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ORIGINAL ARTICLE

Impact of the COVID-19 pandemic on drug-related problems and pharmacist interventions in geriatric acute care units

Impact de la pandémie de la Covid-19 sur les problèmes médicamenteux et les interventions pharmaceutiques dans un service de médecine aiguë gériatrique

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HIGHLIGHTS

- During the COVID-19 pandemic a less typical form of medical care was expected for the infected patients.
- Clinical pharmacists may help the geriatricians in drug management.
- A greater amount of drug-related issues were detected during the first wave of the pandemic.
- The pharmacists' advice focused on drugs used for the management of COVID-19.

Summary
Objectives. — To assess and compare the pharmaceutical analysis on drug management in a geriatric acute care unit prior to and during the COVID-19 pandemic.

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KEYWORDS
Clinical Pharmacy;
COVID-19;
Older inpatients;
Pharmacist interventions;
Therapeutic optimisation

Methods. — This was a single-centre, retrospective, and comparative cohort study. All Pharmacist Interventions (PIs) carried out in the unit between 27 January 2020 and 30 April 2020 were distinguished according to whether they were conducted prior to or during the first wave of COVID-19. The main outcome measure was the rate of PIs per patient and per prescription lines analysed. Other data collected were the drug class managed by the PI, the Drug Related Problems (DRP) identified, the nature of the advice given, and the acceptance rate by geriatricians.
Results. — A total of 355 patients were analysed, with PIs generated for 21.7% of the patients prior to COVID-19, and for 53.4% of the patients during the first wave ($p < 0.001$). Among the 4402 prescription lines analysed, 54 PIs were carried out for prescriptions prior to COVID-19, and 177 during the first wave ($p = 0.002$). DRPs were mostly related to anti-infectious drugs during the pandemic (20.3%, $p = 0.038$), and laxatives prior to the pandemic (13.0%, $p = 0.023$). The clinical impact of the PIs was mainly moderate (43.7%). The acceptance rate was 59.3%.
Conclusions. — A greater amount of DRPs were detected and more therapeutic advice was proposed during the first wave of COVID-19, with a focus on drugs used for the management of COVID-19 rather than geriatric routine treatments. The needs for clinical pharmacists were strengthened during the pandemic.
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MOTS CLÉS
Pharmacie clinique ;
COVID-19 ;
Patients âgés ;
Interventions pharmaceutiques ;
Optimisation thérapeutique

Résumé
Objectifs. — Évaluer et comparer l'analyse pharmaceutique sur la prise en charge médicamenteuse dans une unité aiguë de gériatrie avant et pendant la pandémie de Covid-19.
Méthodes. — Il s'agissait d'une étude de cohorte monocentrique, rétrospective et comparative. Toutes les interventions pharmaceutiques (IP) réalisées entre le 27 janvier 2020 et le 30 avril 2020 ont été distinguées selon qu'elles aient été réalisées avant ou pendant la première vague. Le critère principal était le taux d'IP par patient et par ligne de traitement analysée. La classe thérapeutique concernée par l'IP, les problèmes médicamenteux (PM), la nature des conseils donnés et le taux d'acceptation par les gériatres furent recueillis.
Résultats. — Au total, 355 patients ont été analysés, avec des IP pour 21,7 % des patients avant Covid-19 et pour 53,4 % des patients lors de la première vague ($p < 0{,}001$). Parmi les 4402 lignes de prescriptions analysées, 54 IP ont été réalisées pour des prescriptions antérieures au Covid-19 et 177 lors de la première vague ($p = 0{,}002$). Les IP étaient principalement sur les anti-infectieux pendant la pandémie (20,3 %, $p = 0{,}038$), et les laxatifs avant (13,0 %, $p = 0{,}023$). L'impact clinique des IP était principalement modéré (43,7 %). Le taux d'acceptation était de 59,3 %.
Conclusions. — Un plus grand nombre de PM ont été détectés et davantage de conseils thérapeutiques ont été proposés au cours de la première vague de Covid-19, l'accent étant mis sur les médicaments utilisés pour la gestion de la COVID-19 plutôt que sur les traitements gériatriques de routine. Les besoins en pharmaciens cliniciens ont été renforcés pendant la pandémie.
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Introduction

In December 2019, a new coronavirus, now identified as SARS-COV-2, was discovered in Wuhan, China, in cases of acute respiratory illness [1]. Since then it has spread worldwide and the World Health Organization (WHO) officially declared the disease caused by this virus (COVID-19) as a pandemic. During the ''first wave'' of infections, the virus caused 3,175,207 infections and 224,172 deaths worldwide; in France it resulted in 128,121 infections and 24,342 deaths [2].

