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Review

Pharmacist role in vaccination: Evidence and challenges

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ABSTRACT

Vaccines prevent an estimated 2.5 million deaths worldwide each year and are amongst the most cost-effective preventive measures against infectious diseases. Despite the effectiveness and availability of vaccines in many parts of the world, vaccination rates and service uptake remains suboptimal among both healthcare providers and the public. Pharmacists as established advocates, educators as well as qualified providers of vaccinations have a significant role to play in promoting and supporting the uptake of vaccination. Challenges and barriers to pharmacist vaccination are multifactorial, which needs effective strategies to address. Overcoming these barriers will increase the role of pharmacists as vaccinators that ultimately increases public access to vaccination and accurate and reliable information about vaccines.

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1. Introduction

Vaccination ranks as the number one public health achievement of the 20th century [1]. Vaccines prevent an estimated 2.5 million deaths worldwide each year [2], and are amongst the most cost-effective preventive measures against infectious diseases. According to the World Health Organisation (WHO), vaccines are currently available for over 26 infectious diseases, many of which are designated for childhood vaccination. While vaccination has traditionally been against infectious diseases, there is significant emerging interest and work in developing vaccines for non-communicable diseases and chronic conditions, which is beyond the scope of discussion in this paper.

Until very recently, physicians and nurses were generally the only healthcare professionals permitted to administer vaccines to patients. These vaccines were administered in a range of settings (for example in clinics and primary health care centres, community health clinics, work places, schools, and in hospitals). Despite the effectiveness and availability of vaccines in many parts of the world, vaccination rates and service uptake remains suboptimal among both healthcare providers and the public [3]. Although, vaccination programs have contributed to the decline in mortality and morbidity of various infectious diseases worldwide, minimising the prevalence and incidence of vaccine-preventable diseases relies upon achieving a high level of vaccine uptake amongst the population i.e. herd immunity [4]. For example, the recent outbreaks of vaccine preventable diseases including measles, poliomyelitis and pertussis in developed countries have been linked mainly to underutilisation or non–vaccination. An individual's decision to be vaccinated or not is influenced by several factors such as health beliefs, risk-benefit perceptions, cost, waiting times, and ease of access to vaccinations [5]. Strategies are needed to improve vaccine uptake by addressing major barriers to accessing and receiving vaccines.

Pharmacists are often amongst the most accessible and the most trusted healthcare professionals. As such, they have a significant role to play in promoting and supporting the uptake of vaccination. In various countries, pharmacists act as advisors and educators, facilitating and participating in national and global routine vaccination strategies and practices and/or delivering pharmacy-based vaccinations. Countries such as Australia, Canada, Ireland, New Zealand, Portugal, United States of America (USA), and the United Kingdom (UK) have legislated for pharmacists to administer vaccines [5–7]. Pharmacists may develop their competency to administer vaccinations and provide vaccination services through either their undergraduate qualification, or undertake pharmacist specific training programs designed to meet the professional requirements in each jurisdiction [8]. Training of pharmacists as non-traditional vaccinators ensure vaccines are safely and effectively administered and patients are provided information to make informed choices regarding the benefits as well as the risks [9]. The type of vaccines pharmacists can administer and to whom (adults and under 18 years of age) varies by country and jurisdictions. For example in countries like Australia and Canada, there is regional variability in laws and regulations governing which vaccines can be administered by a pharmacist. For instance, pharmacists in Queensland (Australia) can vaccinate influenza, dTpa, Measles mumps rubella (MMR) to people aged 16 years and over [10], but in Tasmania (Australia) they can administer influenza and meningococcal vaccines to people aged 10 years and over [11]. Similarly, in Ontario (Canada) pharmacists can administer vaccinations in participating pharmacies to anyone five years of age and older [12] however in Quebec, Canada pharmacists are still not allowed to administer vaccines to any age groups. A recent Bill presented by Quebec Health Minister to amend the Pharmacy Act might, however, change the scenario and allow pharmacists to prescribe and administer vaccines to anyone six years of age and older [13]. This paper reviews the barriers and challenges to vaccination with a focus on the role of pharmacists as vaccinators, and the challenges associated with effective implementation of pharmacist administered vaccination services.

