Medication management throughout hospitalization with a focus on discharge – the pharmacist's contribution

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To my loving family

"What we know is a drop, what we don't know is an ocean."

Isaac Newton

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LIST OF ABBREVIATIONS

ASHP	American Society of Health-System Pharmacists
BPMH	Best Possible Medication History
CIRS	Critical Incidence Reporting System
CRM	Crew Resource Management
DRP	Drug-Related Problem
EAHP	European Association of Hospital Pharmacists
FIP	International Pharmaceutical Federation
GSASA	Swiss Association of Public Health Administration and Hospital Pharmacists
PCNE	Pharmaceutical Care Network Europe
PCP	Primary Care Provider
WHO	World Health Organization

SUMMARY

Transitions of care occur when patients are transferred between different settings. Patient hospitalizations are accompanied by several transitions of care, potentially leading to a variety of problems, one type of which are drug-related problems (DRPs). DRPs are issues involving medication therapies that can result in undesired health outcomes. As DRPs can lead to patient harm, they need to be addressed before they reach the patient. Pharmacists have been shown to identify and resolve DRPs by themselves or in collaboration with physicians or patients. Healthcare professionals should strive to prevent these problems from occurring in the first place. Different pharmacist-led services, such as medication reconciliation or medication reviews, have been shown to improve patient safety. Despite the known benefits of pharmacist-led services at transitions of care in other countries, little is known about the hospital discharge management in Switzerland and what the role of pharmacists is. Additionally, Switzerland lacks guidelines at a national level that could direct hospitals in the implementation of such services.

The goal of this thesis was to provide the basis for designing an improved process in supporting patients in their medication management at hospital discharge. We aimed to achieve this goal through the description of the current discharge management with a focus on the role of pharmacists (Part A) and the impact of pharmacist-led services on DRPs at hospital discharge (Part B).

Clinical pharmacy services are constantly evolving; in Switzerland, the status was first described in a national survey conducted in 2013. Since these services continued to develop in the following years, the objective of the first project was to give an overview of the current implementation status of clinical pharmacy in Switzerland and its development in recent years (Project A1). In 2017, we sent an online questionnaire to all chief hospital pharmacists registered at the Swiss Association of Public Health Administration and Hospital Pharmacists (n=60). In total, 44 hospital pharmacies participated (return rate 73.3%) and among the participants all five university hospitals were represented. The participating hospital pharmacies employed a total of 265.8 full-time equivalents of hospital pharmacists, of which 20.4 % were allocated to clinical pharmacy. In the 31 hospital pharmacies that indicated to offer clinical pharmacy services, process-related and treatment-related services were offered more frequently than patient-related services. Activities related to the European Association of Hospital Pharmacists statements on clinical pharmacy were implemented with varying frequency. A direct comparison with the results of the survey in 2013, showed an increase in both hospital (+24.5%) and clinical (+62.7%) pharmacists full-time equivalents.

The objective of the second project was to describe the involvement of pharmacists in medication management at hospital discharge in Switzerland and to compare it to international guidelines (Project A2). We developed an online questionnaire on medication management at discharge that was sent together with the one described in Project A1. Moreover, to gain further insight into the role of the pharmacist, semi-structured face-to-face interviews were conducted with selected hospital pharmacies and where appropriate, the collaborating community pharmacy. During this project, as there are no Swiss guidelines regarding medication management at hospital discharge, we compared our results to international guidelines. We discovered that in Swiss hospitals healthcare professionals frequently conducted interventions recommended by guidelines, such as patient education or communication to primary care providers. Overall, pharmacists were rarely involved at hospital discharge. Seventeen of the 44 (38.6%) hospitals were in close collaboration with a community pharmacy (owned or not owned by the hospital) or had a hospital pharmacy with a counter open to discharged patients. These collaborating pharmacies mainly aimed at assuring initial medication supply.