Our department (of Maine et Loire, France) was relatively spared during the first wave with a peak incidence rate of 83.2 per 100,000 inhabitants on April 30, 2020 [3]. However, to cope with this pandemic, several COVID-specific units were set up in our University Hospital in Angers, France. This allowed us to take care of patients from our department and to relieve other hospitals in more affected regions via patient transfers, but also to support residential care home in their management of infected residents.

Older people are at a higher risk of severe illness (respiratory distress, cardiovascular accident) due to their advanced

age and comorbidities [4—6]. In France as of May 18, 2020, 75% of those who have died of COVID-19 are over 75 years of age [7]. Thus, since March 19th, the geriatric acute care unit, for patients over 75 years, has been separated into two wards: one for positive or suspected patients (17 beds) and one for ''non-COVID-19'' patients (20 beds).

This unit benefits from a continued pharmaceutical presence. A major task for the clinical pharmacy team is the analysis of the patients' prescriptions within this unit. Pharmacists can highlight the problematic of inappropriate prescriptions and provide therapeutic advice. These Pharmacist Interventions (PIs) prevent a risk of medicinal error and encourage optimal prescriptions, especially for frail elderly inpatients who are at higher risk of an iatrogenic event due to their natural vulnerability and their polypharmacy [8,9].

The value of working with clinical pharmacists on the prevention of drug-related iatrogenic events and the optimisation of therapeutics, especially in a geriatric unit, has been demonstrated in several previous studies [10—13]. During this period of health emergency linked to the emergence of the COVID-19 pandemic, an unusual and less typical form of medical care was expected for patients with the use of specific protocols or drugs uncommon in geriatric standard practice. Therefore the pharmaceutical analysis of prescriptions by the clinical pharmacists in this unit may be a valuable support for the medical team.

With this work we wanted to assess the activity of pharmaceutical analysis in the geriatric acute care unit during the first wave of COVID-19 pandemic and its potential impact on drug management. To do so, we chose to compare the PIs carried out by the clinical pharmacy team during the analysis of the patients' prescriptions in this period with PIs carried out prior to the pandemic, over the same time-scale.

The primary objective was to compare the number of PIs in the two periods.

The secondary objectives were:

- to compare the drug class managed by the PIs;
- to compare Drug Related Problems (DRP) identified and the pharmacists' therapeutic advice given;
- to compare the clinical impact of our PIs;
- to compare the acceptance rate of our PIs by the geriatricians.

Methods

All inpatients whose medical prescription was analysed by clinical pharmacists (1 senior pharmacist or 1 pharmacy resident) in the geriatric acute care unit between January 27 and April 30, 2020 were included in this single-centre, retrospective and comparative cohort study.

The characteristics of those patients collected for the study were the following: demographical measures (age and sex), autonomy score (AGGIR scale - Autonomy Gerontology Iso-Resources Groups), COVID-status, length of stay and in-unit mortality. Those data were retrieved by consulting the electronic health records.

All PIs carried out by the clinical pharmacy team during the prescriptions analysis were gathered. They were categorised according to whether they were conducted prior to COVID-19 (between January 27 and March 18) or during the first wave of COVID-19 (between March 19 and April 30).

The medical and pharmaceutical staff were the same in both periods.

The endpoints to answer our main objective were the rate of PIs per patient and per prescription lines analysed. To answer our secondary objectives we collected the following data: drug class managed by the PI, DRP identified and nature of advice given. The PIs data were collected for the study via Business Objects© (v12.1.0, SAP Walldorf, Germany).

The study was conducted in accordance with the ethical standards set forth in the Helsinki Declaration (1983). The Angers ethical committee approved the study protocol under number 2020/140. The study protocol was declared to the National Commission for Information Technology and Civil Liberties (CNIL) under number ar20-0058v1.