2. Barriers and challenges to vaccination

Despite the numerous vaccines available globally for a wide range of infectious diseases, vaccination and vaccination programs are consistently not fully utilised around the world [14]. The effective implementation of vaccination and vaccination programs depends upon overcoming several biological, social, economic, logistic, and epidemiological factors that act as barriers and challenges [15]. These barriers significantly impact upon the levels of vaccine uptake by the general public and consequently, the incidence and prevalence of vaccine-preventable diseases, and the achievability of national and international vaccination goals to eradicate vaccine-preventable diseases. The barriers and challenges must be identified and addressed so that tailored and well-organized strategies are developed to improve vaccination rates, thereby reducing morbidity and mortality associated with vaccine-preventable diseases. Some of the key barriers and challenges that influence vaccination are discussed below:

Patient and family barriers: Patients and their parents or caregivers may not have access, or lack accurate information about vaccination. While many parents and caregivers accept and understand vaccines are necessary to prevent infections and disease in children, they may have concerns, misconceptions, or misinformation about the risks and benefits of vaccination. A common misconception is that with the increasing number of vaccines in the vaccination schedule, multiple vaccines can overwhelm the immune system [16]. Some parents chose to delay the vaccine schedules and are also selective in accepting or rejecting vaccines based on their perceived severity of the disease. For example, parents more commonly refuse varicella vaccines as they are not aware of common complications associated with chickenpox (e.g. encephalitis and pneumonia), which increases the risk of morbidity and mortality even in healthy children [17]. Moreover, many people are also unaware that an unvaccinated child can be a threat to others in the community who are too young or unable to be vaccinated [18].

Other beliefs and misconceptions such as vaccination leads to infestation with other infectious diseases or health conditions, and vaccines are not effective in preventing infection; together with any related cultural and/or religious beliefs can hinder vaccination uptake [19]. These beliefs and misconceptions are also frequently propagated by anti-vaccine movements, which are organized and vocal in their opposition to vaccinations. These movements are particularly prevalent in some parts of the

developed world, and can have celebrity endorsements which help increase their reach, influence and perception of credibility [20]. This movement is often influenced by unrelated health scares, conspiracy theories, and controversies e.g. toxic cumulative effects of thiomersal (a preservative used in vaccines) because of its mercury content [21], and MMR vaccines causing autism despite original research being discredited and redacted, and subsequent research showing there is no association [22]. Propagation of this misinformation shifts the focus and balance away from recognising true benefits of vaccination, towards increasing suspicion of adverse effects resulting from vaccination. Other factors parents identified as barriers to vaccinating their children were largely related to health literacy e.g. complex vaccination schedules, and accessibility issues e.g. long wait times and/or inconvenient clinic hours, associated costs and transportation to access the vaccination service [23].

Provider barriers: Any gaps in, or lack of knowledge around vaccine indications, contraindications and side effects on the vaccinator's behalf can have a significant detrimental impact on vaccination rates [24]. Staying updated with the current vaccination schedules and guidelines can also be difficult for some healthcare providers, and vaccination coverage is impacted by the insufficient knowledge of the benefits of vaccination among healthcare providers [25]. Patient dissatisfaction with the advice provided by doctors with regards to vaccines is one of the most prominent reasons for low vaccine acceptance rates. On the other hand, a doctor's recommendation to receive a vaccine is also the strongest predictor of vaccination [26]. This demonstrates the important influence healthcare providers can have to help increase the uptake of vaccines. Unfortunately, some healthcare professionals especially homeopathic practitioners [3,27] and practitioners of some complementary or alternative medicines and therapies hold negative attitudes towards vaccination, even despite official position statements from their professional organizations which support the use of mainstream evidence-based vaccines. These providers consider vaccines against certain diseases ineffective, which contributes to lower vaccination uptake amongst their patient cohort [28].