The first two projects addressed several aspects of discharge processes in regard to medication management. The objective of the third project was to provide an overview of guidelines for medication review in the hospital setting (Project A3). We first conducted a grey literature search with the following inclusion criteria: to contain recommendations on medication reviews in the hospital setting, to be accessible in full text and to be written in English or German. For the development of the categories in the overview, we used an iterative process to identify elements recommended in the guidelines. Our search yielded three international and nine national guidelines. Some guidelines described different types of medication reviews, for instance the Pharmaceutical Care Network Europe differentiated between simple, intermediate, and advanced medication reviews depending on the sources of information available. While all guidelines addressed patient safety and nearly all medication appropriateness, conducting medication reconciliation or obtaining a best possible medication history was recommended in less than half.

As already mentioned, DRPs frequently occur at transitions of care, such as hospital discharge. With Part B we aimed to obtain an impression of frequent DRPs in Swiss hospitals at discharge and the impact of pharmacist-led services on these DRPs.

First, to describe the pattern of DRPs at hospital discharge, we retrospectively analyzed DRPs discovered on discharge prescriptions with a focus on drug-drug interactions in two Swiss hospitals: a regional hospital and a cantonal hospital (Project B1). Pharmacists documented 2539 DRPs at the regional hospital 2754 DRPs at the cantonal hospital. Recommendations following the discovered DRPs were frequently accepted in both hospitals, many resulted in a change of the discharge prescription (regional hospital 70.2% of DRPs, cantonal hospital 69.5%). In both hospitals DRPs were frequently related to

dosage problems (regional hospital 53.2%, cantonal hospital 48.1%). When focusing on DRPs due to drug-drug interactions, we found that the most frequent drug combinations could often be grouped into two interaction types: problem of complexation and problem of QT interval prolongation.

The objective of the last project was to assess the effect that two pharmacist-led services (medication reconciliation at admission and interprofessional ward rounds including a pharmacist during the stay) had on DRPs at hospital discharge (Project B2). We conducted a retrospective data analysis of DRPs identified on discharge prescriptions at the cantonal hospital of Zug. We included all patients discharged from the internal medicine ward that filled their discharge prescription in the in-hospital community pharmacy and that were >18 years old. The combination of the two pharmacist-led services was associated with a reduction of DRPs at hospital discharge. Patients receiving a pharmacist-led medication reconciliation at hospital admission had fewer DRPs related to medication reconciliation problems at hospital discharge.

In conclusion, this thesis described the current discharge management in Switzerland and pharmacists' role in it. It also evaluated the impact of pharmacist-led services on DRPs at hospital discharge. The findings revealed that while clinical pharmacy services have increased, pharmacists are still rarely involved in medication management at hospital discharge. It also shows that when pharmacists have access to clinical data, they can identify and resolve a variety of DRPs. Our results confirmed an association between a comprehensive involvement of pharmacists throughout the hospital stay and a reduction in DRPs at hospital discharge. Based on these findings, hospitals should be encouraged to strengthen the role of pharmacists at transitions of care.

GENERAL INTRODUCTION

Patient safety at transitions of care

Patients with acute or chronic conditions often require care from healthcare professionals (e.g., physicians, pharmacists, nurses). Although many conditions can be cared for in an ambulatory setting, some may require that patients are hospitalized. The next paragraphs will address two factors of patient care in regard to patient safety; namely, transitions of care and drug-related problems (DRPs).

Transitions of care

A multitude of reasons may lead to a hospitalization of patients. In this case, healthcare professionals from the hospital setting assume responsibility for the care for patients. After hospital discharge, the lead in the care is given back to healthcare professionals in the ambulatory setting. During these transitions of care, patient safety is a matter of great importance. In their third Global Patient Safety Challenge "Medication Without Harm", the World Health Organization (WHO) has identified transitions of care as one of three key areas that need to be prioritized when addressing patient safety.[1] Transitions of care include not only hospital admission and discharge, but also other transfers, for instance the transfer between wards within a hospital, the transfer to another hospital or the admission and discharge to and from a rehabilitation clinic after a hospitalization.[2] As transitions of care require the communication between different healthcare professionals working in different settings, it makes them a hotspot of problems in patient care. Problems at transitions of care can arise, for instance from changes in patients' medication or from poor/delayed communication. This includes discharge letters to general practitioners, as well as discharge prescriptions to be filled in community pharmacies or information provided to home care nurses.[3-6]