Computerized medication orders and pharmaceutical analysis were allowed with three interfaced software packages (v8.2.6, Maincare, Cestas, France): Crossway® and Horizon Expert Order® for the medical prescription and M-Pharmacie® for the pharmaceutical analysis.

The prescriptions were analysed on working days (Monday to Friday) by the senior clinical pharmacist or their resident according to the standards set out by the French Society of Clinical Pharmacy (SFPC) [14] based on the patient's medical records, test results, medication records and with the Hospital's therapeutic booklet taken into account.

The tools used for analysing were:

- the French drug compendium (Vidal Hoptimal® database);
- the kidney adapted prescription guide website (GPR®) which provides dosing adjustments according to renal clearance;
- the screening tool to detect potentially inappropriate prescribing in persons aged 65 or older (Laroche list [15] and STOPP/START list [16]);
- the Geriatric Dosage Handbook 14th Edition (Semla T., Beizer J., Higbee M.).
- The latest internal clinical guidelines for COVID-19 were used during the pandemic.

PIs can be carried out by prescription lines: a prescription of a new drug (original prescription or addition during hospitalisation), a discontinuation or suspension of a drug or a dosage adjustment.

The standardisation of the PIs was proposed by the SFPC [17]. Their tool for the documentation of PIs includes the identification of the drug related problem and the therapeutic advice given. The detailed categories are presented in Appendix 1.

A PI is notified in both the analysis software and the prescription software. PIs are discussed orally with the medical team and considered as accepted if they lead to a change in the prescription. The acceptance rate of our PIs was assessed in this study.

The Anatomical Therapeutic Chemical (ATC) classification of the World Health Organization (1969) was used to detail the most frequently implied drugs in our PIs.

The clinical impact of each PI was evaluated with the Clinical, Economic and Organizational (CLEO) tool v3 [18] after consultation between the senior pharmacist and a geriatrician from the unit. This consultation was made

Table 1 Characteristics of the patients analysed by the clinical pharmacists ($n = 355$).
Caractéristiques des patients analysés par les pharmaciens cliniciens (n = 355).

Collected characteristics	Total cohort ($n = 355$)	Population analysed			Population with a Pharmacist Intervention		
		Prior to COVID-19 ($n = 166$)	During COVID-19 ($n = 189$)	*p-value*	Prior to COVID-19 ($n = 36$)	During COVID-19 ($n = 101$)	*p-value*
Demographical measures							
Age (mean ± SD, years)	88.0 ± 5.7	87.8 ± 5.8	88.3 ± 5.7	*0.346*	88.6 ± 5.4	89.0 ± 5.8	*0.726*
Female sex, n (%)	211 (59.4%)	100 (60.2%)	111 (58.7%)	*0.829*	20 (55.6%)	59 (58.4%)	*0.845*
AGGIR score, /5	3.2 ± 1.2	3.1 ± 1.1	3.3 ± 1.3	*0.26*	2.7 ± 1.3	3.2 ± 1.2	***0.02***
COVID-positive status	74 (39.2%)	0	74 (39.2%)	***< 0.001***	0	41 (40.6%)	***< 0.001***
Hospitalization in geriatric acute care unit							
Length of stay (mean ± SD, days)	10.2 ± 6.7	11.9 ± 7.0	8.6 ± 6.0	***< 0.001***	13.1 ± 6.3	8.1 ± 5.3	***< 0.001***
In-unit mortality, n (%)	37 (10.4%)	12 (7.2%)	25 (13.2%)	*0.081*	6 (16.7%)	14 (13.9%)	*0.784*
Number of prescription lines validated (mean ± SD)	12.4 ± 7.8	8.7 ± 6.1	15.7 ± 7.7	***< 0.001***	*13.7 ± 6.9*	*16.5 ± 8.3*	*0.171*

Characters in bold : significant *p-value*.

retroactively while analysing the data and the assessment of the problem was not patient-specific. The clinical impact scale ranges from −1 C (harmful) to 4 C (vital). The different scores are presented in Appendix 2.

All statistics were performed using SAS© (v9.4, SAS Institute Inc., Cary, NC, USA). The Student test was used for the comparison of the characteristics of the study population and the Chi-squared test or Fisher test were used for the comparison of the pharmaceutical analysis data. *P*-values < 0.05 were considered statistically significant.

