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Provision of clinical pharmacy services during the COVID-19 pandemic: experiences of pharmacists from 16 European countries

INTRODUCTION

COVID-19 is caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) and has been recognised as a global pandemic.[1] Since the first case was reported in the Wuhan province of China in December 2019, the virus has spread rapidly across the world with devastating impact on practically every aspect of daily life. As of 11th of September 2020, COVID-19 has infected over 28 million people worldwide and resulted in more than 900,000 deaths.[2] High rates of infection and deaths have been reported globally in many countries in Europe having experienced some of the highest mortality rates in the world including Italy, France and the United Kingdom.[2]

Healthcare services across Europe have been severely impacted by COVID-19. At the early stages of the pandemic, various health services including hospital, community and primary care were restricted (e.g. non-urgent elective surgeries, routine health checks and medication reviews) to ensure adequate resources were in place to deal with patients presenting with COVID-19.[3,4] Following public health measures to suppress the spread of the virus (e.g. social distancing, wearing of face coverings), restrictions have now been eased to some degree in many countries. An additional challenge for healthcare services is dealing with the backlog of cases for non-COVID-19 related illnesses that did not present during the most severe stages of lockdown.[5-7] The delays caused by the pandemic to patients in seeking timely medical intervention will have a profound negative impact on health outcomes over the coming months and years. For example, a national population-based modelling study in England estimated increases in deaths due to cancer up to five years post-diagnosis ranging from 4·8% for lung cancer to 16·6% for colorectal cancer compared to pre-pandemic figures.[8]

The pharmacy profession has had an important role in the frontline healthcare response to COVID-19. For many individuals with COVID-19 related queries or health concerns, community pharmacists may often be the first point of contact for reliable information and advice.[9] Community pharmacists have undertaken a range of roles and activities in response to the pandemic which include providing public health advice, information and education on personal and environmental hygiene, and making appropriate referrals in suspected cases of COVID-19.[10] Primary care-based pharmacists (i.e. those working in general practice) and hospital pharmacists have also undertaken various roles and activities spanning disease

prevention and infection control, provision of patient care and support to other healthcare professionals, as well sourcing and ensuring adequate supplies of medication.[11]

Although the scope and nature of their roles and clinical activities varies across settings and jurisdictions,[12-14] pharmacists' ultimate focus is on providing effective pharmaceutical care to improve health outcomes and quality of life for patients. In order to ensure evidence-based responses to future public health crises, it is also important to explore how clinical pharmacy services have adapted and responded to the pandemic.[15] This will help in identifying and sharing good practices, determining barriers and facilitators to service provision, as well as any lessons that can be learnt for future public health crises. However, a recent scoping review highlighted a deficit of studies to date examining core services provided by clinical pharmacists in various health settings in Europe during the COVID-19 pandemic.[11] The aim of this study was to explore the views and experiences of clinical pharmacists in Europe regarding their provision of clinical pharmacy services during COVID-19 with focus on prevention, preparedness and learning points for future public health crises.

METHODS

Design

This study consisted of semi-structured qualitative interviews with pharmacists working in clinical roles in various healthcare settings across Europe. The study is reported in accordance with the Consolidated Criteria for Reporting Qualitative studies (COREQ) checklist [Electronic supplemental material 1].[16]

Sampling and recruitment

A multi-strand sampling method was employed. Firstly, email invitations to take part in the study were issued to the membership of both the European Society of Clinical Pharmacy (ESCP) and European Association of Hospital Pharmacy (EAHP), and study information also included in the organisations' electronic newsletters. The ESCP is a professional network of clinical pharmacists across Europe which aims to promote, support, implement and advance education, practice and research in clinical pharmacy in order to optimise outcomes for patients and society.[17] The EAHP represents over 23,000 hospital pharmacists across Europe and seeks to develop the hospital pharmacy profession in order to continually improve the care and outcomes for patients in European hospitals.[18] Secondly, a snowballing technique was used to recruit additional participants known to ESCP and EAHP members who responded to the original invitation. Finally, members of the research team disseminated study information to their professional acquaintances with a view to achieving

a maximum variation sample in terms of practice setting (e.g. hospital, primary care) and speciality (e.g. respiratory, critical care) and country of practice.

In order to meet inclusion criteria, individuals had to work as a pharmacist in a clinical role in any healthcare setting in Europe. Individuals who were not practising as pharmacists in clinical roles Europe or could not communicate in English were not eligible to take part in the study. Pharmacists interested in participating in the study were asked to contact the principal investigator (XX anonymised) who emailed a study information sheet and consent form and arranged for a member of the research team to follow-up those agreeing to participate to schedule an interview. Sampling and recruitment proceeded until data saturation was achieved. No honorarium was provided for participating in the study.

Data collection and analysis

Interviews were conducted by members of the research team consisting of academic and clinical pharmacists (all with PhD level qualification) with extensive qualitative research experience. All interviews were conducted in English using online platforms Microsoft Teams, Skype and Zoom) and took place over June- July 2020. With participants' consent, each interview was digitally recorded and transcribed. Any identifiers were removed and an anonymous code was assigned to each participant.

