel outside the recommended range for storing vaccines</li> <li>Out of 123 pharmacists:               <ul style="list-style-type: none"> <li>26.8% indicated no adequate space</li> <li>9.8% reported insufficient refrigerator space</li> <li>33.3% reported inadequate freezer space</li> <li>31.7% reported procedures not in place</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Support from physician               <ul style="list-style-type: none"> <li>chain pharmacy: 24%</li> <li>grocery chain: 24%</li> <li>independent: 50%</li> <li>mass merchandiser: 24%</li> <li>Staff support                   <ul style="list-style-type: none"> <li>chain pharmacy: 47%</li> <li>grocery chain: 55%</li> <li>independent: 29%</li> <li>mass merchandiser: 25%</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>46.3% agreed with &lt;12 years old</li> </ul>	<ul style="list-style-type: none"> <li>Lack of reimbursement               <ul style="list-style-type: none"> <li>chain pharmacy: 32%</li> <li>grocery chain: 36%</li> <li>independent: 61%</li> <li>mass merchandiser: 25%</li> <li>Concern about legal liability                   <ul style="list-style-type: none"> <li>chain pharmacy: 50%</li> <li>grocery chain: 9%</li> <li>independent: 41%</li> <li>mass merchandiser: 50%</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Inconsistent inclusion criteria: Valid and reliable measures were not used; the low response rate from pharmacists in certain practice sites precluded a rigorous statistical evaluation of certain survey items; Knowledge of pharmacists not assessed, only level of training assessed.</li> </ul>
Pace A (2010) USA <sup>35</sup>	Quantitative: mailed questionnaire (n = 129)	<ul style="list-style-type: none"> <li>48 (37%) were certified to immunize               <ul style="list-style-type: none"> <li>chain pharmacy: 8%</li> <li>grocery chain: 7%</li> <li>independent: 33%</li> <li>mass merchandiser: 0%</li> </ul> </li> <li>37 of those who certified reported that they had administered an immunization within the past year               <ul style="list-style-type: none"> <li>chain pharmacy: 4%</li> <li>independent: 27%</li> <li>grocery chain (excluded due to unreliable results)</li> </ul> </li> <li>Level of knowledge/training perceived as barrier               <ul style="list-style-type: none"> <li>chain pharmacy: 45%</li> <li>grocery chain: 18%</li> <li>independent: 29%</li> <li>mass merchandiser: 0%</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Availability of space:               <ul style="list-style-type: none"> <li>chain pharmacy: 47%</li> <li>grocery chain: 45%</li> <li>independent: 26%</li> <li>mass merchandiser: 25%</li> <li>Time constraints                   <ul style="list-style-type: none"> <li>chain pharmacy: 89%</li> <li>grocery chain: 73%</li> <li>independent: 71%</li> <li>mass merchandiser: 50%</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Support from physician               <ul style="list-style-type: none"> <li>chain pharmacy: 24%</li> <li>grocery chain: 24%</li> <li>independent: 50%</li> <li>mass merchandiser: 24%</li> <li>Staff support                   <ul style="list-style-type: none"> <li>chain pharmacy: 47%</li> <li>grocery chain: 55%</li> <li>independent: 29%</li> <li>mass merchandiser: 25%</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>79% agreed it advanced the profession               <ul style="list-style-type: none"> <li>53.5% agreed it increased their desire to implement other patient care services</li> <li>36 reported that they were planning to become certified in the next year. Out of 92 non-immunisers, 18.5% were very interested, 22% interested and 36% somewhat interested in providing immunisations in the future</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Lack of reimbursement               <ul style="list-style-type: none"> <li>chain pharmacy: 32%</li> <li>grocery chain: 36%</li> <li>independent: 61%</li> <li>mass merchandiser: 25%</li> <li>Concern about legal liability                   <ul style="list-style-type: none"> <li>chain pharmacy: 50%</li> <li>grocery chain: 9%</li> <li>independent: 41%</li> <li>mass merchandiser: 50%</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Inconsistent inclusion criteria: Valid and reliable measures were not used; the low response rate from pharmacists in certain practice sites precluded a rigorous statistical evaluation of certain survey items; Knowledge of pharmacists not assessed, only level of training assessed.</li> </ul>	