Systems barriers: The most obvious system barriers are those affecting the supply and distribution of vaccines. In jurisdictions where vaccines are not subsidized or provided free of charge, costs remain a considerable barrier, especially for those who are not covered by health insurance [29]. The strict vaccine storage requirements (e.g. maintaining cold chain) and lack of trained personnel to administer the vaccine also represents a major challenge for some developing countries [29]. Inadequate stock or delayed production and supply of some vaccines (e.g. for influenza, tetanus, pneumococcal and measles) have also been reported due to the lack of manufacturing capacities in some countries [30]. Vaccination coverage is also influenced by the lack of adequate systems for supporting patient health literacy (e.g. to understand complex vaccine schedules). The other barriers to achieving vaccination requirements in a timely manner are the missed opportunities for administering vaccines or inadequate reminder/recall systems for those whose vaccines are overdue [29]. Missed vaccination opportunities occur when there is any contact with health services, but that did not result in an eligible patient receiving the needed vaccine(s). A secure, timely and reliable population-based system to collect and consolidate vaccination data, with the ability to activate effective reminders or recalls for patients to receive vaccinations is urgently required [31]. Unfortunately, such systems are not well developed or fully adopted in many countries. Missed vaccination opportunities are predominant in adolescents as they are no longer followed by paediatricians and often do not require ongoing medical care [32].

3. Pharmacists role in vaccination

One of the strategies proposed to help address the barriers and challenges associated with vaccination services is the training of non-traditional vaccination providers such as pharmacists who can safely and effectively administer vaccines in their practice settings [5].

Pharmacists have always played an important role in the vaccination process, from as early as the mid-1800s by storing vaccines in pharmacies, delivering vaccines to physicians, preparing antitoxins for administration, and distribution of vaccines. Later in the twentieth century, pharmacists evolved into educators about vaccines, and promoters of vaccine services [33]. Today, pharmacists in many countries are also more actively involved in vaccination activities through administering vaccines to patients. Pharmacists are ideal for this role as they are already established in their competency for many aspects related to medication management such as taking medication histories, counselling, and managing medication-related adverse effects [34–36]. For the past 18 years, pharmacists have established themselves as advocates for vaccines and preventative health [37], with significant increases in vaccination rates when pharmacists made targeted interventions [38–40]. For instance, a study of a single-day versus daily offerings of influenza vaccines in community pharmacies reported an eightfold increase in the number of vaccines administered when pharmacists offered vaccination daily compared to nurses offering vaccination on a single day [41]. Similarly, higher vaccination rates [39] and lower vaccination-related health care resource utilization and costs have been observed in states and territories where pharmacists are allowed to vaccinate compared to the states where pharmacists are not authorised to vaccinate [42].

Pharmacists are one of the most trusted healthcare professionals and are dispersed throughout the healthcare system across various practice settings [43]. In many parts of the world, pharmacists are the most accessible healthcare professionals via community pharmacies and are the first point of contact for many patient healthcare needs. Pharmacists vaccinating patients are trained in vaccine storage, administration, recognition of adverse events associated with vaccines. They provide a highly accessible option for individuals who would benefit from vaccination [44]. Pharmacists have essential training to engage in discussion with patients to prompt vaccine recommendations and reminders and they are perfectly positioned to disperse myths and misconceptions regarding vaccination [45]. With multiple locations in metropolitan and urban areas, convenience, extended opening hours, and reduced cost to administer vaccines, community pharmacies can address the challenges of vaccination, which might help achieve vaccination goals by increasing vaccination rates [45].

3.1. Global scenario

The involvement of pharmacists in administering vaccines and other vaccination services varies globally. While some countries have authorized pharmacists to administer vaccines, this is not consistent around the world. Some developed countries, including the USA, Portugal, Canada, New Zealand, Ireland, Australia and the UK have provided legal rights to pharmacists to administer vaccines, manage patient vaccination schedules, and organise educational and promotional campaigns to increase vaccination rates.