The interview schedule (Electronic supplemental material 2) was developed using a combination of the Pharmacy Emergency Preparedness and Response (PEPR) Framework[19] and Disaster Preparedness Framework (DPF) for pharmacy services.[20,21] Key domains within the PEPR and DPF are defined under a) prevention/ mitigation actions to minimise transmission and ensure patient and staff safety, and b) preparedness of clinical pharmacy services to respond to the pandemic c) action-response and adjustments and d) recovery. Topic guide questions under the four domains were then constructed according to the research aim and objectives. The topic guide questions related to participant perspectives on the impact of the pandemic on patient care and population health interventions; adjustments and actions undertaken to mitigate the impact; knowledge and skills required and gained; and any learning points for the future. The topic guide was refined through discussions amongst the research team which included a range of clinical practice and research experiences and represented seven different countries within Europe.

The analytical process commenced during the transcribing process by listening to interview recordings and repeated reading of the transcripts, thereby allowing the researchers to familiarise themselves with the data. Data analysis was conducted in accordance with the

framework method[22] and adopted a deductive approach using pre-defined coding categories with data categorized into a matrix system in Microsoft Excel based on emergent themes and subthemes.[22] The construction of the initial thematic framework was guided by the PEPR and DPF.[19-21] Transcribed data from the first two interviews were first coded using the predefined coding framework. This framework was further refined through discussion within the research team before a final agreed version was applied in the analysis of the remaining transcripts. Key themes describing the data were listed in column headings within the Excel spreadsheet with relevant quotes from participants presented across rows. Two researchers independently analysed each transcript. The matrix system was reviewed in estimating the point of data saturation (i.e. the point at which no new information was identified). We focused on the range of experiences and stipulated examples on perceived impact on practice, mitigation measures, and action response and adjustments when estimating data saturation.

Ethical approval

Ethical approval was granted by the Ethics Review Panel, University of XXX (anonymised), United Kingdom (ERN_20-0781).

RESULTS

Twenty-two pharmacists participated representing 16 different countries within Europe (table 1). Participants represented hospital, community and primary care settings. Those within the hospital sector delivered a range of specialist clinical roles including intensive care medicine, respiratory and transplant medicine. Practice experience (i.e. years qualified as a pharmacist) ranged from 3 to 30 years (table1). Interviews lasted approximately 50 minutes on average.

Results from the framework analysis of themes and illustrative quotes are presented under the following key domains a) prevention/mitigation, b) preparedness c) action-response and adjustments d) recovery and e) reflection of personal experience. Barriers and facilitators specifically relating to ensuring adequate prevention/mitigation, preparedness and action-response and adjustments are presented throughout and summarised in table 2.

A. Prevention/Mitigation

Reducing the health risks posed by COVID-19

Participants described a range of prevention and mitigation measures to reduce the spread of COVID-19. These included adoption of social distancing, increased sanitisation and hand hygiene practices. Facilities were rearranged to ensure limited personnel and patients in clinical and office spaces as well as waiting areas. For example, community pharmacies described using 'night time' windows, purposefully-built hatches and cashless transactions to serve patients and customers. Such adjustments were made using community pharmacy's own resources as no external funding was received.

> 'Because when the pandemic started in Estonia, which was officially on March 12th we decided to close the doors of the pharmacy and dispense the medications and consult the patients through the small window like we do it at night.' Community pharmacist, Estonia

Some participants from hospital settings described facing difficulties in adjusting the facilities to ensure socially distanced services due to a lack of adequate space.

Patients were provided with protective masks upon entering clinical facilitates. Some participants noted that sanitizing chemicals, wipes and personal protective equipment (PPE) were not in adequate supply at the beginning of the pandemic. Many pharmacists reported being unsure about how to effectively use PPE which in a number of cases was attributed to a perceived lack of training.

> 'The personal protective equipment was not enough and not adequate all the time. They hadn't got enough quality [either] … We did not know how to use the personal protective equipment.' Clinical Pharmacy Resident, Hospital, Turkey

Educating the public on reducing the spread of COVID-19

Many participants described being actively involved in directly educating patients and members of the public about social distancing, correct use of PPE and preventing the spread of COVID-19. This included verbal advice, information provision through social media and the development of educational material. Advice provision on the use of analgesics in COVID-19 was frequently mentioned. Some participants however, described the challenges they faced in educating the public.

> 'They thought we were exaggerating. And some of them even told me: "Why are you spreading the panic?" I answered: "I am not spreading the panic; ...everybody should act according to these rule". But you know, they did not perceive it as a threat at all. They perceive it just as additional burden or something unnecessary.' Community pharmacist, Croatia

B. Preparedness

Participants described a range of activities relating to preparedness for COVID-19. These included measures to ensure that effective response systems were in place by adjusting the physical layout and infrastructure including risk stratification, deployment of pharmacist across clinical settings, adjustment of working hours, staff leave, testing staff for COVID-19 and utilising healthcare students to assist with the services.

Adjusting physical facilities

Participants from hospital pharmacy described the segregation of facilities to care for COVID-19 patients, high risk patients and those who were non-infected or at of low risk. For many, the early outbreak in Italy allowed some time to prepare and adjust their physical facilities to respond to COVID-19. Examples of physical facility adjustments included a separate hospital for COVID-19 patients, separate wards or even turning a cafeteria into an intensive care unit (ICU).

> '…so the hospital is divided into green, amber and red zones. …Red section which would be ICU and also anywhere there would be active aerosol generating procedures…and that would be the full gown over your scrubs, hat, mask and visor… we closed our canteen and turned it into a temporary ICU and we've put like a marquee at the front of the hospital where everyone goes for food.' Cardiology pharmacist, hospital, Northern Ireland

Maintaining safe staffing levels

Participants in the hospital sector described redeployment of clinical pharmacy staff from other clinical areas to COVID-19 wards and ICUs. While some participants described receiving some training prior to their deployment, others learnt while in practice.