**TABLE A1** (Continued)

Author (year) location	Study design/sample size (n)	Physical capability	Psychological capability	Physical opportunity	Social opportunity	Reflective motivation	Automatic motivation	Remarks
Richman AR (2013) USA <sup>24</sup>	Quantitative: online questionnaire (n = 1600)	<ul style="list-style-type: none"> <li>56% comfortable, 24% somewhat or very uncomfortable, 20% unsure in administering the vaccine; 24% reported fear of handling adverse events</li> </ul>		<ul style="list-style-type: none"> <li>42% agreed limited time to provide vaccination</li> <li>35% reported difficulties ensuring 3 doses are provided</li> </ul>		<ul style="list-style-type: none"> <li>64% supported expand of authority to administer HPV vaccine</li> <li>HPV vaccination to different age group:                             <ul style="list-style-type: none"> <li>any age (11%)</li> <li>&gt;9 years with parent/guardian present (10%)</li> <li>&gt;12 years with parent/guardian present (16%)</li> <li>&gt;14 with parent/guardian present (17%)</li> <li>&gt;18 years (28%)</li> </ul> </li> <li>Not supportive (13%)</li> <li>Perceived benefits:                             <ul style="list-style-type: none"> <li>77% increased access to the vaccines for patients</li> <li>61% convenient for patients</li> </ul> </li> <li>35% allow greater relationship to patients</li> <li>Patients' concerns:                             <ul style="list-style-type: none"> <li>insurance coverage (27%)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>36% concerned about insurance reimbursement</li> </ul>	
Silvaggio JL (2014) USA <sup>31</sup>	Quantitative: printed & online questionnaire (n = 533)		<ul style="list-style-type: none"> <li>23.08% identified patient education</li> </ul>				<ul style="list-style-type: none"> <li>41.75% concerned about reimbursement</li> <li>30.41% indicated it was not easy to adapt to new laws and guidelines</li> <li>Adaptations and challenges due to legislation:                             <ul style="list-style-type: none"> <li>23.08% reported documentation for school records</li> <li>22.53% reported scheduling appointments</li> </ul> </li> </ul>	
Srivastava A (2018) USA <sup>25</sup>	Quantitative: online questionnaire (n = 261)		<ul style="list-style-type: none"> <li>Out of 8 who not conducting routine vaccination assessment and 34 who not recommending vaccinations, 24.4% and 18.2% reported inadequate vaccination expertise at the pharmacy</li> </ul>	<ul style="list-style-type: none"> <li>Out of 8 who not conducting routine vaccination assessment, 34 who not recommending vaccinations and 18 who not administering vaccines, 69.4%, 65.2% and 44.2% reported lack of staff</li> </ul>	<ul style="list-style-type: none"> <li>253 reported assessing vaccination, 227 recommending vaccinations, 243 administering vaccines</li> <li>179 perceived patient resistant to getting vaccinated</li> <li>Out of 8 reported not conducting routine</li> </ul>	<ul style="list-style-type: none"> <li>Out of 8 who not conducting routine vaccination assessment and 18 who not administering vaccines, 54.8% and 28.8% identified lack of reimbursement</li> </ul>	<ul style="list-style-type: none"> <li>Inconsistent inclusion criteria; Response bias due to nature of study (self-report); Results not validate; estimates of sampling error were not computed; the results based on these non-probability samples might not represent the U.S.</li> </ul>	

(Continues)

TABLE A1 (Continued)