Results

Between January 27 and April 30, 2020, 355 patients were analysed by the clinical pharmacists team, 166 (46.8%) prior to COVID-19 and 189 (53.2%) during the first wave of COVID-19 (mean ± SD age 88.0 ± 5.7y; 59.4% female; AGGIR score 3.2 ± 1.2); mean number of prescription lines validated 12.4 ± 7.8; mean length of stay 10.2 ± 6.7 days; death rate 10.4%). Seventy-four patients were COVID-positive (39.2%), with a PI for 41 (40.6%) of them.

There were no significant differences in the demographical measures of the population. During COVID-19 the mean length of stay was shorter ($p < 0.05$) and the mean number of prescription lines per patient was larger ($p < 0.05$). Characteristics of the population analysed by the clinical pharmacists are outlined in Table 1.

The pharmacists analysed and validated 4,402 prescription lines (1,436 before COVID-19 and 2,966 during the pandemic). Among them 231 PIs were carried out (5.2%): 54 for prescriptions prior to COVID-19 (23.4%) and 177 during COVID-19 (76.6%). There were significantly more PIs per prescription lines validated during the pandemic ($p = 0.002$).

Prior to COVID-19, PIs were generated for 21.7% ($n = 36$) of the patients; the rate of PIs per patient was 0.33. During the first wave of COVID-19, PIs were generated for 53.4% ($n = 101$) of the patients; the rate of PIs per patient analysed was 0.94. There were significantly more PIs per patient during the pandemic ($p < 0.001$).

The distribution of the PIs according to the therapeutic classes is outlined in Table 2.

Prior to COVID-19, the therapeutic classes with most PIs were ''laxatives'' ($n = 7$; 13.0%), ''inhibitors of acid secretion'' ($n = 6$; 11.1%) and ''analgesics and antipyretics'' ($n = 6$; 11.1%). There were significantly more PIs on laxatives during this period ($p = 0.023$).

During the COVID-19 pandemic, most PIs were put forwards for ''anti-infectious drugs'' ($n = 36$; 20.3%), ''analgesics antipyretics'' ($n = 31$; 17.5%) and ''anticoagulant drugs'' ($n = 17$; 9.6%). There were significantly more PIs on anti-infectious drugs during the pandemic ($p = 0.038$).

The distribution of the highlighted issues within the prescriptions and the pharmacists' therapeutic advice is outlined in Table 3.

Table 2 Distribution of the pharmacist interventions according to the ATC therapeutic classes ($n = 231$).
Distribution des interventions pharmaceutiques selon la classe thérapeutique ATC ($n = 231$).

Therapeutic classes	Pharmacist Interventions *n* (%)		
	Prior to COVID-19 ($n = 54$)	During COVID-19 ($n = 177$)	*p-value*
Analgesics and antipyretics	6 (11.1%)	31 (17.5%)	*0.298*
Anticoagulants	5 (9.3%)	17 (9.6%)	*1.000*
Antidiabetics	1 (1.9%)	2 (1.1%)	*0.552*
Antiemetics	1 (1.9%)	0	*0.234*
Anti-histamine	0	1 (0.6%)	*1.000*
Anti-infectious	4 (7.4%)	36 (20.3%)	***0.038***
Anti inflammatories	2 (3.7%)	4 (2.3%)	*0.626*
Anti-parkinsonians	0	1 (0.6%)	*1.000*
Anti-platelets	3 (5.6%)	9 (5.1%)	*1.000*
Cardiovascular system drugs	0	6 (3.4%)	*0.340*
Drugs for obstructive airway diseases	0	2 (1.1%)	*1.000*
Experimental drugs	0	1 (0.6%)	*1.000*
Inhibitors of acid secretion	6 (11.1%)	16 (9.0%)	*0.606*
Laxatives	7 (13.0%)	7 (4.0%)	***0.023***
Lipid lowering drugs	4 (7.4%)	6 (3.4%)	*0.249*
Ophthalmic drugs	2 (3.7%)	4 (2.3%)	*0.626*
Opioids analgesics	2 (3.7%)	11 (6.2%)	*0.738*
Psychoanaleptics	0	2 (1.1%)	*1.000*
Psycholeptics	3 (5.6%)	2 (1.1%)	*0.085*
Supplements (vitamins, minerals)	5 (9.3%)	13 (7.3%)	*0.772*
Urological agents	3 (5.6%)	6 (3.4%)	*0.440*

Characters in bold : significant *p-value*.