> 'People just got on with it. More staff went into critical care and they needed training.' Hospital pharmacist, cardiology and pharmacy management, Republic of Ireland

Some participants reported that accommodation and shuttle transport services were provided to minimise transmission amongst healthcare staff. Some participants reported being asked to work from home, particularly those with young children and vulnerable family members. While this aimed to ensure social distancing and minimised transmission within the clinical setting, some participants were unhappy with their new working arrangements.

> 'I was annoyed that I was not allowed to run an inter-professional clinical meeting face to face in June. It had to be via Zoom. I was the only one from the practice that

was still working remotely from home. I felt lonely.' Clinical pharmacist, Primary Care, the Netherlands

Many participants described having their work hours adjusted including reduced number of days but longer hours or alternate work days. Some noted that all annual leave was cancelled and this often led to low staff morale.

'Not getting to take any annual leave and not getting a break would just cause a lot of sickness and things like that. So the four days off (three days in) was good in terms of maintaining resilience' Specialist respiratory pharmacist, hospital, England

A community pharmacy owner reported that many locum pharmacists cancelled their shifts which led to difficulty sourcing the required personnel to ensure safe operation of the community pharmacy. Some participants described getting students to help out to ensuring adequate staffing while others had to send students home to ensure safe staffing levels.

Participants from community pharmacy also described that adjustments in community pharmacy opening hours were enabled by the government which allowed them to operate limited hours to minimise staff burnout and fatigue. However, some primary care pharmacists noted that this caused issues in timely supply of medicines to the patients

Testing staff for COVID-19

While participants noted that staff testing for COVID-19 was not made available at the earlier stages of the pandemic, the situation was perceived to have improved over time. Many relied on the emergence of symptoms before isolating.

'We had no tests, we had only a few testing sets. So, nobody knew the situation…… and it did not allow us to really measure the risks and benefits of our interventions [preventative measures].' Intensive Care Unit, hospital, Czech Republic

C. Actions –response and adjustments

Various actions in relation to responses and adjustments to routine clinical practice were described.

Ensuring uninterrupted supply of medications and business continuity

Most participants described shortages of medical supplies during the early phase of the pandemic. Medical supply shortages in ICUs were a particular issue. Participants mentioned borrowing stocks from other wards, departments, hospitals and other healthcare facilities. Such stock transfer was often organized by professional organisations or governmental

bodies. Some used their aseptic laboratories to prepare formulations to make up for the shortfall.

> 'We had a brief moment where propofol was an issue because they used it a lot for the corona [COVID-19] patients mostly in intensive care…but they managed to distribute from the main pharmacy…I needed to call them every other day for propofol.' Pharmacy department manager, hospital, Denmark

Some participants reported having had 'very good' business continuity plans and described having received excellent support from their government in ensuring adequate medical supplies and having 'never' faced shortages.

Hospital-based participants described ordering medicines such as hydroxychloroquine for the first time and this led to procurement challenges. Rationing of medicinal supplies as well as supplies of PPE and disinfectants was implemented throughout all stages.

Participants from community pharmacy described high demand for repeat prescriptions and over the counter (OTC) analgesics, vitamins, particularly vitamin C and OTC products claiming to boost the immune system. Temporary restrictions were implemented to address the situation. Some community pharmacist participants described repackaging bigger packs into smaller packs to ensure equitable supply. Some reported being allowed to extend the supply of repeat prescriptions without needing additional authorisation from the prescriber. Therapeutic substitutions were often exercised due to supply issues across all settings.

> 'People wanted the same brand name and we ran out. When the pandemic started people were buying 10 packages or 100 tablets of paracetamol per person. And one important change what was made in Estonia by our minister was that every person could buy only 2 packages of OTC medication and people didn't understand why…Patients were at first shocked [about therapeutic substitutions for prescribed medicines], but then they became very cooperative.' Community pharmacist, Estonia

Impact and adjustment of routine clinical practice

Participants described the enormous impact of COVID-19 on routine clinical practice. Routine and non-urgent appointments in hospitals were cancelled and participants described seeing unusually low number of patients for routine admissions. Many deemed that patients were often fearful of using healthcare services and that overcoming such fears was challenging.

Participants in the primary care settings reported that they could no longer offer blood pressure, temperature, oxygen saturation and cholesterol testing and had to advise patients to buy home testing kits. Reductions and adjustments of routine activities such as medicine use reviews and medicine reconciliations were noted and many were conducted over the phone.

> ‘I was used to do domiciliary reviews or to see the patients at the surgery and they often brought their medicines with them. I was a bit pessimistic to start with. I thought that this was not the way to do medication reviews. But actually, it is going really well via phone. People can explain their symptoms very well over the phone, have their medications next to them, and are surprisingly open about sensitive topics.’ Clinical pharmacist, Primary Care, the Netherlands

Many noted that the cancellation of routine clinical services created difficulties in ensuring that patients received appropriate monitoring and follow up.

> ’The biggest change was the clinics, because I do asthma clinics, which are quite hands on, checking their peak flow, doing spirometry, I’d be listening to their chest you think they are having an exacerbation. When they come in it is all visual, you can see how they walk how they talk, you observe them. And all these things are lost. I found that it was really hard.’ Clinical pharmacist, general practice, England.