Author (year) location	Study design/sample size (n)	Physical capability	Psychological capability	Physical opportunity	Social opportunity	Reflective motivation	Automatic motivation	Remarks
Valiquette JR (2015) Canada <sup>20</sup>	Qualitative: descriptive survey Quantitative: questionnaire (n = 115)	<ul style="list-style-type: none"> <li>92% agreed lack of training</li> <li>95% identified need for increasing professional training</li> <li>49% do not want to manage allergic reactions caused by vaccines</li> <li>25% feel uneasiness with blood and bodily fluids</li> <li>14% fear of potential adverse events</li> </ul>		<ul style="list-style-type: none"> <li>25.9% indicated lack of necessary vaccine storage and handling equipment and provisions</li> <li>199 having space to administer vaccinations privately</li> <li>Out of 83 reported not documenting vaccinations in LIS, 51.6% not aware that state/ city has LIS for adults and 44.2% not sure how their electronic system would link to LIS</li> <li>134 reported that their pharmacy does not have access to systematic process to assess vaccination of adults at every visit</li> <li>185 reported that their practice prioritizes acute and complicated chronic problems and cannot assess the vaccination status of adults on every visit</li> <li>90% agreed with time constraints</li> <li>50% agreed with lack of space</li> <li>45% agreed with lack of storage space</li> </ul>	<ul style="list-style-type: none"> <li>249 reported having staff trained to administer vaccines</li> <li>247 believed that adults are receptive to being vaccinated by a pharmacist</li> </ul>	<ul style="list-style-type: none"> <li>69% identified pharmacists' personal interest as facilitator</li> <li>47% do not want to be professionally accountable for the act of vaccination</li> <li>Only 23% agreed with pharmacists involvement in vaccine administration</li> <li>25% agreed with insufficient demand</li> <li>54% identified need for increasing patient demands</li> </ul>	<ul style="list-style-type: none"> <li>92% agreed adequate remuneration as facilitator</li> </ul>	<ul style="list-style-type: none"> <li>clinicians and pharmacists as non-coverage and non-response bias may still remain even after weighting adjustments.</li> </ul>
		<ul style="list-style-type: none"> <li>82% agreed support from the Pharmacists Association as facilitator</li> <li>69% agreed support from medical and nursing professional associations as facilitator</li> <li>67% agreed support from chain management as facilitator</li> <li>68% reported vaccination service offered near practice setting</li> <li>43% reported vaccination service offered by other professionals in practice setting</li> <li>26% agreed to avoid conflicts with other professionals who can immunize</li> </ul>					<ul style="list-style-type: none"> <li>Web-based questionnaire was used; Important confounding variables not considered.</li> </ul>	



TABLE A 1 (Continued)