Table 3 Distribution of drug-related issues within the prescriptions ($n = 231$).
Distribution des problèmes médicamenteux des prescriptions ($n = 231$).

Drug-related issues	Pharmacist interventions *n* (%)		
	Prior to COVID-19 ($n = 54$)	During COVID-19 ($n = 177$)	*p-value*
Adverse drug reaction	0	1 (0.6%)	*1.000*
Drug monitoring	2 (3.7%)	2 (1.1%)	*0.234*
Drug without indication	18 (33.3%)	30 (16.9%)	***0.013***
Failure to receive a drug	0	1 (0.6%)	*1.000*
Improper administration	5 (9.3%)	42 (23.7%)	***0.021***
Non conformity to guidelines or contraindication	13 (24.1%)	41 (23.2%)	*0.857*
Subtherapeutic dosage	5 (9.3%)	3 (1.7%)	***0.019***
Supratherapeutic dosage	11 (20.4%)	51 (28.8%)	*0.292*
Untreated indication	0	6 (3.4%)	*0.340*

Characters in bold : significant *p-value*.

The most frequently identified problem in the whole data collection was a drug supratherapeutic dosage ($n = 62$, 26.8%) which was followed by a non-conformity to the guidelines or a contraindication ($n = 54$, 23.4%) and the prescription of a drug without an indication ($n = 48$, 20.8%).

Prior to the pandemic, there were significantly more PIs for a drug without an indication ($p = 0.013$) and for a subtherapeutic dosage ($p = 0.019$). During COVID-19, there were significantly more PIs for an improper administration ($p = 0.021$).

For both periods combined, 72 PIs (31.2%) were proposed for discontinuing a drug, 57 (24.7%) for adjusting the dosage of a drug and 41 (17.7%) for switching a drug.

Table 4 Correspondence between therapeutic advice given by the pharmacists and changes of prescriptions by the geriatricians ($n = 231$).
Correspondance entre les conseils thérapeutiques des pharmaciens et les changements de prescriptions par les gériatres ($n = 231$).

Therapeutic advice	Pharmacist Interventions *n* (%)			Acceptance rate % (*n*)		
	Prior to COVID-19 ($n = 54$)	During COVID-19 ($n = 177$)	*p-value*	Prior to COVID-19	During COVID-19	*p-value*
Addition of a new drug	2 (3.7%)	16 (9.0%)	*0.257*	50.0% (1)	75.0% (12)	*0.490*
Administration modalities optimisation	1 (1.9%)	27 (15.3%)	***0.007***	100.0% (1)	59.3% (16)	*1.000*
Change of administration route	2 (3.7%)	8 (4.5%)	*1.000*	0% (0)	62.5% (5)	*0.444*
Dose adjustment	13 (24.1%)	44 (24.9%)	*1.000*	53.8% (7)	59.1% (26)	*0.759*
Drug discontinuation	26 (48.1%)	46 (26.0%)	***0.004***	57.7% (15)	52.2% (24)	*0.806*
Drug monitoring	2 (3.7%)	3 (1.7%)	*0.333*	100.0% (2)	66.7% (2)	*1.000*
Drug switch	8 (14.8%)	33 (18.6%)	*0.684*	75.0% (6)	66.7% (22)	*1.000*

Characters in bold : significant *p-value*.

Thirty-two PIs (59.3%) were accepted by the medical staff prior to COVID-19. During the pandemic our PIs acceptance rate was 60.5% ($n = 107$; $p = 0.875$). Table 4 describes the distribution of the pharmacists' therapeutic advice and their acceptance rate.

The clinical impact of our PIs is outlined in Table 5.

One hundred and one PIs (43.7%) had a moderate clinical impact, 76 (32.9%) a minor impact and 40 (17.3%) a major impact. There was no significant difference between the two groups.

Discussion

This study on pharmaceutical analysis in a geriatric care unit at a teaching hospital reports that clinical pharmacists detected a higher number of DRPs within prescriptions during the first wave of the COVID-19 pandemic than beforehand. Associated therapeutic advice focused on the use of drugs specific to the management of COVID-19 rather than routine geriatric treatments.