Communicating with patients and healthcare professionals

Remote forms of communications including web-based services were used extensively by participants to communicate with patients and other healthcare staff. Many however described that online platforms were overloaded. Remote communications were deemed to have caused issues in communicating with patients with low health literacy as well as older and disabled patients, immigrant communities with interpreter needs and those without access to the online communication facilities.

Many noted that PPE created communication challenges to offering the same level of patient care and experience.

> ‘Many patients are old, they have hearing problems, they have problems with their vision, they do not understand what you are saying, especially when you wear masks and they

> do not see your lips. So I had to write down what I wanted to say'. Community pharmacist, Croatia

Some perceived remote forms of communications being less effective in providing recommendations to doctors and some needed intensive follow up to make sure that their advice was accepted by the doctors.

> 'I've realized that the acceptance rate of the interventions went down. I really had to follow up on the patients to make sure that the interventions were accepted. That was more time intensive.' Hospital pharmacist (general), Switzerland

Advocating pharmacy's role and being a source of information for doctors

Many participants reported offering information to doctors during the pandemic by searching and appraising guidelines, particularly in relation to the experimental drug treatments including hydroxychloroquine and remdesivir. Many described that the pandemic offered the opportunity to showcase their expertise as pharmacists.

> 'Doctors/colleagues see me as someone who provides the medicine information and of course critically appraise elevating literature, [e.g.] what is known about remdesivir etc., Although clinical pharmacists are not recognized enough in my country, I think this period maybe will leave a better recognition for clinical pharmacists and pharmacists as medicinal experts.' Liver transplant pharmacist, hospital, Serbia

However, not everyone agreed that pharmacists were well recognised. Participants particularly from primary care felt that they were left out of care and planning activities during initial phase of the crisis.

> 'The first two weeks were very unsettling. I felt like I was in a sort of identity crisis.' I felt like we [primary care pharmacists] are useless, not necessary anymore. Everyone was working around the clock at the front line, who cares about my job? But that turned out differently, at least for patients. We developed protocols to provide care remotely and patients really appreciated this.' Clinical pharmacist, general practice, the Netherlands.

One participant mentioned that the same PPE and colour of uniforms being worn during the pandemic levelled the hierarchy and therefore everyone was 'seen as equal'.

Taking care of COVID-19 patients

Some participants described being directly involved in the care of COVID-19 patients. Participants described a lack of information during the early phase of the pandemic and had to extensively search the literature to source the information they were looking for. Many reported attending several webinars in some days. Others described relying on medical journals as well as World Health Organisation (WHO) and local hospital guidelines. Some admired the promptness at which information was made available by the professional societies (such as the EAHP) and public health agencies. However, some participants described the confusion created by different guidelines and their interpretation by different clinical departments.

> 'It was also really hard to understand who is doing what and when due to guidelines changing hour to hour…the physicians got one guideline then the nurses got another then we got another and these guidelines didn't speak in the same direction at all so that did something for the collaboration in multidisciplinary teams.' Pharmacy department manager, hospital, Denmark

D. Recovery and returning to normal

Most participants were still adjusting and coping with the pandemic. However many noted that they were anticipating that the virus would remain in the community for the foreseeable future and that social distancing measures would remain common practice. Many believed that telecommunications and web-based communications would remain part of work practices in the future. Those working with high risk patients such as in the transplant and immunotherapy departments considered that current social distancing measures shall remain in place.

Community pharmacists identified opportunities for more clinical screening and interventions in the future, particularly as many patients considered visiting their GPs less preferable.

> 'In Spain it is not really easy to go to the General Practitioner, so we have increased the number of people who actually come to pharmacy to know their cardiovascular risk and then we take more glycosylated haemoglobin, the lipid profile, the blood pressure and so. I think that these services have gained importance and strengthen here the role of pharmacists. We really want to keep these services in the future.' Community pharmacist, Spain

Participants in the community also described their readiness to offer vaccinations for COVID-19 once available/approved and other currently available vaccinations (e.g. influenza).

> ‘pharmacist can be very important and active in promoting vaccination, for COVID or other diseases.’ Clinical Pharmacy healthcare solutions designer, Portugal

E. Reflection on personal experience

Most participants described feeling proud to serve their communities and countries at this time of need. They considered it a professional and ethical responsibility.

> ‘I felt it as my professional and human responsibility. I think it was something that was not even negotiable, I felt this is my responsibility.’ Liver transplant pharmacist, hospital, Serbia

Measuring success and failures of responsive actions were often based on how such actions helped patients and ensured a safe working environment for participants and other healthcare professionals. Those directly responsible for the care of COVID-19 patients reported that seeing patients being discharged from the hospital was a great motivation.

> ‘So being able to help with that was really good and even little things like seeing how many patients have been discharged from hospital with coronavirus compared to the amount of deaths and was really good to see.’ Specialist respiratory pharmacist, hospital, England

Participants reflected on the experiences and skills developed during the crisis thus far. They felt that the pandemic brought people from different disciplines and pharmacy colleagues together to look after each other, as well as their patients.