Author (year) location	Study design/sample size (n)	Physical capability	Psychological capability	Physical opportunity	Social opportunity	Reflective motivation	Automatic motivation	Remarks
Westrick SC (2018) USA <sup>32</sup>	Quantitative: questionnaire (n = 292)			<ul style="list-style-type: none"> <li>25.7% reported time spent on the insurance and billing as barrier</li> <li>24.4% reported lack of a system to track multiple-dose vaccines</li> </ul>		<ul style="list-style-type: none"> <li>Patients' concerns:               <ul style="list-style-type: none"> <li>insurance coverage (68.2%)</li> <li>cost of vaccine (35.6%)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>26.4% reported lack of reimbursement for vaccine administration</li> <li>59.7% referred patients elsewhere because patient's age does not fit within approved protocol, pharmacy policy or state law</li> <li>24.3% reported hassle of accessing regional or state immunization registry</li> </ul>	<ul style="list-style-type: none"> <li>Inconsistent recruiting strategy; sampling frame error is possible when using the Hayes' directories; this study collected self-reported behaviors and perceptions, there is potential for recall and social desirability biases.</li> </ul>
Ryan G et al (2020) USA <sup>39</sup>	Qualitative: telephone interview (n = 11)	<ul style="list-style-type: none"> <li>3 of 11 rural pharmacist offered no vaccines               <ul style="list-style-type: none"> <li>Only 1 of 11 offered HPV vaccine</li> </ul> </li> <li>Some pharmacists reported not being certified to administer the HPV vaccine.               <ul style="list-style-type: none"> <li>Many are willing to educate and refer patients, but fewer reported willingness to administer the vaccine.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Pharmacists reported:               <ul style="list-style-type: none"> <li>Insufficient knowledge to recommend, refer, or educate parents about HPV vaccine.</li> <li>Recommended training to increase knowledge about vaccines and its administration.</li> <li>Sensitivity of subject towards certain infections e.g. HPV, safety.</li> <li>Concerns about safety.</li> <li>Lack of information or misinformation.</li> <li>No protocols created for administering the HPV vaccine.</li> <li>Discussion of the vaccine could have a political and contentious aspect.</li> <li>Recommend increase in advertising through social media.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Pharmacists reported:               <ul style="list-style-type: none"> <li>The better accessibility and convenient hours of pharmacies, compared with clinics, for busy parents.</li> <li>Lack of space, e.g. consultation rooms are not big enough for both a parent and an adolescent.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Pharmacists reported:               <ul style="list-style-type: none"> <li>Collaboration with healthcare providers, schools, and public health agencies.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Most indicated recommending HPV vaccination was within their role.</li> <li>Pharmacists reported HPV vaccination should be a priority for adolescent health but it was not a priority in their workplaces.</li> <li>The potential to be seen as competitive with local health care providers.</li> <li>Pharmacists reported liability in administering the HPV vaccine.</li> <li>Low numbers of adolescents coming to the pharmacy.</li> </ul>	<ul style="list-style-type: none"> <li>Small sample size of 7 rural counties; results are not generalisable beyond rural settings.</li> </ul>	
Berce P et al (2020) USA <sup>26</sup>	Quantitative: survey (n = 236)	<ul style="list-style-type: none"> <li>Remembering to screen patients for needed vaccines (76%)</li> </ul>	<ul style="list-style-type: none"> <li>Remembering to screen patients for needed vaccines (76%)</li> </ul>	<ul style="list-style-type: none"> <li>Other responsibilities taking precedence over vaccinating (84%)</li> <li>Having enough staff to provide vaccines (78%)</li> </ul>	<ul style="list-style-type: none"> <li>Patients having insurance coverage for vaccines (90%)</li> <li>Patients refusing vaccines for financial reasons (89%) and perceived safety issues (79%)</li> </ul>	<ul style="list-style-type: none"> <li>Determining if a patient's insurance will reimburse for a vaccine (87%)</li> <li>Adequate compensation for vaccine administration (72%)</li> <li>Having enough patients needing vaccines to</li> </ul>	<ul style="list-style-type: none"> <li>The pharmacy practice settings of survey respondents may not be representative of the whole state, and the opinions of non-respondents may differ from the respondents.</li> </ul>	

(Continues)

TABLE A1 (Continued)

