



A qualitative exploration of pharmacists' roles in centralised vaccination centres during the COVID-19 pandemic

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ABSTRACT

Introduction: The COVID-19 pandemic prompted rapid implementation of public health interventions aimed at protecting population health. In Ireland, mass vaccination was integral to the national response. Pharmacists played key roles in the safe delivery of vaccines within centralised vaccination centres (CVCs), particularly medicines management and vaccine stewardship. This study aimed to explore pharmacists' motivations for taking on these roles, explore their experiences and identify how their learning may inform the future development of pharmacy practice and education in Ireland, with a view to strengthening preparedness for future public health emergencies.

Methods: A qualitative case study methodology design was employed, using semi-structured interviews for data collection. Fourteen pharmacists were recruited, with eleven included in the final analysis. Interviews were transcribed verbatim and analysed thematically.

Findings.

Three primary themes were developed from the data: (1) A Sense of Duty and Opportunity, (2) Navigating the Frontline: Challenges and Adaptation, and (3) Professional Growth and Future Directions. Pharmacists reported some challenges working in high-pressure, fast-changing, multidisciplinary environments. Their experiences highlighted the evolving scope of pharmacy practice and the unique contribution pharmacists can make within multidisciplinary teams (MDTs) in national-level public health responses.

Conclusions: Pharmacists' involvement in CVCs provided opportunities to develop and showcase their professional competencies in MDTs, notwithstanding challenges associated with the role. The findings also emphasise the importance of effective multidisciplinary teamwork and mutual respect among healthcare professionals. A continued focus on interprofessional learning and practice, alongside expansion and recognition of the pharmacists' roles, may enhance preparedness for future public health emergencies.

1. Introduction

The recent resurgence of avian influenza (H5N1) as a potential pandemic threat has renewed global attention on the need for robust pandemic preparedness, informed by lessons from the COVID-19

pandemic response.^{1,2} A key milestone in the COVID-19 response was the rapid development and regulatory approval of vaccines that significantly reduced disease severity, hospitalisation and mortality in late 2020.³ At that time, population-level modelling indicated that uptake of at least 67 % would be required to adequately protect public health and

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enabling this level of uptake required large-scale, coordinated efforts, including the rapid establishment of mass vaccination centres.^{4,5}

In Ireland, the Department of Health published a COVID-19 Vaccination Strategy and accompanying implementation plan in December 2020.⁶ This strategy prioritised initial vaccination of high-risk groups, including older adults living in long-term care facilities, frontline healthcare workers, and those over the age of 70, followed by mass ramp-up and open access phases to vaccinate the rest of the population as vaccines became more widely available. Mass vaccination centres, known in Ireland as 'Centralised Vaccination Centres' (CVCs) were a key component of this effort, enabling the efficient, high-volume administration of vaccines across the country.^{5,7,8} To maximise uptake, CVC locations were selected based on logistical considerations, including population density, site accessibility and capacity, cold-chain and vaccine storage capabilities, and internet connectivity for real-time recording of vaccine dispensing and administration. Using non-traditional settings for vaccine administration has previously been shown to be cost-effective and associated with improved vaccination rates in certain groups, such as the homeless, migrants, and minority groups, as well as working-age adults who may not otherwise engage regularly with healthcare.^{5,9,10} At the height of the vaccination rollout in Ireland, there were 48 CVCs in operation with at least one CVC located in each of Ireland's 26 counties.¹¹

The success of these centres depended heavily on effective workforce planning, including the recruitment, training, and retention of healthcare professionals and operational and support teams, therefore, ensuring adequate staffing was a key strategic concern.⁶ Healthcare professionals and operational staff were drawn from diverse backgrounds, and included doctors, nurses, midwives, emergency medical technicians, paramedics, pharmacy technicians, members of the Irish Defence Forces, administrators, students of healthcare disciplines, retired healthcare professionals, and volunteers. Pharmacists were a key part of this workforce, recruited through a combination of secondments coordinated by Ireland's national Health Service Executive (HSE) and open recruitment, which drew pharmacists from community, hospital, regulatory, industry, and academic roles, primarily on short-term 'zero-hour' contracts or in some cases, secondments.¹¹

While some pharmacists worked in the CVCs as vaccinators (given most community pharmacists in Ireland are qualified as vaccinators and involved in seasonal vaccine campaigns) or clinical leads (healthcare professionals responsible for planning and guiding clinical activities within the CVCs and providing clinical supervision to CVC staff), the primary role of most was in medicines management and vaccine stewardship. This was a specific role for pharmacists with three or more years post-qualification experience and encompassed responsibilities including cold-chain management, vaccine stock management, aseptic reconstitution, quality assurance, adverse event monitoring and reporting, and clinical support regarding excipients, allergies, and interactions.¹¹ These responsibilities broadly aligned with international trends in pharmacist involvement in mass vaccination centres.¹² In these roles, pharmacists worked alongside other healthcare professionals reporting into a designated lead pharmacist (who was either onsite in bigger centres or remote with periodic site visits for smaller centres) who formed part of the multidisciplinary leadership team.