> ‘Used to high risk patients. Used to people dying. How fast it came and too much and too little information at same time. Every day something changed…traumatic at speed of complications and death of patients…uncertainty and worry about colleagues…trying to look after each other all the time. Worried about …bringing it [the virus] home to family. Worried about staff member with four small children who caught it.’ Cardiology pharmacist, hospital, Republic of Ireland

All participants felt that providing care during the pandemic was challenging but rewarding. Participants in the hospitals mentioned that they were able to develop new skills relating to critical care, extemporaneous compounding and clinical trials medicine. Other skills mentioned by participants included remote communications, time management, resilience and the ability to work under pressure.

> ‘Well, I would only say that providing limited clinical pharmacy services in my own environment will be improved based on our current experience, which will basically be focused on better communication, better supervision on treatments and maybe more efficient communication, when there is another wave or another peak of Covid-19 pandemic.’ Orthopaedic surgery pharmacist, hospital, Serbia

DISCUSSION

To our knowledge, this is the first multinational study on the delivery of clinical pharmacy services, and associated adaptations, during the COVID-19 pandemic. Qualitative data were obtained from 22 pharmacists from 16 different European countries representing a diverse range of clinical settings, specialities and experiences in response to aspects of protection, preparedness and planning during the ongoing pandemic. Pharmacists adapted their existing roles and implemented innovations to existing work practices in order to counter the challenges presented by COVID-19. Many described working to the best of their abilities to ensure that clinical pharmacy services were uninterrupted insofar as possible at the time of critical need. Many clinical pharmacists (particularly in primary care and community settings) became the first point of contact for patients with the healthcare systems particularly where GP services were operating at reduced capacity or even locally unavailable. Participants described that they were motivated by a strong sense of professionalism and desire to deliver services for the sake of humanity, taking pride in what they had achieved and the value placed in them by patients and other health professionals.

Many measures were adopted in an attempt to protect against transmission of the virus. A previous study in Kosovo involving community pharmacists reported that implementation of preventative measures was associated with respondents’ perception that pharmacists and the pharmacy profession were valued more by patients and other health professionals.[23] However, pharmacies received no external funding support to adopt such preventative measures, similar to the experiences faced by our study participants. Key barriers to pharmacy activities included the requirements to restructure the physical environment to ensure social distancing. Pharmacists described being involved in the development and dissemination of educational materials and offering verbal advice to patients, members of the public and health professionals.

Some described facing challenges to counter misinformation in social media as well as the difficulty in dealing with constantly changing advice and evidence. While there have been recent efforts by World Health Organisation working with technology companies in fighting

the 'infodemic'[24] pharmacists are likely to encounter patients who have been misinformed by false information. A previous study conducted in the community pharmacy setting suggests that vast majority of pharmacy clientele lack skills in critically interpreting information about their illness and medicines.[25] In the context of new disease such as COVID-19, such misinformation is likely to negatively influence patients' self-management and care seeking behaviours. Pharmacists will have important roles in continuing to counter the misinformation for the duration of the COVID-19 pandemic[26] including the development of credible and reliable pandemic-specific information resources for the general public.[27]

Many participants, particularly those from hospital settings, described being involved in the delivery of new clinical roles. A number of participants were reallocated to the care of ICU patients. While some received training, albeit limited, others had to learn and adapt as they gained experience resulting in rapid expansion of their existing knowledge and skills. While continuing professional development (CPD) is mandatory for pharmacist registration in many countries, the planning of CPD is normally systematic and not time pressured.[28] Study participants reported being able to adjust current clinical services and innovate where necessary within a very short time period. This is an important learning point for future service interruptions and adaptations, as well as the sustainability of such services. Facilitation of clinical trials, intensive care medicine and extensive involvement in the retrieval of evidence-based literature to inform clinical practice of their own and other healthcare professionals were some of the stipulated examples.

Service adaptation to the pandemic had major consequences for routine clinical services across all settings. Many described that patient care could not be provided to groups of patients and that for others there were adaptations to specific activities such as routine monitoring of clinical biomarkers. However, several participants highlighted opportunities to enhance their clinical services as many patients were reluctant to use primary care general practice services due to fear of being contracting the virus. This increased focus on community pharmacy based clinical care is in line with the strategic developments in countries such as the UK.[17]

Most participants considered that other healthcare professionals appreciated and valued pharmacists' expertise and skills in their contributions to the clinical care of COVID-19 patients or for other associated responses. Many described that the pandemic offered the opportunity to showcase the profession to other healthcare professionals particularly their expertise in the provision of new clinically relevant information, adjustments of clinical pharmacy services to accommodate digital communication as well as better prioritization of patients in need of relevant services. Previous literature suggests that the opportunity for

494 physicians and pharmacists to work together in a ward is an important facilitator for
495 interprofessional collaboration.[29]

496 The use of remote communications to provide clinical services, both with patient and other
497 healthcare professionals was also a key adjustment to the delivery of pharmacy services.
498 Many valued the opportunities to communicate remotely through telephone and digital
499 services. However, others reported that remote communication methods did not offer the
500 same opportunity to interact with and monitor patients. Previous systematic reviews suggest
501 that clinical pharmacist-led telemedicine services can improve clinical outcomes in patients
502 with chronic disease[30] and effectively deliver public health services such as vaccinations,
503 smoking cessation, hypertension management, and medication adherence and
504 counselling.[31] Given that many participants in this study identified that there will be greater
505 utilisation of remote communications in the future, healthcare systems should look into
506 investing in digital communications and telemedicine platforms in the context of clinical
507 pharmacy services.