The administration of vaccines by pharmacists in pharmacies increases the accessibility of vaccines for a wider range of the population and promotes vaccination programs. A global survey of 45 member organisations of the International Pharmaceutical Federation (FIP) explored the current role and impact of pharmacist vaccination [46]. Based on the sample of countries presented in this

report, 940 million people live in countries where over 193,000 community-pharmacies can potentially offer access to vaccination services. In this sample alone, it is estimated that currently, pharmacist-administered vaccination services have the potential to reach a total global population of 655 million [46]. The findings reported that regions involving pharmacists in actual vaccine administration had more positive views towards addressing the challenges and barriers to vaccination, and indicated more positive patient acceptance of pharmacists as vaccinators.

The legal authority to conduct vaccination activity in different countries, the gradual changes in vaccination policy, pharmacy workforce training, tools and resources available for pharmacists, and the impact of pharmacists vaccination services are explained in further sections below. This section will focus on pharmacist-administered vaccination in pharmacies, their impact, and the limitations and challenges for effective implementation of pharmacist vaccination services in Australia, Canada, the UK and the USA.

3.2. Pharmacist administered vaccination service in pharmacies

Pharmacists are actively involved as 'educators' providing information and recommendations about vaccines, 'facilitators' hosting nurses and other traditional vaccinators in the pharmacy to help make access to vaccination services easier, and 'administrators' giving vaccines as a vaccinator [4]. Community pharmacy based vaccination services has repeatedly demonstrated success in increasing levels of vaccination uptake. A large proportion of pharmacist-provided vaccinations occur in the community pharmacy setting because they provide a convenient and easily accessible option for patients to receive vaccines from a pharmacist trained in vaccine administration [45]. Even patients eligible for free vaccination services in physician/doctor surgeries chose to pay for this service in a pharmacy [8,47]. Patients preferred to receive their vaccines from a pharmacist in a pharmacy because of the inconvenience associated with attending physician/doctor surgeries (e.g. opening hours, making appointments, waiting with 'sick people at the reception, locations and accessibility). Likewise, a pharmacist's recommendation to be immunized has been shown to have a similar effect on a person's decision to be immunized as that of a physician or nurses [48].

Patients who receive vaccination from pharmacists in the community pharmacy setting have reported a positive experience and indicated that immunisation service was better in the pharmacy than that previously experienced elsewhere [49,50]. Patients reported a high degree of satisfaction with pharmacist administered vaccination and higher adherence to most recommended vaccines [51,52]. Some even reported that they would not have been vaccinated if pharmacist-administered vaccination had not been available [49]. Also, parents who visited community pharmacies accepted pharmacists as an immunisation resource for their children and indicated that pharmacists provided immunisation is more convenient than other traditional vaccination options [53]. Pharmacists can help increase the uptake of vaccines in the community by complementing the vaccination services currently provided by physicians and nurses.

3.2.1. Australia

Australia's first pharmacist vaccination service was initiated in Queensland as the 'Queensland Pharmacist Vaccination Pilot' (QPIP) in 2014. Pharmacists across approximately 200 community pharmacies administered over 35,000 influenza vaccinations to adults in just over 2 years. The pilot started with vaccinations for influenza which were later expanded to include pertussis and measles vaccinations because of overwhelmingly positive response and uptake of this service in community pharmacies [54]. The pilot demonstrated that an appropriately trained pharmacist can deliver vaccinations safely and effectively in the community setting, and provided the evidence for supporting the authorization of pharmacist vaccination services across all other jurisdictions in Australia [54]. However, a legislative requirement governing the administration of vaccines varies between jurisdictions within Australia. The types of vaccines pharmacists can administer, the age of patients who can have a vaccine administered by a pharmacist, and the training and continuing professional development requirements also vary across Australia.

3.2.2. Canada

Pharmacists administer vaccinations in 9 of the 13 provinces and territories in Canada. In 2007, Alberta was the first province in Canada to obtain the authority for pharmacist administered vaccination services to the public [55]. Later in 2012, Ontario pharmacists received rights to administer influenza vaccines, whereby more than 765,000 flu vaccines were administered by community pharmacists in the 2013–2014 flu season [56]. Depending upon the rules and legislations of different jurisdictions, pharmacists in Canada are permitted to administer a range of vaccines such as influenza, rubella, hepatitis, and chickenpox [57].