This study aimed to explore the experiences of pharmacists who held medicines management and vaccine stewardship roles within CVCs. The objectives were to (1) understand pharmacists' motivations for undertaking these roles, (2) explore their experiences within CVCs, and (3) identify key learnings that could inform the future development of pharmacy practice and contribute to strengthened preparedness for future public health emergencies.

2. Methods

2.1. Study design

This study employed a qualitative case study methodology using semi-structured interviews for data collection. This approach enabled in-depth exploration of the experiences of pharmacists who worked in medicines management or vaccine stewardship roles in Irish COVID-19 CVCs.¹³ Ethical approval was granted by the Research Ethics Committee (REC) of RCSI University of Medicine and Health Sciences (REC202301012). The Consolidated criteria for Reporting Qualitative research (COREQ) checklist was used to guide study reporting (included as Appendix A).¹⁴

2.2. Study participants and recruitment

A combination of purposive and snowball sampling approaches was used to recruit participants with the relevant experience.¹⁵ Eligible participants were pharmacists who had worked in a CVC as a medicines management or vaccination stewardship pharmacist and were willing to participate in a Microsoft Teams-based interview. The concept of information power guided the target sample size. Given the focused study aim and narrow scope, a target sample size of 10–12 pharmacists was deemed appropriate.¹⁶

Potential participants were contacted via a study gatekeeper (one of the national lead pharmacists for the vaccination programme) who had contact details for pharmacists who had worked in the CVCs. The gatekeeper emailed potential participants on 6 July 2023 with the participant information sheet, consent form and reply contact details for the research team. A reminder email was sent on 26 July 2023. Interested individuals were invited to contact the research team to schedule an interview at a convenient time. Interviews were scheduled for a date and time convenient for participants. Written informed consent was obtained prior to data collection. No remuneration was offered to participants.

2.3. Data collection

Data were collected using a semi-structured interview protocol that was developed specifically for the study and informed by a literature search. It was piloted with research team members before finalisation (Appendix B). Interviews took place between 14 July and 4 August 2023. Interviews were conducted by the first authors, both of whom were female final-year Master of Pharmacy students at the time of interview, with training in qualitative research and conduct of semi-structured interviews. None of the participants were known to the interviewers. Interviews were audio recorded via Microsoft Teams. Before interview recording started, participants were given an explanation of the research study, and reminded of consent procedures and the interview format and offered the opportunity to ask questions. Participants were invited to turn off their camera to ensure only audio was captured.

Participants were asked for some demographic information followed by questions about their experiences working in the CVCs in Ireland; topics explored included the reasons for working in the CVCs, the nature of the teams they worked in, any challenges encountered, important knowledge learned/insights from their experience and areas for enhancement within pharmacy education curricula to support future pandemic preparedness. No field notes were made. All participants were given the option to add further comments throughout and at the end of the interview. Although it was not feasible to return transcripts for participant checking, participants were advised they could review their transcript upon request.

2.4. Data analysis

Audio recordings were transferred to a secure university OneDrive

folder immediately following the interviews and original recordings were deleted from Microsoft Teams. The audio files were transcribed verbatim by either of the first authors and any identifying information was removed. At this point, participant numbers e.g. Participant 1 were assigned to ensure participant anonymity. Thematic analysis was guided by the six-step framework outlined by Nowell et al. which included: 1. data familiarisation, 2. generation of initial Codes, 3. searching for themes, 4. reviewing themes, 5. naming and defining themes, 6. producing the report.¹⁷ All interviews were coded independently by both first authors using Microsoft Excel, with regular weekly meetings to compare coding and ensure consistency. Minor discrepancies identified during the coding process were resolved through discussion between the two first authors. Theme development was completed collaboratively by both first authors with support from the corresponding author. Participants did not provide feedback on findings in this study.

3. Findings

Fourteen pharmacists participated in online interviews. Three were excluded from the final analysis as it became clear during the interviews that they did not meet the inclusion criterion of having direct experience in a medicines management or vaccine stewardship role within a CVC. The primary professional role, length of experience as a pharmacist, and extent of involvement in the CVCs were recorded for each of the eleven included participants. Level of involvement in the CVCs was defined as full-time (being scheduled for >35 h per week or fully seconded from their fulltime role), part-time (scheduled for <35 h per week and/or had another role elsewhere), and occasional (not scheduled weekly, irregular involvement on an ad hoc basis). Participant characteristics are summarised in Table 1. Interviews ranged from 21 to 42 min, with the mean interview duration being 32 min.