508 Strengths and limitations

509 To our knowledge, this is the first multi-national study investigating pharmacists' experiences
510 of their responses to COVID-19. The study addresses a recognised gap in the literature.[15]
511 The interview topic guide was developed using the PEPRF[19] and DPF[20] for pharmacy
512 services. This enabled a detailed exploration of pharmacists' preparation and response
513 activities in relation to COVID-19. Participants represented a range of practice setting,
514 clinical expertise and experiences. Although our recruitment strategy did not aim for a quota
515 sampling, diverse range of countries in relation to demography, timing of the first wave of
516 COVID-19 pandemic (i.e. early vs late) and mortality rates were represented. Data analysis
517 was conducted independently by two members of the research team using the framework
518 method[22] which ensured a comprehensive and robust analysis, as well as the
519 trustworthiness of the findings.[32] In terms of limitations, it must be noted that due to the
520 adoption of qualitative design, the study findings may not be generalizable to all pharmacists
521 and pharmacy services. The study did not investigate in-depth, the impact of national or local
522 healthcare systems on participant responses to the pandemic and as such country specific
523 research to promote best practices is needed. Due to time constraints, the interview
524 schedule was not piloted or externally validated. However, the research team included a
525 range of clinical practice and research experiences across seven different countries within
526 Europe which allowed evaluation of face and content validity of the interview schedule within
527 the research team. In addition, while estimating data saturation, we primarily focused on the
528 range of examples in relation preparedness, prevention, actions response and adjustments.

Our approach to estimation of data saturation did not cover clinical setting specific barriers and facilitators.

Recommendations for practice and research

The facilitators and barriers to effective preparedness and response to the pandemic as identified in this study needs to be harnessed and addressed respectively. Pharmacists in diverse clinical settings can benefit from training to deliver pharmaceutical care services in critical care areas in preparedness to public health crises such as the ongoing pandemic as many participants had to undertake new roles without adequate education and training. Facilitators and barriers of practice changes as reported in the context of other clinical pharmacy services such as provision of public health interventions and supply of newly approved medicines in clinical practice are likely to be applicable.[33,34] Pharmacy educational curricula should also incorporate aspects of global health and pandemic preparedness.[35] Pharmacists' expertise and skills should be harnessed to enable them to source and critically appraise evidence-based information by providing relevant continuous professional development opportunities. While accessing and interpreting information from established drug information sources are recognised and expected skills of pharmacists, sourcing information from research databases and journals may often not be routine practice. A list of recommendations for health systems and services have been summarised and presented in table 3.

Participants reported that clinical pharmacy services including medicines were rationed to address staff shortages during the pandemic. Developing strategies to protect supply levels in anticipation of the future public health crises would benefit practice and patients. Governments and healthcare agencies should utilise clinical pharmacists in gathering intelligence around the lists of medicines that are at risk of shortages. Pharmacists should be trained to enable therapeutic substitutions at the time of medicines shortages.

Remote communication systems need to be strengthened to allow better communication between pharmacists and patients, as well as other health care professionals. Remote means of communications and telemedicine should cater for patients with low literacy, low cognitive functions, older patients and those with the need for interpreters as indicated by many participants in this study. Novel technologies should be harnessed to facilitate effective communications while pharmacists are using PPE.

Government and healthcare agencies should utilise pharmacists in the delivery of vaccinations and new medicines to provide protection and treatment. Pharmacists' routine clinical services such as provision of information on effective, cost-effective and safe drug

use, dispensing of medicines, minor ailments services and prescribing activities should be supported during the ongoing pandemic. In addition, government and healthcare agencies should ensure that the new knowledge and skills gained during the pandemic should be maintained and passed on to new practitioners.

Future research should identify the impact of the pandemic on clinical pharmacy services on patients, healthcare resources and cost-related outcomes. Further in-depth studies need to be conducted in various settings to identify context specific facilitators and barriers to clinical pharmacy service provision. Case study investigations should be conducted to identify and share best practices.

Conclusions

This multi-national study of clinical pharmacists' views and experience around prevention, preparedness and response to COVID-19 has identified pharmacists' diverse contributions to patient care and the education of other healthcare professionals and members of public. Key clinical pharmacy contribution areas include direct clinical care of COVID-19 patients; gathering and appraising evidence to inform patients and healthcare professionals; ensuring uninterrupted supply of medicines in the hospitals and community through effective procurement, planning, dispensing and supply of medicines, and by making therapeutic substitutions where necessary; providing clinical pharmacy services to high-risk populations; and adopting new digital communication with healthcare professionals and patients. Government and public health agencies should harness the facilitators and address the barriers to the provision of clinical pharmacy services as reported in this study. Future research should include outcome evaluations to examine the effectiveness of adapted and novel services in the context of the pandemic, including remote clinical pharmacy services.