3.2.3. The United Kingdom

Until the 2013/2014 'pharmacy initiative' in the UK that authorized qualified pharmacists to administer influenza vaccinations to individuals eligible for the National Health Service (NHS) programs, physicians/doctors and nurses vaccinated all eligible individuals in England [58]. Prior to this, most community pharmacies provided vaccinations only to individuals who paid for the service themselves, or they were conducted as a part of research pilot studies. Following NHS endorsement of a pharmacist vaccination program in 2015/2016, pharmacists administered 10,407,913 seasonal influenza vaccinations, which included an additional 240,259 patients who chose to receive the vaccination in a community pharmacy compared to the previous year [59]. This success of vaccinating nearly a quarter of a million more people in community pharmacy settings prompted NHS England to recommission the Community Pharmacy Seasonal Influenza Vaccination Program for 2016/2017 flu seasons.

3.2.4. The United States

In 1996, pharmacy based vaccination delivery began with a nationally recognised training program for pharmacists. By 2009, pharmacists in all 50 states were allowed to administer all adult vaccinations, with an estimated 280,000 pharmacists in the USA currently trained to provide vaccinations [60]. An adult vaccination survey conducted in 2013 reported that pharmacists provided vaccinations in 86% of community pharmacy settings [61]. Pharmacies are noted to be the second most utilized sites for influenza vaccination among adults, after physician's offices [60].

3.3. Impact of pharmacist vaccination services

Community pharmacists that have an authority to administer vaccines play a major role in overcoming barriers in vaccination because of their ease of accessibility, walk-in services, extended opening hours, and service provisions [40]. Studies from several countries report positive outcomes with pharmacist delivered vaccination services.

3.3.1. Australia

In Australia, the impact of pharmacist delivered vaccination services was demonstrated in QPIP. Amongst the patients electing to receive a vaccine from the pharmacist, almost 14% had never previously had an influenza vaccination. Similarly, 15% indicated if the QPIP service was unavailable they would not have received a

vaccination for influenza [54]. Pharmacist administered vaccinations were well accepted by patients, who also expressed a high level of satisfaction with the service. Almost 95% were happy to return to the pharmacist for vaccines in future, and more than 97% would recommend the service to others [8].

3.3.2. Canada

In Canada, pharmacists in most jurisdictions (except Quebec, and three other territories; Nunavut, Northwest Territories, and Yukon) have some level of authority to inject vaccines. Pharmacists can administer the influenza vaccine in all of these regions but administering other vaccines depends upon the province-specific legislation. For example, Ontario has recently expanded pharmacist vaccination authorization to include 13 vaccines–preventable diseases in addition to the influenza vaccine [44]. However, this legislation excludes the administration of publicly funded vaccines, therefore patients who need these vaccines can either visit physicians or public health clinic that has publicly funded supply or can pay the cost of privately acquired service through the pharmacy [44]. Vaccination rates in older people were increased in parts of the country where pharmacy vaccination clinics were introduced [62]. Across all age groups eligible for pharmacist-administered influenza vaccines, a study evaluating the benefit of involving community pharmacist for administration of influenza vaccines within the publicly funded universal influenza program reported an increase in overall vaccination rates [63]. Pharmacists as vaccine providers are accepted and recognized among the public and other healthcare providers. A 2015 national survey reported that 82.3 percent of pharmacist, 64.6 percent of the public, 57.4 percent of nurses, and 38.9 percent of physicians supported pharmacists as vaccine providers [55].

3.3.3. The United Kingdom

The NHS aimed to administer influenza vaccines to 75% of 'at-risk' patients in a 2013/2014 campaign. Unfortunately, they fell short of the target, with only 52% receiving vaccinations that year, and even fewer people (50.3%) in the subsequent 2014/15 flu season. It was notable that areas which commissioned this service through community pharmacies reported higher uptake among those aged <65 years, and 'at-risk' groups compared to those that did not commission the service [64]. The potential to improve national vaccination rates through pharmacists in community pharmacies were recognized because of the convenience and easy access to community pharmacies.