As mentioned above, the accurate transmission of patients' information, including the information on medication changes, between settings is crucial for a seamless transition of care. A lack thereof can lead to unintentional medication discrepancies and potentially to DRPs.[3-5] One of those problem areas can be found in discharge summaries, which do not always contain information on patients' discharge medication. A systematic review revealed that only 78% of discharge summaries contained the required data.[7] As medication is frequently changed during hospitalizations (e.g., a Canadian study reported a mean of 4.4 changes per patient[8]) and patients frequently leave hospital with more medicines than they enter with,[4,8] an accurate communication of medication changes to primary care providers is crucial for continuity of care. It has been recently proposed that involving pharmacists in the communication at hospital discharge can further improve the quality of medication information transferred.[3] In this study, it was reported that physicians' discharge summary

only correctly documented 37.6% of medication changes whereas pharmacists' discharge medication management summary correctly documented 72.8% of medication changes.[3]

Communication of information to subsequent care providers should not only be accurate, but also happen in a timely manner.[9-11] While in two thirds of cases, discharge summaries are completed by hospital physicians within 48h, only 55% are received by primary care provider within 48h. After four weeks up to 85% of discharge summaries reached primary care providers.[7] Pertaining to discharge prescriptions, those can also lead to problems with continuity of care at hospital discharge.[4] A study conducted in the Netherlands found that 92% of discharge prescriptions contained at least one problem related to continuity of care. In these cases, community pharmacies often had to contact the physician in order to resolve the problem. The problems included medication discrepancies, patients needing further education or administrative problems. Attending to discharge prescriptions with problems of continuity of care can be more time-consuming than prescriptions without problems.[4] To improve the continuity of care at hospital discharge and facilitate medication supply in community pharmacies, providing community pharmacies with additional patient information (e.g., medical history, laboratory test results, medication changes) accompanying the discharge prescription could improve post-discharge medication supply. A study piloting this intervention (timely hospital-to-community liaison) found fewer gaps in continuity of care in patients for which pharmacies received additional information in a timely manner than in the control group. Most pharmacists were satisfied with this additional information provided.[12]

As described above, transitions of care pose several risks for patients. One patient group particularly affected are elderly people,[13,14] as they are more frequently hospitalized than younger ones.[14,15] Additionally, it has to be taken into consideration that the proportion of elderly patients can be assumed to increase, as life expectancy is also increasing. In Switzerland, life expectancy has risen steadily over the last decades; in 2019, it was above 80 years for both women and men.[15] Additionally, elderly patients tend to have more chronic conditions and are prescribed more medicines,[16] which in turn increases the risk of DRPs.[17,18] Pharmacotherapy is the most frequent therapeutic intervention[16] and can help to prevent, to cure or to manage many diseases and conditions.[19,20] Although polypharmacy (often denoted as five or more concurrently and routinely used medicines[16]) has been described as one of the risk factors of DRPs,[17,18] it has to be noted that polypharmacy for some patients is appropriate. As an example of appropriate polypharmacy the WHO identifies the treatment with a statin, a beta blocker, an angiotensin-converting enzyme inhibitor and an antiplatelet agent in post-myocardial infarction patients for secondary prophylaxis.[16]

Drug-related problems

DRPs are one of the issues arising at transitions of care. They have the potential to impair patient safety, especially when they lead to patient harm;[21] this concern therefore needs to be addressed during transitions of care. A systematic review has found a widespread range of drug-related harm occurring to older patients after hospital discharge, ranging from 0.4%-