3.1. Themes

and subthemes generated from the interview transcripts are summarised in Table 2, alongside illustrative quotes.

1: A Sense of Duty and Opportunity.

This theme and associated subthemes capture pharmacists' motivations for participating in the national mass vaccination programme. Participants reflected a mix of professional obligation, personal values, and pragmatic considerations in their decision to contribute to the national COVID-19 response through their roles in the CVCs.

1.1: Called to Action: Organisational Secondments.

Many pharmacists were formally seconded from their primary roles, particularly from hospital and non-patient-facing roles, to support the vaccination programme. Secondments were initiated by their

Table 2

Overview of Themes and Subthemes with Illustrative Quotes.

Theme	Subtheme	Illustrative Quote
1. A Sense of Duty and Opportunity	1.1 Called to Action: Organisational Secondments	<i>I was asked by my employer would I agree to being seconded a couple of days a week to support the vaccination programme...So I did two days a week in the CVC and then the remainder of the week in my other role.</i>
	1.2 Answering the Call: Professional Responsibility and Moral Imperative	<i>Because it was a job that needed to be done..... I felt that it was a good opportunity to help with the getting the system in place.</i>
	1.3 Personal Motivation and Practical Considerations	<i>I signed up to it to be a vaccinator initially [but subsequently took a medicines management role] ... and I was like, I just want to do something that is not pharmacy for a while...like gosh you are never going to get a chance to do this again.</i>
2. Navigating the Frontline: Challenges and Adaptation	2.1 Defining the Role: Evolving Expectations and Responsibilities	<i>There was a clear gap then identified in terms of medication management and in terms of clinical, I suppose pharmacy governance, because there's a lot [of complexity] to the vaccine.</i>
	2.2 Under Pressure: High-Volume Work and Operational Complexity	<i>And there was so much pressure on...everybody was pushing to get their vaccines and stuff...it was a huge responsibility to steward it properly, to make sure that everything was properly used and properly accounted for and stuff like that.</i>
	2.3 Negotiating Space: Professional Boundaries in Multidisciplinary Teams	<i>We really kept it safe. We, I think we, pharmacists, are very good at following procedure and protocol and writing procedures and they'll also keep the risk to a minimum.</i>
3. Professional Growth and Future Directions	3.1 Collaborating in Practice: Learning Through MDTs	<i>That was the first time I had to work with a really, really big team of people.</i>
	3.2 Expanding the Pharmacist's Role: Recognition and Opportunity	<i>I think it is really positive and that the scope of the role of the pharmacist in Ireland is being expanded. I think working through the CVCs is a good example of a role for pharmacists. We're very capable.</i>
	3.3 Preparing Future Pharmacists: Educational Priorities	<i>There should be a lot more training on the practical side of pharmacy.</i>

Table 1

Participant Characteristics.

Interview ID	Sex	Professional Role	Years' Experience	Level of involvement in CVCs
P1	M	Secondary care	10–15 years	Full-time then occasional
P2	F	Primary care	30+ years	Full-time
P3	F	Secondary care and non-patient facing role	30+ years	Occasional
P4	M	Primary care	5–10 years	Full-time
P5	F	Non-patient facing role	10–15 years	Part-time
P6	F	Primary care	5–10 years	Part-time
P7	M	Primary care	5–10 years	Full-time
P8	F	Primary care	30+ years	Full-time
P9	F	Secondary care	30+ years	Part-time
P10	F	Primary care	10–15 years	Full-time
P11	F	Primary and secondary care	25–30 years	Part-time

employers, primarily from the HSE, and ranged from part-time to full-time roles.

For example, one participant described the abrupt nature of their transition:

"I was redeployed on the Friday or on the Monday.... And we started on like the Monday afternoon. So it was a very intense quick off-the-mark experience." (P10).

Another reflected on maintaining dual responsibilities:

"I was asked by my employer would I agree to being seconded a couple of days a week to support the vaccination programme...So I did two days a week in the CVC and then the remainder of the week in my other role." (P6).

Most of those interviewed were seconded from their roles for periods

of a few months, generally during the early stages of the vaccine rollout, for example:

"I was only there for about two and a half months" (P5).

1.2: Answering the Call: Professional Responsibility and Moral Imperative.