To date, several articles on the roles of pharmacists during the COVID-19 pandemic have been published [19—21]. They emphasize the importance of pharmacists in managing stocks of health products but also their support role for the medical staff in the proper use of these treatments.

Previous reports on PIs during this pandemic focused specifically on the management of COVID-19 patients, whether via pharmaceutical teleconsultations in a tertiary care centre [22] or in hospitalised patients in a community teaching hospital [23,24]. We provide here a comparative review of the pharmaceutical analysis practices in a population of frail, elderly inpatients - regardless of their COVID-19 status, prior to and during the first wave of this pandemic.

The main result is that, during the COVID-19 pandemic, pharmacists released significantly more PIs per patient and per prescription lines than prior to the pandemic.

During the first wave, 6.0% of PIs were performed out of the total number of prescription lines analysed, 53.4% of inpatients' prescriptions were subject to a PI and the total number of PIs per patient was 0.94. This rate is higher than those presented by two studies in French geriatric acute care units [25,26] and whose results were similar to ours prior to the pandemic. On the other hand, the works of Collins et al. [23] and Perez et al. [24] have shown higher rates of PIs than ours, but with a greater number of staff in the clinical pharmacy team.

Nevertheless, these studies suggest that the medical management of COVID-19 patients is particularly at risk of medication errors. This can be explained in different ways. Firstly, the mean length of stay for patients was shorter during the COVID-19 pandemic than beforehand. More first-prescriptions, which are more at risk of DRPs [27,28], were analysed. Secondly, the number of prescription lines per patient is higher among those hospitalized during the first wave and thus increases their risk of exposure to an iatrogenic event and potential DRP identified by the pharmacists. Thirdly, during the pandemic there were significantly more PIs on anti-infectious drugs than before. These drugs are frequently cited as a cause of DRPs, due to their prescription in acute illness and their specificities of use in elderly patients which reinforced the pharmacists' vigilance during the analysis [29,30].

The results showed a significant difference in the types of the PIs recorded over the two periods.

During the first wave of the pandemic there was a focus on drugs which are part of the medical management protocol of COVID-19 patients: ''anti-infectious drugs'' (20.3%), ''analgesic and antipyretics'' -i.e. acetaminophen- (17.5%), and ''anticoagulant drugs'' (9.6%). The DRPs found in

Table 5 Impact Clinique des Interventions Pharmaceutiques s évalué selon l'échelle CLEO ($n = 231$).
Clinical impact of the Pharmacist Interventions issued assessed with the CLEO tool ($n = 231$).

Clinical Impact	Pharmacist Interventions *n* (%)		
	Prior to COVID-19 ($n = 54$)	During COVID-19 ($n = 177$)	*p-value*
Harmful	0	1 (0.6%)	*1*
Null	2 (3.7%)	11 (6.2%)	*0.738*
Minor	22 (40.7%)	54 (30.5%)	*0.186*
Moderate	22 (40.7%)	79 (44.6%)	*0.641*
Major	8 (14.8%)	32 (18.1%)	*0.684*
Lethal	0	0	-

anti-infectious drug prescriptions were mostly an improper administration (e.g. an injectable form prescribed when the oral route is possible, prescription with no duration of treatment) or a supratherapeutic dosage. There were no significant differences in the number of DRPs in the prescriptions of acetaminophen and anticoagulant drugs. Acetaminophen is the most frequently prescribed molecule during hospitalisation in France [31] and particular attention is paid to its correct prescription in geriatric care (maximum dosage for older adults and according to the patients' weight, adapted route of administration or absence of double prescription line). Anticoagulant drugs are particularly at risk of causing serious adverse effects in older adults [32], their prescription requires reinforced vigilance in their use (duration of treatment, route of administration, adapted dosage, biological monitoring).

Before the COVID-19 pandemic, the drugs with the highest number of PIs were ''laxatives'' (13.0%), ''analgesics and antipyretics'' and ''inhibitors of acid secretion'' (11.1%). These therapeutic classes are frequently found in prescriptions for older adults, and correspond to standard geriatric care. We noted significantly more DRPs for a prescription without an indication and advice on drug discontinuation. This is consistent with the specificities of routine geriatric care where particular attention is paid to the reassessment of inappropriate prescriptions. The purpose is to encourage deprescribing whenever possible to limit avoidable iatrogenic risks in this population [33,34].