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Table 1: Participant demographics

SN	Country	Practice setting	Speciality	Job title	Years qualified as a pharmacist
1	Belgium	Hospital	Clinical pharmacy	Responsible clinical pharmacist	25
2	Croatia	Community pharmacy	Community pharmacy	Community pharmacist	16
3	Czech Republic	Hospital	Intensive Care Unit	Clinical pharmacist	19
4	Denmark	Hospital pharmacy	Hospital pharmacy	Head of hospital pharmacy	6
5	England	Primary care	Respiratory	Clinical pharmacist	21
6	England	Hospital pharmacy	Respiratory	Specialist clinical pharmacist	7
7	England	Community pharmacy	Community pharmacy/ Primary care	Manager/owner of a community pharmacy and part time in primary care	15
8	Estonia	Community pharmacy	Community pharmacy	Community pharmacist	3
9	France	Hospital	Hospital pharmacy	Pharmacist supervisor	20
10	France	Hospital	Hospital pharmacy	Hospital pharmacist	4
11	Republic of Ireland	Hospital	Cardiology and pharmacy management	Pharmacy education and research	28
12	Republic of Ireland	Community pharmacy	Community pharmacy	Superintendent and supervising	30
13	Italy	Hospital	Hospital pharmacy	Hospital pharmacist	8
14	Netherlands	Primary care	Elderly and polypharmacy	General practice pharmacist	9
15	Northern Ireland	Hospital	Cardiology	Senior hospital pharmacist	20
16	Portugal	Other	Consultancy- pharmaceutical care	Healthcare solutions designer	5
17	Serbia	Hospital	Liver transplant	Consultant clinical pharmacist	15
18	Serbia	Hospital	Orthopaedic surgery	Clinical pharmacist	16
19	Spain	Community pharmacy	Community pharmacy	Manager of a community pharmacy	28
20	Switzerland	Hospital	General hospital	Clinical pharmacist	5
21	Turkey	Hospital	Oncology	Clinical pharmacy Manager	10
22	Turkey	Hospital	Clinical Pharmacy	Clinical pharmacist Resident	3

Table 2 Thematic framework of analysis

Domain	Themes	Subthemes (where available)	Facilitators	Barriers
Reducing the health risks posed by COVID-19	Minimising the spread of COVID-19 in the workplace	Social distancing	-Organisational and estates arrangements to allow social distancing -Resources to build facilities in pharmacy to allow social distancing	-Physical facilities not allowing social distancing
		Risk stratification of patients in the clinical setting	-Availability of facilities to segregate patients as per risks	-
		Availability of PPE	-Availability of PPE	-Lack of access to good quality personal protective equipment -Lack of adequate personal protective equipment -Lack of resources to buy PPE
		Knowledge about correct use of PPE	-Training on how to use PPE	-Lack of training and knowledge about how to use PPE
		Sanitisation and hygiene practices	-Availability of chemicals and equipment for sanitisation	-Inadequate supply of sanitising chemicals
	Educating the public on reducing the spread of COVID-19	Actions undertaken to educate the public (such as provision of information around transmission risks)	-Resources to develop educational materials -Time to develop educational resources and provision of advice	-Lack of public acceptance of advice -False information available from other sources
Preparedness	Ensuring timely and effective response systems are in place	Adjustment of physical layout and infrastructure	-Organisational preparedness in adjusting clinical facilities -Availability of spaces to build temporary critical care units	-
	Maintaining safe staffing levels	Adjusting pharmacist distribution across clinical settings	-Readiness of pharmacists to practice in a new clinical setting	-Lack of training -Lack of knowledge and understanding of clinical

			-Training to adapt new roles -Staff readiness to commit to new roles -Creation of new teams -Readiness to cover for new staff	procedures and drugs in a new setting -Lack of willingness to work from home -Lack of access to clinical records from home
		Adjustment of leave and staff absences	-provision of accommodation and shuttle services for staff -Flexibility to work from home -Remote access to clinical records when working from home -Government decisions to restrict opening hours of community pharmacy	-Burnout and fatigue -Difficulty sourcing locums
		Getting students to help out	-Availability of space to accommodate students	-Social distancing measures limiting the number of staff in a clinical setting
	Testing staff for Covid-19	Access and availability of COVID-19 test facilities	-Early testing and isolation practices	-Lack of access to testing
Action-response and adjustment	Ensuring uninterrupted supply of medications and ensuring business continuity plans	Sourcing and ordering medicines	-Government support to source medicines -Good procurement services in the clinical setting -Ordering medicines to ensure business continuity	-Lack of availability of medicines for intensive care medicine
		Rationing of medicines and medical supplies	-Time and resource to repackage and label -Availability of alternative brands and products -Patient acceptance of alternative brands and and smaller pack sizes	-
		Making therapeutic substitutions	-Doctor’s acceptance of therapeutic substitutions	-
		Extending repeat prescriptions without	-Flexibility in legislations to allow special supply	-Lack of availability of medicines to ensure seamless supply

		doctors' agreements	provisions	
	Impact and adjustment of routine clinical practice	Low use of healthcare services by patients	-	-Patient fears about the use of healthcare settings
		Cancelled elective appointments in hospitals	-	-Patient fears about the use of healthcare settings
		Interruption to routine clinical pharmacy services such as blood pressure checks and cholesterol testing	-Patient acceptance and understanding to reduced services	-Lack of coordination between primary care and community pharmacy -Lack of ability to conduct appropriate monitoring of disease and medicines use
		Offering home testing kits for disease monitoring	-Patient resources to buy home testing kits	-
		Providing care plan for the patients to care at home	-Family/carer support for patients at home	-
	Communicating with patients and healthcare professionals	Use of telephone, video and social media	-Availability of appropriate digital platform	-Lack of appropriate digital platform
		Ensuring effective remote communications	-Patient access to digital platforms -Patient confidence to use digital platform -Family and carer support to patients for the use of digital platform	-Patient lack of access to digital platform -Patients with reduced cognitive states facing difficulty with digital platforms -Lack of time to set up digital communications -Difficulty persuading patients to adhere to their medicines when communicating remotely
		Barriers to effective communications due to PPE	-	-Interference with voice and body language due to pharmacist use of PPE