Several participants described a strong internal drive to serve during a national emergency, referencing a desire to 'give back' and uphold their professional duty. Some participants described wanting to assist by using their skillset to ensure efficient and safe vaccination of the public, while others reported a sense of moral duty. For example:

"Purely, if you wanted to ask me, I would say it was altruism. I really wanted to give something back. I wasn't doing it for financial gain or anything like that. ... that was my main motivation for doing it." (P3).

"Because it was a job that needed to be done..... I felt that it was a good opportunity to help with the getting the system in place." (P11).

1.3: Personal Motivation and Practical Considerations.

Participants also reported a range of personal motivations for taking CVC roles. They included a desire for new and unique experiences, temporary career change, and financial incentives. Some initially entered for one reason, but stayed due to professional satisfaction or positive experiences:

"I signed up to be a vaccinator initially [but subsequently took a medicines management role]... and I was like, I just want to do something that is not pharmacy for a while...like gosh you are never going to get a chance to do this again." (P7).

Some returned to occasional CVC roles after formal secondments as it was remunerated when it was separate to their secondment. For example:

"And the second [time].. I was asked to do it, to be honest with you, I did it cause we're getting paid for it...so it was financially driven reason to be honest." (P1).

2: Navigating the Frontline: Challenges and Adaption.

This theme and associated subthemes capture the real-time pressures pharmacists faced as they entered unfamiliar and rapidly changing roles within CVCs. Several participants described steep learning curves, high-stress environments, and the challenges of navigating multi-disciplinary team (MDT) environments, and evolving protocols. Role ambiguity was a particular issue given CVCs had never existed previously, and it was perceived by some participants that that there was lack of clarity regarding the role of pharmacists in the centres.

2.1: Defining the Role: Evolving Expectations and Responsibilities.

Many participants reported entering the CVCs with minimal clarity about their role. Some expected to work as vaccinators, but were quickly reassigned to medicines management roles as the importance of having pharmacists in these roles became apparent. For example:

"I had no idea when I started. I thought I might be actually vaccinating cause I'm qualified to vaccinate...it became medicines management within about two hours..." (P2).

"There was a clear gap then identified in terms of medication management and in terms of clinical, I suppose pharmacy governance, because there's a lot [of complexity] to the vaccine." (P4).

The lack of formal training or predefined responsibilities contributed to the initial confusion of several participants. The lack of clarity was not necessarily a result of poor planning or practice, but a reflection of the emergency context and lack of prior existing models. For example, since the establishment of vaccination centres at this scale was unprecedented, policies were developed from scratch:

"So I wrote up my own policies ... because there was nothing" (P2).

While many recognised this was a feature of the emergency nature, a minority struggled more with this uncertainty:

"Almost next, next to nothing, essentially. ... I had a lot of questions ...but I only had one day of training ... and I was very unsure as to what a medicines manager does ..., I didn't really know a lot about it. Literally one day of training was not enough." (P7).

Despite these challenges, all reported that they adapted quickly while advocating for their professional roles and boundaries within

MDTs and played central roles in shaping operational workflows and in clinical governance.

2.2: Under Pressure: High-Volume Work and Operational Complexity.

In addition to role ambiguity, all participants described working in an environment defined by urgency, uncertainty, and intense operational demands. The vaccination programme and CVCs were implemented under emergency conditions, involving newly authorised vaccines, unfamiliar software systems, and rapidly assembled MDTs, often operating within settings not originally intended for healthcare delivery. Policy updates were constant, and guidance changed frequently as national plans evolved in response to vaccine availability and safety concerns. For example, participants explained:

"It was very stressful. Very, very. I like every day I walked in. I was like to myself... what is going to be thrown at me today?" (P1).

"And there was so much pressure on...everybody was pushing to get their vaccines and stuff...it was a huge responsibility to steward it properly, to make sure that everything was properly used and properly accounted for and stuff like that." (P11).

"And then just the fact that everything kept changing, everything kept changing all the time... you'd have a protocol you were supposed to follow... And then... something would happen like...there was clots and they would they would stall the programme...you were on the fly all the time." (P8).

Most participants described significant challenges in recruiting sufficient staff to manage the workload and extended hours of operation of the CVCs. Pharmacists often worked well beyond their scheduled hours, remaining late into the evenings to oversee final vaccinations and minimise vaccine wastage.

"I worked well and above my kind of what you were kind of ordinary hours would be...and that's fair enough...it was a national emergency. But I can only be in one centre at one time. So it was essentially [arranging staff for] the other five centres while I was working...which was really, really tough." (P4).