51.2%.[21] This great variation could be explained by different definitions used,[21] as there are several definitions to describe medication harm.[22] The term DRPs has been used as a collective term for different problems related to patients' medication including, but not limited to, adverse drug events and adverse drug reactions,[23] which can be the cause of drug-related harm. The Pharmaceutical Care Network Europe (PCNE) developed the following definition for DRPs:

"A Drug-Related Problem is an event or circumstance involving drug therapy that actually or potentially interferes with desired health outcomes." PCNE[24]

DRPs have three dimensions: (1) they can be preventable or not preventable, (2) they can be potential or manifest, and (3) they can be caused by an error, by an intentional or unintentional deviation from accepted practice, or by an unpredictable reaction to an appropriate medical intervention.[25] Several studies from a number of countries have examined DRPs from different point of views. A study analyzing problems discovered in hospitalized patients in a Swiss university hospital found an average of 0.92 DRPs per patient.[26] The same study revealed that the three most frequent problems leading to a pharmaceutical intervention that were subsequently accepted by physicians were caused by inappropriate dose, indicated drug not prescribed, and prescribed drug not indicated.[26] In a Dutch study including patients from neurology and pulmonology wards, community pharmacists identified an average of 4.1 DRPs per patient during home visits after hospital discharge. Frequent problems included the need for additional education or information, adherence issues and non-clinical issues.[27] Another Dutch study found that after hospital discharge 96.4% of patients needed patient handling interventions including e.g., education about medication indication, disposal of expired/unused medication, answering questions concerning medication or medication adherence advice.[5] In patients discharged from a German geriatric rehabilitation center the most frequent DRPs were no clear indication, incorrect dose, no clear dosage, and drug–drug interaction.[28] DRPs discovered in Swiss community pharmacies on discharge prescriptions were frequently caused by inappropriate therapy duration, error in the medication process and prescribed drug not available.[29] Focusing on adverse drug reaction, a type of DRP, a meta-analysis found that approximately half of adverse drug reactions were preventable.[30] In summary, DRPs can occur in all settings and frequent problems are inappropriate dosage, patients needing education or adherence issues.[5,26,27]

All the aforementioned studies used different classification systems to document the discovered DRPs, which hinders a direct comparison. A variety of classification systems have been developed and modified in order to document DRPs in different settings.[31] PCNE proposed a classification system that has been revised multiple times over recent years.[24] The current version is V9.1, of which multiple aspects are currently being validated.[24] There are two classification systems available that were developed in Switzerland, one for the hospital setting, the Swiss Association of Public Health Administration and Hospital Pharmacists (GSASA) classification system,[32] and one for the community setting, the PharmDISC.[33]

As described, transitions of care and DRPs can both compromise patient safety, independently or in conjunction with each other. In this regard, healthcare professionals might see themselves facing several challenges that need to be attended in order to prevent patient harm.

The pharmacist's contribution to an improvement in patient safety

The previous paragraphs described the issues patients and healthcare professionals are facing at transitions of care, the following section will now present strategies that have been developed to improve patient care with a focus on the role of pharmacists. As pharmacists have strived to contribute to patient safety, different approaches have emerged over time. The next sections will focus on pharmaceutical care and clinical pharmacy, as well as pharmaceutical interventions. Pharmaceutical interventions are activities that can be part of both pharmaceutical care or clinical pharmacy.

Pharmaceutical care

Over 30 years ago, Hepler and Strand recognized the potential benefits of involving pharmacists in patient-centered care and proposed a widely known definition.[34] With the provision of pharmaceutical care, healthcare professionals aim to improve patients' outcomes and thereby patients' quality of life, through the responsible provision of pharmacotherapy. Hepler and Strand advocated the incorporation of pharmaceutical care into pharmacy practice, thus, pharmacists could contribute to therapy optimization through the identification of potential and actual DRPs. This incorporation could prevent potential problems and resolve actual problems by pharmaceutical interventions. Pharmaceutical care should not be seen as an isolated care service, but should be integrated in the whole patient care process. It is therefore crucial, as emphasized by Helper and Strand, that pharmaceutical interventions are provided in collaboration with other healthcare professionals.[34] At a PCNE workshop in 2013, experts redefined pharmaceutical care and named the pharmacist explicitly as the provider of care aimed at the optimization of medication use and improvement of health outcomes.[35] A recent resolution by the Committee of Ministers of the Council of Europe strongly supported the implementation of pharmaceutical care in both the primary care setting and the hospital setting. It advocates the interprofessional collaboration of pharmacists with other healthcare professionals.[36]