				-Patients with sensory disabilities, different first language and reduced cognitive functions not able to understand masked communications
		Impact on inter-professional communications	-	-Reduced rate of acceptance of pharmacists' interventions when made remotely (compared to face to face)
	Advocating pharmacy's role and being source of information to doctors	Searching and appraising information and evidence	-Access to online resources and journals	-
		Professional role and identity	-Recognition of pharmacists' expertise and knowledge by senior management and other healthcare professionals -Use of same uniform and PPE by all healthcare professional leading to lack of professional hierarchy	-Lack of recognition of pharmacists' expertise and knowledge by senior management and other healthcare professionals
	Taking care of COVID-19 patients	Sourcing and appraising information	-Access to online resources and journals	-
		Availability and access to guidelines from professional societies and public health agencies	-Availability of clinical guidelines -Availability of training opportunities and webinars -Access to peer reviewed journals	-Mismatch of information across guidelines -Conflicting advice from various clinical disciplines in practice
		Monitoring safety and effectiveness of new drugs	-Ability to monitor patients on new drugs	-Lack of knowledge about the experimental drugs
Recovery and returning to normal	Sustainability of social distancing measures	-	-Benefits to high risk patients such as in transplant care	-

	Greater use of technology in communications and clinical care	-	-Availability of effective and efficient digital platforms	-
	Extended roles for pharmacy profession	--	-Other healthcare professionals' recognition and acceptance of pharmacists' clinical roles -Patient reluctance to use general practice services -Pharmacists' confidence to offer extended services	- -
	Readiness to offer vaccination for COVID-19	-	-Pharmacists' readiness to deliver new services	-
Reflection of personal experience, attitudes and behaviours	Personal experiences and coping strategies	-	-Pride in serving patients and humanity -Professional pride -Being able to help others -Being able to look after each other in the healthcare team	-
	Motivation	-	-Professional pride -Service to humanity -Seeing COVID-19 patients discharged and returning home -Looking after patients and each other -Effective clinical leadership	-
	Measuring successes and failures	-	-Being able to measure patient outcomes -Being able to keeping themselves and staff safe	-Lack of benchmarks to measure successes or failures
	Knowledge and skills learnt [e.g. - critical care,	-	-Readiness of pharmacists to practice new skills and in a new clinical setting	-Lack of recognition of pharmacists' skills and expertise from other healthcare

	extemporaneous dispensing, use of telecommunications and telemedicine, clinical trials, resilience and adaptability]			professionals

COVID-19: Coronavirus Disease; PPE: Personal Protective Equipment

Table 3: Recommendations for health systems and pharmacy services

Prevention

1. Government and healthcare agencies should make adequate provision of PPEs and sanitising chemicals
2. Government and healthcare agencies should prepare pharmacists to provide training on correct use of PPEs to other healthcare staff
3. Government and healthcare agencies should promote pharmacists to develop and disseminate evidence based information to the general public and patients about control measures and mitigating the risks of pandemic
4. Education of pharmacists in the professional pharmacy curriculum should incorporate aspects of prevention and mitigation of pandemics

Preparedness

1. Pharmacists should be given key decision making roles in relation to stratification of risks in clinical areas
2. Pharmacists in diverse clinical settings should receive training to deliver pharmaceutical care services in critical care areas in preparedness of the pandemic
3. Pharmacists' expertise and skills should be harnessed to enable them source and critically appraise evidence based information i
4. Pharmacists should receive adequate continuous professional development opportunities to source and appraise evidence based information
5. Healthcare services should identify measures to ration clinical pharmacy services to address staff shortages during the time of pandemic
6. Government and healthcare agencies should build strategies around how to best use student pharmacist resources at the time of pandemic

Action-response

1. Pharmacists should be trained to enable efficient procurement practices to ensure adequate supply of medicines
2. Government and healthcare agencies should utilise clinical pharmacists in gathering intelligence around the list of medicines that are likely to face shortages at the time of pandemic and ensure adequate planning to counter shortages
3. Pharmacists should be trained to enable therapeutic substitutions at the time of medicines shortages
4. Government and healthcare agencies should promote the potential clinical pharmacy can offer during the time of pandemic
5. Government and healthcare agencies should provide resources to pharmacists to ensure clinical pharmacy services are not interrupted at the time of pandemic, such as sourcing additional staff, customising facilities and availability of equipment to monitor disease status and drug safety and effectiveness
6. Remote means of communications and telemedicine need to be strengthened to allow better and effective communications between pharmacists and patients as well as other health care professionals.
7. Remote means of communications and telemedicine should cater for patients with low literacy, low cognitive functions, elderly and those with the need for language interpretation

8. Novel technologies should be harnessed to facilitate effective communications while pharmacists are on PPE
9. Government and healthcare agencies should utilise pharmacists in the delivery of vaccinations and new medicines to provide protection and treatment
10. Pharmacists routine activities such as dispensing of medicines, minor ailments services and prescribing activities should be harnessed to ensure clinical services provision from diverse settings
11. Government and healthcare agencies should ensure that the new knowledge and skills gained during the pandemic should be maintained and passed on to new practitioners

PPE: Personal Protective Equipment