Pharmacist recruitment efforts were further complicated by the high demand for pharmacists in the community pharmacy sector at the time, with elevated locum pay rates creating a financial disincentive for locum pharmacists to take up roles in the CVCs. For example:

"It started off being difficult, very hard to get pharmacists, very hard because the locum rate at that stage was huge and they [the HSE] wouldn't pay the locum rate" (P2).

2.3: Negotiating Space: Professional Boundaries in MDTs.

While pharmacists played a vital role in ensuring the clinical safety and operational efficiency of vaccine handling, participants often described difficulties in maintaining boundaries of their role, as at times exercising the responsibilities of their role caused friction with other members of the MDT. This may have been partly due to many MDT members having not previously worked closely with pharmacists.

All participants expressed a sense of pride in their professional contribution to the safety and efficiency of the vaccination rollout, particularly in areas such as governance, cold-chain management, and waste minimisation.

"We really kept it safe. We, I think we, pharmacists, are very good at following procedure and protocol and writing procedures and they'll also keep the risk to a minimum." (P8).

However, some also described feeling under-recognised by some team members and found it necessary to implement strategies to manage professional space and responsibilities within the CVCs.

"Pharmacists don't seem to be especially popular... I don't know why...I think because they're kind of seen as gatekeepers for the most part." (P7).

Multiple participants described implementing informal measures to control access to the pharmacy and assert professional authority.

"Like I put a table across the door of the pharmacy and nobody other than pharmacy staff was allowed in because before that ... there was nurses coming in and there was clinic leads coming in and they were interfering" (P2).

Tensions sometimes arose due to overlapping roles and lack of clarity and precedent in leadership structures. These conflicts reflected the

broad challenges of operating under evolving emergency conditions:

"I think there was power struggles going on all over the place" (P3).

Most participants highlighted the need for better communication, clearer delineation of responsibilities and greater recognition and use of pharmacists' expertise in future multidisciplinary efforts:

"There were blurred lines... if something like this happened again, there would need to be strong systems with pharmacy being separately governed." (P1).

"I felt pharmacists probably weren't used to their forte there... I think pharmacists could've been utilised better." (P5).

3: Professional Growth and Future Directions.

This theme and associated subthemes capture how pharmacists reflected on their professional growth through participating in the CVCs. Working in a frontline role during a national emergency with unfamiliar teams, under very demanding circumstances, provided many participants with new skills, deeper interprofessional awareness and optimism for the pharmacist's role in healthcare. Participants also provided suggestions about how these experiences could inform the development of pharmacy education and future healthcare delivery approaches.

3.1: Collaborating in Practice: Learning Through MDTs.

Several participants highlighted how their exposure to working in large MDTs was new to most and represented a key area of professional growth. For many, it was their first time working with such diverse colleagues including clinical and non-clinical staff. This exposure enhanced communication, teamwork, and leadership skills, particularly in managing processes under pressure as previously outlined.

"That was the first time I had to work with a really, really big team of people." (P6).

"Just learning a bit more about what other professionals deal with... different ways of doing things, different roles." (P7).

Additionally, some participants valued the opportunity to collaborate with professionals they had not previously engaged with in their regular roles, such as software developers, project managers, and policymakers, which provided new opportunities for professional learning.

"I got to work with software engineers, project managers... a lot of professionals I never would have otherwise. I learnt a huge amount from them." (P4).

While interprofessional challenges were mentioned earlier (Theme 2.3) this subtheme reflects a more constructive view of working in MDTs where participants reported appreciating the shared goal of vaccinating the public efficiently and safely.

"Probably the best thing was working with others and other healthcare professionals. And you know, everyone was doing different jobs, but you're all going towards the same goal." (P10).

3.2 Expanding the Pharmacist's Role: Recognition and Opportunity.

Most pharmacists reported that their involvement in the CVCs allowed them to highlight their skills and knowledge and make positive contributions to MDTs. Many spoke of their growing confidence in what pharmacists can offer in complex healthcare environments.

"I think it is really positive and that the scope of the role of the pharmacist in Ireland is being expanded. I think working through the CVCs is a good example of a role for pharmacists. We're very capable." (P6).

Some others expressed optimism that the experience of the CVCs was an example of a move towards additional pharmacist-led services, new roles in primary and secondary care, and more flexible career paths.

"So there's a huge amount of projects and roles coming on board now... within the health service and outside. I think it's a really good time to be a young pharmacist kind of looking to develop your skills and knowledge and contribute in other areas that you ordinarily probably wouldn't have" (P4).

3.3 Preparing Future Pharmacists: Educational Priorities.

Participants identified how their experiences might inform pharmacy education. Suggestions included emphasising more practical, simulation-based learning, expanding interprofessional learning opportunities, and providing earlier exposure to public health. For example:

"One of the things that we don't do at the moment is actually simulate

what working life is like" (P3).