3.3.4. The United States

In the USA, 18% of all influenza vaccination were administered in community pharmacies in 2011, which increased to 25% in 2017 [65]. The main reason patients chose a community pharmacy for vaccination services was because of convenience (i.e. the service did not require an appointment or additional fees). The pharmacist's role in improving rates of vaccination during a pandemic was also demonstrated in a study that reported a significant increase in vaccination capacity, and reduced time to achieve national vaccination coverage [65]. Similarly, another study evaluating the collaborative effort of community pharmacies and public health programs in pandemic planning found pharmacies were involved in pandemic vaccine distribution plans in more than 85% of public health programs, and 45% recruited pharmacists as vaccine providers [66].

Expanding the scope of pharmacy practice to permit pharmacists as vaccinators has a significant positive impact on improving the uptake of vaccinations amongst the general public, and importantly amongst hard-to-reach and high-risk populations [5]. Therefore, including pharmacists as vaccinators more broadly will help to overcome some of the barriers related to vaccine accessibility and improve overall vaccination coverage.

3.4. Limitations and challenges for effective implementation of pharmacist administered vaccination services

Despite the widespread success and demonstrated positive impact of pharmacist administered vaccination services, several challenges still persist. Some common challenges include jurisdictional variability in laws governing pharmacists' training requirements, vaccine administration (type of vaccine and to which patient cohort), difficulty accessing health information technologies, pharmacy reporting of vaccination services, and inconsistent compensation and reimbursement systems [45]. These restrictions and inconsistencies between jurisdictions within the same country, limits the ability for pharmacists to fully contribute to public health vaccination efforts. The difficulties in accessing health information technologies such as the lack of shared patient record systems have led to inconsistent communication between pharmacists, doctors and other primary care providers. Additionally, the remuneration arrangements often barely cover the overhead costs a pharmacy incurs for offering pharmacist-delivered vaccination services, making it difficult for some pharmacies to offer this service to the community. There is also an obvious disparity and non-uniformity in cost-sharing, government subsidy and remuneration for vaccines and vaccine services amongst the different vaccinator providers. For example, patients often have to self-fund with no government subsidy or support if they choose to utilize pharmacist-vaccination services [45].

3.4.1. Australia

In Australia, there is currently no provision of any financial remuneration from the government to the community pharmacy or community pharmacist vaccinator delivering the vaccination services. Other common challenges include issues with pharmacy staffing, particularly in rural and remote settings, difficulties in meeting legislative requirements or having adequate floor-space to provide a vaccination service in the community pharmacy premises, fear of jeopardizing relationships with local doctors and primary care provides, and inability to effectively promote the service to consumers [7]. Like the other countries, Australia also had fierce opposition from the medical associations and medics, and some nurses regarding pharmacist vaccinations. A majority of doctors believe pharmacists should not be permitted to administer vaccinations as they argue that pharmacists are not trained to do vaccination or to manage a patient with an adverse drug reactions, and had a perceived fear of fragmentation of care and records [67].

3.4.2. Canada

Barriers to implementing pharmacy administered vaccination services in Canada are multifactorial that includes logistic and infrastructural issues, patient knowledge on vaccine and vaccine-preventable diseases, financial constraints, and perception of patient and conventional health care providers towards vaccination [55]. A survey of traditional vaccinators found they were only moderately supportive of pharmacists administering vaccines, with opposition voiced by 32% of nurses and 46% of physicians. Similarly, less than 50% of the nurses and physicians surveyed would refer their patients to a pharmacist for vaccine administration [55]. Reasons cited for this reluctance and lack of support was in relation to doubts about whether pharmacists were adequately or effectively trained to manage adverse effects following vaccine administration [55]. Other concerns were related to record-keeping and affordability concerns and that patient would not be charged more for the service at the pharmacy, compared to that offered at public health centres or doctor/physician surgeries.