Author (year) location	Study design/sample size (n)	Physical capability	Psychological capability	Physical opportunity	Social opportunity	Reflective motivation	Automatic motivation	Remarks
Mohammed E et al (2021), Saudi Arabia <sup>40</sup>	Qualitative: semi-structured face-to-face or telephone interviews (n = 14)	<p>Both facilitator and barrier:</p> <ul style="list-style-type: none"> <li>Education system to allow the uptake of non-traditional pharmacist roles through course structure and focus:               <ul style="list-style-type: none"> <li>Universities differ in the courses they offer</li> <li>Practical experience during degree</li> </ul> </li> </ul> <p>Barriers:</p> <ul style="list-style-type: none"> <li>Lack of resources:               <ul style="list-style-type: none"> <li>Staff shortage</li> <li>Lack of access to patient records</li> <li>Lack of consultation rooms</li> </ul> </li> </ul>	<p>Facilitators:</p> <ul style="list-style-type: none"> <li>Pharmacist's perception of their current roles</li> <li>Pharmacist's perceived definition of non-traditional role regarding new service that was established</li> </ul> <p>Barriers:</p> <ul style="list-style-type: none"> <li>Patients aren't registered at community pharmacies</li> <li>Patients do not obtain their medication from community pharmacies</li> </ul>	<p>Facilitators:</p> <ul style="list-style-type: none"> <li>Impact of new technology on the uptake of non-traditional roles               <ul style="list-style-type: none"> <li>Patient records are computerized and easily accessible</li> </ul> </li> </ul> <p>Barriers:</p> <ul style="list-style-type: none"> <li>Patients aren't registered at community pharmacies</li> <li>Patients do not obtain their medication from community pharmacies</li> </ul>	<p>Facilitators:</p> <ul style="list-style-type: none"> <li>Hospitals differ in recognizing clinical pharmacy</li> <li>Employer support to uptake non-traditional roles</li> <li>Hospital institutions' recognition of non-traditional roles</li> <li>Pharmacist-patient relationship               <ul style="list-style-type: none"> <li>Patients who have more contact with pharmacists trust them</li> </ul> </li> </ul> <p>Barrier:</p> <ul style="list-style-type: none"> <li>Patients do not trust pharmacists as much as doctors</li> <li>Lack of communication between healthcare professionals and pharmacists in community settings</li> <li>Lack of support from other healthcare professionals</li> </ul>	<p>Facilitators:</p> <ul style="list-style-type: none"> <li>Development of pharmacists' roles</li> <li>Patients' awareness of pharmacists' non-traditional roles</li> <li>Hospital institutions' recognition of non-traditional roles</li> <li>Patients' perceptions on the roles of pharmacists</li> </ul> <p>Both facilitator and barrier:</p> <ul style="list-style-type: none"> <li>Pharmacists' willingness to develop their own roles (Facilitator)</li> <li>Pharmacists stick to traditional roles (Barrier)</li> <li>Attitude towards progression of pharmacist's roles               <ul style="list-style-type: none"> <li>Impact of ease of access to pharmacists on the uptake of non-traditional roles</li> </ul> </li> </ul>	<p>Facilitators:</p> <ul style="list-style-type: none"> <li>Governmental policies to support the uptake of non-traditional roles</li> </ul>	<ul style="list-style-type: none"> <li>It is unknown the extent to which this study can be generalized outside Wisconsin.</li> </ul> <p>Recruitment through convenience sampling, non-representation of all sectors of practice, and lack of data saturation are key limitations.</p>
Qamar M et al (2022), Malaysia <sup>27</sup>	Quantitative: questionnaire (n = 218)	<p>Facilitators:</p> <ul style="list-style-type: none"> <li>Permitting and training community pharmacists to provide vaccination (88.6%) would improve accessibility of public immunization services (84.4%).</li> </ul> <p>Barriers:</p> <ul style="list-style-type: none"> <li>Inadequate training and learning on vaccination topics during their pharmacy studies (55.5%).</li> <li>87.1% believe there should be formal certification.</li> </ul>	<p>Facilitators:</p> <ul style="list-style-type: none"> <li>58.3% were aware of propositions to involve pharmacists in delivering vaccination services and community pharmacists allowed and certified to administer vaccinations.</li> <li>50% had a moderate level of knowledge towards vaccination. 95.5% had a good attitude towards the implementation of a community pharmacy-</li> </ul>	<p>Barriers:</p> <ul style="list-style-type: none"> <li>Vaccination record practice (74.3%)</li> <li>The amount of time and effort for vaccination training and development (73.4%)</li> </ul>	<p>Facilitators:</p> <ul style="list-style-type: none"> <li>36.7% agreed and 35.8% were neutral regarding the improvement of the relationship between community pharmacists and other vaccine providers, such as physicians.</li> <li>Only 6% disagreed that the public would feel comfortable if community pharmacists were vaccinators.</li> </ul> <p>Barrier:</p> <ul style="list-style-type: none"> <li>Lack of support from the authorities (79.4%)</li> </ul>	<p>Facilitators:</p> <ul style="list-style-type: none"> <li>62.8% believed community pharmacists should be permitted to expand their practice.</li> <li>69.3% were willing to provide vaccination to the public and 66.5% believed the benefits outweigh the drawbacks if community pharmacists were permitted to provide vaccination.</li> </ul> <p>Barriers:</p> <ul style="list-style-type: none"> <li>Resources cost (77.1%)</li> </ul>	<p>Study limitations:</p> <ul style="list-style-type: none"> <li>Study location: study was only conducted in 15 areas in Selangor and hence a cross-sectional survey. The findings might be difficult to generalize all of Selangor's community pharmacies.</li> <li>The COVID-19 pandemic had limited the data collection process, yielding a smaller number of respondents.</li> </ul>	

TABLE A 1 (Continued)