"There should be a lot more training on the practical side of pharmacy." (P5).

Additional focus on specific skills were also mentioned, including vaccine preparation, vaccine delivery, and interprofessional communication. Some also emphasised the importance of interprofessional learning, both to improve collaboration and develop mutual respect between professions.

"That's what I firmly believe... it leads to respect for other team members... and the patient will benefit." (P11).

Only one participant felt the existing curriculum provided adequate preparation for future challenges.

"I think anything that the job requires would be definitely covered under the curriculum as it stands." (P7).

4. Discussion

4.1. Summary of key findings

This study explored pharmacists' experiences working in medicines management and vaccine stewardship roles within Ireland's COVID-19 CVCs. Pharmacists described a range of motivations for participating in the programme, including organisational secondment, altruism or moral imperative, and personal or practical considerations. Despite taking on new roles under emergency conditions, participants reported that they adapted quickly to manage evolving expectations and believed they contributed significantly to the operational and clinical delivery of the national vaccination programme. Participants highlighted both the professional growth that developed from these experiences and the systemic challenges faced, including challenges with staffing and high workloads, limited role clarity, and difficulties within the MDTs. The findings indicated opportunities to enhance the pharmacy curriculum to better prepare future pharmacists for such roles.

4.2. Workforce challenges and sustainability

One of the main challenges described by participants was the difficulty in achieving and maintaining adequate pharmacist staffing levels in the CVCs. While this was highlighted during the pandemic, it reflected pre-existing pressures on Ireland's pharmacy workforce, reflecting international trends.¹⁸ Prior to the COVID-19 pandemic, the profession had already been experiencing concerns around pharmacist shortages and retention.¹⁹ The additional needs of the vaccination programme placed additional demand on a system already under strain. In parallel to the need for pharmacists in CVCs, the community pharmacy sector was also experiencing a shortage of pharmacists to support a surge in demand. This was partly driven by a move to team-based working in pharmacies and partly by reduced access to general practice resulting from infection control policies, public health restrictions, and the rapid shift to telehealth reflecting international experiences.^{20,21} These changes meant patients increasingly relied on pharmacies for advice and support, and presented many challenges for pharmacists, including ensuring patient safety.^{22,23}

This increased dependency on pharmacy services created unanticipated demand, on top of the requirements to engage with new and rapidly changing guidelines, further inflating locum pharmacist rates in the community sector. As a result, there was a significant mismatch in remuneration between community pharmacy roles and those available through the CVC positions. This highlights the importance of flexibility in remuneration models during national emergency responses as financial disparities can hinder effective workforce mobilisation and reduce update of key temporary roles. For many of the CVCs, seconded pharmacists from the HSE were core members of staff. While this circumvented the issue of payment, it also meant that the activities of departments and key national projects were curtailed or paused, and the associated opportunity cost should also be factored into workforce

planning in future public health emergencies. Developing resilient health financing mechanisms to enable resources to be used efficiently is a critical step in ensuring better preparation for future crises.²⁴

Finally, the emotional burden of working in a high-pressure, fast-changing environment, exacerbated by limited staffing and long working hours was evident in participants' descriptions. This may have been less of a problem for those who worked short-term on secondment in the CVCs, but for those who worked over a more extended period may have been at risk of burnout.²⁵ The findings highlight the need for coordinated, cross-sector pharmacy workforce planning that balances capacity for emergency responses with continuity of core pharmacy services, while also supporting the wellbeing of pharmacists.²⁶

4.3. Working in MDTs: Challenges and enablers

Participants described experiencing challenges working as part of MDTs in the CVCs. These difficulties were often attributed to early confusion around their roles and where pharmacists fit in the CVC MDT structure. Role ambiguity is a well-recognised challenge in healthcare delivery, particularly when roles are not clearly defined in advance.²⁷ In these cases, professional boundaries and responsibilities may blur, leading to confusion and/or conflict. This appeared to be heightened in the evolving and uncertain CVC environment, where multiple experienced professionals were brought together into a new system without established protocols or team hierarchies. The impact of experienced staff becoming 'novices' again in these new systems was identified as an additional challenge to interprofessional collaboration at this time in similar contexts.²⁸ While pharmacists made important contributions to the CVCs, particularly in managing the cold chain, preventing wastage, advising on excipients and allergies, and in quality assurance, they reported that their clinical expertise was not always fully recognised by other team members, reflecting the experience of their community pharmacy colleagues.²⁶ This aligns with the wider literature on pharmacists' status within healthcare teams, especially in unfamiliar or non-traditional settings and highlights the need for improved mutual understanding of professional roles prior to emergency situations that had been identified in previous research.^{29,30} Lack of clarity regarding pharmacists' scope may have contributed to perceptions of power struggles and reduced professional respect. In response, several participants reported taking measures to protect the pharmacy space. Efforts to assert control amid the absence of formal governance mechanisms are a common feature of emergent health systems in a crisis.³¹ While many participants described friction or tension, examples of positive collaboration were shared, highlighting how MDT working in high-stakes environments can be successful in spite of role-based conflict where a shared goal provides unity. These findings highlight that emergency preparedness should go beyond operational readiness and include emphasis on role clarity and cultural readiness in areas such as mutual respect, shared language, and clear communication protocols, and further research identifying learning from COVID-19 would further support this.³²