Clinical pharmacy

Several countries have implemented initiatives for seamless care at transitions, some of which include clinical pharmacists.[37] Clinical pharmacy is a health science discipline in pharmacy that focuses on rational medication use and incorporates the integrative philosophy described for pharmaceutical care.[38] Clinical pharmacists contribute to the development and promotion of safety, appropriateness and cost-effectiveness in the use of medicines.[39] Clinical pharmacy activities can take place in all healthcare settings.[38] The GSASA states that:

"In the hospital setting, clinical pharmacy includes direct patient oriented pharmaceutical activities, implemented on patient care wards in collaboration with other health care professionals." GSASA[39]

In a series of statements, the European Association of Hospital Pharmacists (EAHP) developed the common objectives that pharmacists should seek to achieve. These statements were approved in 2014 and include a section on clinical pharmacy.[40,41] After an initial baseline assessment in 2015,[42] questionnaires — each covering three sections of the statements — are sent out regularly to hospital pharmacists, to evaluate the development in European countries regarding these statements.[43,44] Only 28 Swiss pharmacists participated in the baseline survey,[45] however, and in the follow-up survey assessing the implementation status of the statements on clinical pharmacy, only 17 pharmacists from Switzerland provided answers. No information was provided on the language regions of the hospitals in which participating pharmacists were employed;[43] therefore, the results may not give a representative image of the implementation status of clinical pharmacy services in Switzerland. A regular assessment of pharmacists' advancements in the hospital setting is also seen in the United States of America, where the development is assessed by surveys of the American Society of Health-System Pharmacists (ASHP). The ASHP divides the pharmacist's tasks into six topics: prescribing, transcribing, dispensing, administration, monitoring, and patient education. Every year a survey is sent out covering two of these sections, so that together the most recent three reports published give an overview over all six sections.[46-48] In Switzerland, pharmacists' resources in the hospital setting and the implementation status of clinical pharmacy services was described in a survey conducted in 2013. The report demonstrated differences in the extent of the implementation of clinical pharmacy services according to the three language regions in Switzerland;[49] however, little is known about the development thereafter.

Pharmaceutical interventions

The activities pharmacists undertake when providing pharmaceutical care or clinical pharmacy are often referred to as pharmaceutical interventions. With their pharmaceutical interventions often including recommendations to physicians, clinical pharmacists use not only their in-depth knowledge on therapeutics, but also their clinical experience and expert judgment to provide scientifically valid information on the therapeutic use of medicines.[38] They can thereby detect manifest DRPs, as well as help to avoid potential ones.[28,29,50]

Different pharmaceutical interventions have been studied, for instance medication reconciliation, medication reviews, patient education, and interprofessional ward rounds; they will be further described below. Interventions can be delivered as a single intervention or as bundles of interventions, combining multiple activities.[51] They can also be delivered at different stages of transition of care (e.g., at admission, at discharge) or be aimed at continuity of care.[52] Interventions to support patients at discharge can be grouped into pre- and post-discharge interventions and interventions bridging the transition (Table 1).[51] Interventions that were described as probable to be effective in supporting older patients at transitions of care included medication reconciliation and telephone follow-up activities, as well as interventions aimed at improving patients' self-management.[53]

Table 1 Taxonomy for discharge interventions adapted from Hansen et al.[51]

Pre-discharge	Post-discharge	Bridging the transition
Patient education	Timely follow-up	Transition coach
Discharge planning	Timely PCP communication	Patient-centered discharge
Medication reconciliation	Follow-up telephone call	instructions
Appointment scheduled	Patient hotline	Provider continuity
before discharge	Home visit	

PCP = Primary care provider.