Author (year) location	Study design/sample size (n)	Physical capability	Psychological capability	Physical opportunity	Social opportunity	Reflective motivation	Automatic motivation	Remarks
		<ul style="list-style-type: none"> <li>87.2% believed that they required additional learning and training before they could safely administer vaccines.</li> <li>78.5% were not confident that they would be comfortable in providing vaccination.</li> <li>Inadequate level of training by community pharmacists to administer vaccines (89.9%).</li> <li>Community pharmacists with master's degrees had a significantly higher knowledge level (<math>p = 0.01</math>) as compared to community pharmacists with bachelor's degrees.</li> </ul>	<ul style="list-style-type: none"> <li>based vaccination program</li> <li>Barriers:                             <ul style="list-style-type: none"> <li>The level of knowledge towards vaccination (76.6%)</li> <li>Concern for public's safety (70.2%)</li> <li>Community pharmacists with master's degrees had a significantly better attitude (<math>p = 0.037</math>) compared to community pharmacists with bachelor's degrees.</li> </ul> </li> </ul>		<ul style="list-style-type: none"> <li>Lack of support from other vaccine providers (69.3%)</li> </ul>			<ul style="list-style-type: none"> <li>The study was conducted at a specified time.</li> <li>Possible bias from the respondents when answering the questionnaire due to busy workload in the community pharmacy during COVID-19.</li> </ul>
Merks et al (2021), Poland <sup>28</sup>	Quantitative: questionnaire (n = 1777)	<ul style="list-style-type: none"> <li>Not enough training courses for pharmacists (<math>p = 0.0001</math>).</li> </ul>	<ul style="list-style-type: none"> <li>Pharmacists trained in vaccination more often indicated that providing vaccinations in community pharmacies would improve the overall vaccination rate (<math>p = 0.0001</math>).</li> <li>Pharmacists could play an important role in promoting vaccinations (<math>p = 0.0001</math>).</li> <li>For pharmacists not trained in vaccinations, they indicated to a much greater extent possible barriers affecting the readiness to provide vaccinations in pharmacies</li> </ul>	<ul style="list-style-type: none"> <li>Vaccination services would cause a significant workload increase (<math>p = 0.0001</math>)</li> <li>Pharmacies were not adapted to immunization (<math>p = 0.0001</math>)</li> </ul>				<ul style="list-style-type: none"> <li>Potential participant bias: Questionnaires distributed to pharmacists who are willing to provide immunization services and interviews with flu vaccination trained pharmacists with the Pharmacist Without Borders project as the response of trained pharmacists was lower.</li> <li>Findings might differ in the other areas and local pharmacy jurisdictions due to differences in vaccination service opinions in pharmacies.</li> </ul>
Alshahrani SM et al (2022)	Quantitative: questionnaire (n = 415)	<ul style="list-style-type: none"> <li>45% believed that community pharmacists are not experienced in</li> </ul>	<ul style="list-style-type: none"> <li>72.8% have not been exposed to COVID-19 and are not aware of the</li> </ul>		<ul style="list-style-type: none"> <li>More than 68% agree that community pharmacies should</li> </ul>			<ul style="list-style-type: none"> <li>The use of the convenience sampling method is a limitation.</li> </ul>

(Continues)

TABLE A1 (Continued)

Author (year) location	Study design/sample size (n)	Physical capability	Psychological capability	Physical opportunity	Social opportunity	Reflective motivation	Automatic motivation	Remarks
Saudi Arabia <sup>29</sup>		administering vaccines. However, 63% are satisfied with getting the COVID-19 vaccination by a community pharmacist; if no other option is available.	approval of COVID-19 vaccination by community pharmacists.			expand their health care services to include vaccinations, prescriptions, checkups, and other forms of preventative medicine.		<ul style="list-style-type: none"> <li>The high percentage of healthcare sector participants could have higher clinical experience and trust in the pharmacist.</li> </ul>

Abbreviations: COVID-19, Coronavirus disease 2019; GP, general practitioners; HCP, healthcare professional; HPV, human papillomavirus; IS, immunization information system; PCP, primary care provider.