4.4. Implications for pharmacy education

Participants described how their experience in CVCs revealed gaps and opportunity in their pharmacy education, particularly in relation to practical skills, multidisciplinary collaboration, and emergency response preparedness reflecting broader thinking on pandemic preparedness.³³ While some felt equipped, others felt a stronger focus in specific areas would have prepared them better for their roles. This reflects wider calls in the health professions education literature for curricula to evolve to encompass emergency situations and disaster preparedness.³⁴ Simulated and hands-on scenario-based teaching were described by participants as having particular strengths in preparing pharmacists to navigate the professional demands of crisis response. Participants' experiences also highlighted the importance of

interprofessional learning to improve understanding of the pharmacists' role by other healthcare professions to address issues arising from role ambiguity and maximise benefits and reduce confusion.³⁵ This includes developing an improved understanding of team dynamics and professional identity, which may be of particular value in new or evolving situations since role ambiguity may contribute to emotional exhaustion.²⁷ These findings highlight the opportunity for pharmacy education to expand its focus from traditional pharmaceutical and clinical knowledge to place additional emphasis on practical, interpersonal, and adaptive leadership skills required for evolving environments and prepare them for roles in future healthcare emergencies. Health emergency preparedness exercises may have particular value in improving knowledge, competence, confidence, and understanding of individual and team member roles.³⁶

4.5. Implications for pharmacy leadership and governance

Alongside the implications for education and workforce sustainability, this study also highlights key governance challenges that impacted the integration of pharmacists during the national COVID-19 pandemic response. While pharmacists contributed significantly to medicines management and vaccine stewardship, particularly in navigating the complexity of multi-dose vials, storage requirements, and resource management, these roles were not consistently embedded. Effective pharmacy input often relied on the presence of experienced, senior pharmacists who were in the right place at the right time and able to advocate for pharmacists' roles. Therefore, the degree of pharmacist involvement varied considerably between regions, with some areas reporting limited or no pharmacy engagement.

These findings reflect the broader systemic issue of the lack of formal pharmacy representation in senior planning and policy-making roles in Ireland within both the Department of Health (DoH) and the HSE. This absence hindered the profession's ability to contribute strategically to crisis preparedness and response. Our findings align with previous research identifying the impact of fragmented pharmacy leadership on limiting the profession's influence in shaping health policy.³⁷ While it is welcome to see focused workforce initiatives such as the PSI's Pharmacy Workforce Working Group, they have yet to prioritise emergency preparedness or leadership development. The group has placed a focus on professional leadership for Pharmacy in the DoH however this has yet to be implemented.³⁸ Strengthening the integration of pharmacy at governance level is essential to ensure a coordinated response to future public health emergencies, and make full use of the unique expertise pharmacists can offer.³⁹

4.6. Strengths and limitations

To the best of our knowledge, this was the first national study to explore the experiences of pharmacists working in medicines management and vaccine stewardship roles in COVID-19 CVCs. While previous research has captured similar experiences from a single-site in Australia (16), this research provides broader insight into workforce challenges, interprofessional collaboration, and educational implications.

There are a number of limitations. Interviews were completed approximately two years after the initiation of the vaccination programme, and recall bias may have influenced participants' reflections. Additionally, participants were predominantly female, which may not reflect the demographic profile of all pharmacists involved in the CVCs (due to the nature of CVC recruitment, it is not possible to access these data). Findings may not be fully generalisable beyond the experience in Ireland. Nevertheless, the findings will be relevant for future planning for pharmacist involvement in emergency public health initiatives.