This difference in practices adopted during the pandemic, and significantly highlighted, can be explained by the notion of emergency in the management of COVID-19 patients on their admission to the unit. Indeed, PIs on inappropriate administration or dosage adjustments are more in line with those expected for acute care management whereas PIs on laxatives or drugs without an indication are more appropriate for routine management, when the patient stays long enough on the ward to benefit from geriatric therapeutic optimisation.

Our PIs during the pandemic were similar to the advice for therapeutic optimisation during COVID-19 recommended by the work of Burgess et al. [21] and found in several studies [22—24]. Basically, we proposed dosage adjustments to use the appropriate dose for each patient, we insisted on the optimisation of the administration of drug modalities and advised on deprescription to ease the treatment regimens for those patients, but we note, however, a lower proportion of PIs on treatment monitoring in our results.

Concerning the clinical impact of the PIs, no significant difference was found between the two periods. Only 3 studies proposing an evaluation of the impact of PIs using the CLEO scale were found in the literature [35—37]. The CLEO scale being a French scale and of recent implementation, is currently rarely used. Other scales have been used in previous works (Hatoum, Pippins) and these tools have demonstrated that PIs in geriatrics most often have a ''significant'' clinical impact [26,38,39]. This is similar to our results. As the pharmaceutical team works in partnership with the medical team, PIs have little major or even vital clinical impact for patients.

The acceptance rate of the PIs is similar for both analysis periods, with an average value of 60.2%. This result is lower than those found in the literature, ranging from 63.3% to 92.0%. The main hypothesis to explain this lower rate is the lack of systematic oral communication of the PI to the medical team which has been proven to be a better way of having our interventions accepted [40]. Studies that have shown an acceptance rate of computer-transmitted-only PIs in their results have similar results to ours [26]. Proposals to improve our communication were discussed with the medical team but were not always successful in the health context of the pandemic which reduced the contact between pharmacists and the healthcare team.

This study had some limitations. Contrary to other works, we decided to compare the PIs carried out over two distinct periods of time rather than between COVID-19 positive and COVID-19 negative patients. This may have caused a bias in our analysis practices. As the clinical pharmacy team has only been working in the unit since November 2019, its efficiency in analysing prescriptions was not optimal at the beginning of the data collection. As the gain in experience through contact with the medical team and the performance of clinical pharmacy activities is acquired over time, it is logical to highlight an improvement in the pharmacists' analysis during the 2nd period of data collection.

Also, due to the difficulties in determining the COVID-19 status of the population, the results are more a reflection on general geriatric management during this pandemic than specific management for COVID-19 patients.

Conclusions

There was an intensification of pharmaceutical analysis of patients' prescriptions in the geriatric acute care unit

during the first wave of the COVID-19 pandemic compared to prior COVID-19. A greater amount of DRPs were detected and more therapeutic advice was proposed to the medical team by the clinical pharmacists, with a focus on drugs used for the management of COVID-19 rather than geriatric routine treatments. The needs for clinical pharmacists were strengthened during the pandemic.

To optimize our impact on drug management, the acceptance rate of PIs needs to be improved by a better communication with the prescribers.

With the persistent high level of hospitalizations for COVID-19, this work may be used to improve practices and provide better adapted PIs to support patient care.

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Availability of data and material

The data collected for the study is stored on a server with regulated access. They can be available on request from the authors.

Ethics approcal

Ethical approval was waived by the local Ethics Committee of Angers ethical committee in view of the retrospective nature of the study and all the procedures being performed were part of the routine care.

Author's contribution

Chappe has full access to the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analyses.

Study concept and design: Chappe, Annweiler and Spiesser-Robelet.

Acquisition of data: Chappe, Corvaisier and Annweiler.

Analysis and interpretation of data: Chappe and Annweiler.

Drafting of the manuscript: Chappe, Spiesser-Robelet, and Annweiler.

Critical revision of the manuscript for important intellectual content: Corvaisier and Brangier.

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Study supervision: Annweiler and Spiesser-Robelet.

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Disclosure of interest

The authors declare that they have no competing interest.

Appendix A. Appendices 1—2

Supplementary data associated with this article can be found, in the online version, at http://doi.dx.org/10.1016/j.pharma.2021.12.006.

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