3.4.3. The United Kingdom

In the UK, public awareness about the availability of vaccination services in community pharmacies is lacking which acts as a most challenging barrier in delivering vaccination program and services. Other barriers perceived by patients were concerns about pharmacist's expertise delivering vaccination, confidentiality and privacy and the lack of space in pharmacy [68]. Some of these barriers are addressed with the re-commissioning of the national vaccination campaign. The biggest challenge has been the GPs disagreement in letting community pharmacists administer vaccination services because GPs in the UK receive payments for administering flu vaccines and were less likely to let go of this income source to community pharmacists. The concerns over the lack of effective record sharing protocols between pharmacists and the GPs have also been raised by the committee of GPs stating that it might cause duplication of vaccination and hinder their follow up procedure on their at-risk patient groups [68].

3.4.4. The United States

Laws and regulations around vaccination practices across jurisdictions have become more uniform and aligned in recent years. However, to effectively deliver pharmacist vaccination services across the country, consistency across all the states is required. This is particularly important for overcoming barriers to vaccine access for high risk, and hard to reach populations. The other challenges continue to be around the arrangements for remuneration, payment and health insurance. Pharmacists providing vaccination services are reimbursed under current fee schedule in some states where pharmacists are recognised as healthcare providers under state Medicaid, Medicare and other commercial health insurance plans, while other states exclude pharmacists based on provider type [69].

Overall, pharmacists are recognized as qualified vaccinators in many countries and community pharmacies are convenient and accessible sites for patients to receive vaccinations. The pharmacist is an integral and accessible member of the health care team with the ability to conveniently, competently, and safely deliver immunizations to patients of different age groups [70]. Other healthcare professionals report safety and training, service duplication, and fragmented care as concerns for patients receiving vaccination from a pharmacist [33]. However, in reality, the credential training and certification, safety standards and processes that pharmacist is required to complete are often more stringent than the training of other practitioners [33,71]. They undergo detailed required training for becoming a vaccinating pharmacist, and the education and training for continuing maintenance and competence [71]. The training programs include information on vaccine administration, such as cold chain management, aseptic techniques, and the management and reporting of adverse reactions, including anaphylaxis [44]. Moreover, pharmacists are suitably positioned to enhance communication between other healthcare providers via maintaining good surveillance and immunisation registration quality [7] as well as good documentation (up-to-date) of vaccination records for both practitioners and patients. Nonetheless, to fully harness the potential of pharmacists as vaccinators, the existing barriers and challenges must be addressed, and focus needs to be on effective documentation that provides robust evidence of the value of a pharmacist's vaccination services.

4. Conclusions

Pharmacists have established themselves as advocates, educators, facilitators as well as qualified providers of vaccinations. The value of pharmacists as vaccinators to increase levels of vaccination uptake amongst the community through accessibility and convenience must be recognised and valued. This is especially important amongst high-risk populations, or in areas where access to healthcare services and traditional vaccinators (e.g. doctors/-physicians and nurses) are more difficult.

The intention of pharmacists as vaccinators is not a turf war for remuneration, nor to encroach upon other healthcare professionals' scope of practice. Rather, the most important point is to work collaboratively as a part of an integrated healthcare team to help patients more easily access this invaluable health service. A coordinated effort from all members of the healthcare team and policymakers are required to overcome the multifactorial challenges and barriers to pharmacist vaccinations.

The ability of pharmacists to safely and effectively administer injectable medications and manage adverse drug reactions points to an opportunity for pharmacists to further contribute to delivering public health services beyond that of selected vaccinations, and to selected cohorts of people in the community. Similarly, in the future, there is potential opportunity for wider delivery of healthcare services to people in the community, which extends beyond vaccinations (e.g., other injectable medications such as contraception, anti-psychotics, vitamin B12).

Nevertheless, at this current point in time, one of the major limitations preventing pharmacists from more actively playing a role to help increase the uptake of vaccinations is the disparate legislative requirements across jurisdictions, particularly those within the same country. Another is the inequality of remuneration for pharmacists as vaccinators. A systematic change is required to ensure pharmacists are included in the same funding model as those for physicians and other traditional vaccinators. Overcoming these will be an important first step toward capitalizing upon a capable and ready workforce that can help achieve more effective herd immunity.

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The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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