4.7. Future research

Future research should explore models for integrating pharmacists

into public health responses, including recruitment strategies, support systems, and workforce sustainability. Further qualitative research with other members of the MDT, and using a conceptual framework drawing on role theory would provide a more comprehensive understanding of professional collaboration within CVCs. Future research should include a national curriculum mapping exercise to identify key gaps at the university level, and enable a coordinated approach to be taken by all pharmacy schools to address them. Further research is also needed to explore in detail the role of compensation and other forms of recognition in encouraging pharmacists to work in such disruptive and ambiguous settings.

5. Conclusions

This study highlights the important contribution of pharmacist to Ireland's COVID-19 vaccination response. It captures their key roles in promoting patient safety, clinical governance, and operational efficiency. Despite the significant challenges of working under emergency conditions, pharmacists adapted quickly and shared their expertise within MDTs. To enhance future workforce preparedness, an increased emphasis on vaccination training, interprofessional learning, and communication and collaboration skills may be beneficial. Role clarity, sustainable staffing models, and formalised support structures are also important considerations for maximising the contributions of pharmacists in future public health emergencies.

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CRediT authorship contribution statement

Jessica Bennett: Writing – original draft, Project administration, Investigation, Formal analysis, Data curation. **Aoife Clabby:** Writing – original draft, Project administration, Investigation, Formal analysis, Data curation. **James W. Barlow:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **Theo Ryan:** Writing – review & editing, Methodology, Conceptualization. **Muriel Pate:** Writing – review & editing, Methodology, Conceptualization. **Joan Peppard:** Writing – review & editing, Methodology, Conceptualization. **Damon Gaffney:** Writing – review & editing, Project administration, Methodology, Conceptualization. **Niamh Dillon:** Writing – review & editing, Resources, Project administration, Methodology, Conceptualization. **Frank Moriarty:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **Michelle Flood:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

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.

Appendix A. COREQ (COnsolidated criteria for REporting Qualitative research) Checklist (14)

No. Item	Guide questions/description	Reported on Page #
Domain 1: Research team and reflexivity		
<i>Personal Characteristics</i>		
1. Inter viewer/facilitator	Which author/s conducted the interview or focus group?	5
2. Credentials	What were the researcher's credentials? E.g. PhD, MD	5
3. Occupation	What was their occupation at the time of the study?	5
4. Gender	Was the researcher male or female?	5
5. Experience and training	What experience or training did the researcher have?	5
<i>Relationship with participants</i>		
6. Relationship established	Was a relationship established prior to study commencement?	5
7. Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	5
8. Interviewer characteristics	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	5
Domain 2: study design		
<i>Theoretical framework</i>		
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	4
<i>Participant selection</i>		
10. Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	4
11. Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	5
12. Sample size	How many participants were in the study?	5
13. Non-participation	How many people refused to participate or dropped out? Reasons?	6
<i>Setting</i>		
14. Setting of data collection	Where was the data collected? e.g. home, clinic, workplace	6
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	5
16. Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	7
<i>Data collection</i>		
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	5 and 29
18. Repeat interviews	Were repeat inter views carried out? If yes, how many?	n/a
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	5
20. Field notes	Were field notes made during and/or after the interview or focus group?	6

(continued on next page)

(continued)

Domain 2: study design		
21. Duration	What was the duration of the inter views or focus group?	6
22. Data saturation	Was data saturation discussed?	n/a
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	6
Domain 3: analysis and findings		
<i>Data analysis</i>		
24. Number of data coders	How many data coders coded the data?	6
25. Description of the coding tree	Did authors provide a description of the coding tree?	7
26. Derivation of themes	Were themes identified in advance or derived from the data?	6
27. Software	What software, if applicable, was used to manage the data?	6
28. Participant checking	Did participants provide feedback on the findings?	6
<i>Reporting</i>		
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	7–15
30. Data and findings consistent	Was there consistency between the data presented and the findings?	7–15
31. Clarity of major themes	Were major themes clearly presented in the findings?	7–15
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	7–15

Appendix B. Semi-Structured Interview Protocol

1. Tell me about your career to date.
2. Why did you decide to work as a medicines management/vaccine stewardship pharmacist in a CVC?

- What attracted you to the role
- What did you know about the role before you started

3. Tell me about your experience in the CVC

- Please describe your role
- How did you find the role at first (what was surprising, challenging)?
- Who did you work with and how did you work with them?
- What was the best/worst thing about it?

4. What did you learn in the vaccination Centre?

- What skills or experience do you now have?
- What is relevant to your primary/current role?
- Do you feel anything you learned will be useful in future roles?

5. Did you feel prepared for the role e.g. from your undergraduate or postgraduate education?

- What would you have liked to know to be better prepared?
- What (if anything) should be added to the pharmacy curriculum to support these roles in the future?

6. Is there anything I haven't asked you that you'd like to share?

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