The following sections will focus on some interventions frequently implemented by pharmacists to improve patient safety; namely, medication reconciliation, medication review, patient education and interprofessional ward rounds.

Medication reconciliation is a pharmaceutical intervention commonly implemented at transitions of care; it is defined as:

"The process of creating the most accurate list possible of all medications a patient is taking and comparing that list against the prescriber's orders. In addition, the patient's allergies, history of side effects from medications and medication aids are listed with the goal of providing correct medication to the patient at all transition points within the health care system." Penm et al.[54]

At transitions of care, discrepancies between the current medication order and other medication information sources (e.g., general practitioner's medication history) can occur. Medication discrepancies include the omission of a patient's home medication, the commission of a medication that had previously been stopped or the incorrect documentation of the name/dose/dosage form/frequency of a medication. Although some changes are made intentionally, in accordance with a patient's current health status, other discrepancies are unintentional and potentially lead to patient harm.[55] In the scope of the High 5s Project, the WHO has provided a guide to aid the implementation of medication reconciliation at transitions of care.[2]

In order to obtain an accurate medication list, the best possible medication history (BPMH) should be attained. Taking a BPMH requires a systematic and structured approach and should rely on multiple sources, such as a structured patient or caregiver interview, a medication history from the general practitioner, community pharmacy, the patient's healthcare/hospital record, and the patient's own medication list or medication packages.[2] It should include not only prescribed and as-needed medication, but also over-the-counter medicines, vitamin and mineral supplements, herbal and homeopathic products.[56] It is recommended that pharmacists are involved in the process of obtaining a BPMH.[2] While ideally all patients should receive medication reconciliation at transitions of care, it has been proposed to prioritize certain patient groups (patients with renal impairment, transplant, >4 prescribed medicines, admission to intensive care units or low literacy) or patients receiving certain medicines.[54]

In daily practice, however, medication discrepancies still occur frequently, as studies in different countries highlighted. A study conducted in Italy asserted that 25.7% of the included patients had at least one discrepancy at transitions of care.[57] In France, 45.8% of patients receiving usual care (medication history taken by the physician) had at least one unintended medication discrepancy at hospital admission. Introducing pharmacist-led medication reconciliation lowered the percentage to 2.1% of patients with at least one unintended medication discrepancy.[55] A study from the United States of America detected 116 discrepancies among 81 patients (average of 1.43 discrepancies per patient).[58] A study from the southern part of Switzerland found a mean of 5.24 discrepancies per patient.[59] In all the aforementioned studies pharmacists were involved in medication reconciliation. The most frequent medication discrepancy in these studies was the omission of a patient's home medication with a rate ranging from 40.5%-79.2%.[55,57-59] Although all studies used a classification system to document the detected discrepancies that included a category "omission", it has to be noted that the studies did not use the same classification systems, which hinders a direct comparison of the studies.

Two of the aforementioned studies also evaluated the clinical relevance of the detected discrepancies, using different rating systems. The French study noted that 42% of unintended medication discrepancies would have needed monitoring or an intervention to prevent harm, 10% had potential harm, and 2% were judged to be potentially life-threatening.[55] In the Swiss study 19% were esteemed to be significant with the potential to cause a minor to moderate adverse drug event (e.g., moderate discomfort or clinical deterioration) and 2% were judged as serious (e.g., severe discomfort or clinical deterioration).[59] Although the benefits of medication reconciliation (e.g., reduction of medication discrepancies, hospital revisits due to adverse drug events) have been shown in systematic reviews,[50,60] a Cochrane review concluded that the impact is uncertain.[61]

Medication review is used to describe different activities. In order to harmonize the understanding of the scope of medication review, the following definition was agreed upon by experts in the field, mainly from European countries, and was approved by the PCNE general assembly in 2016[62]:

"Medication review is a structured evaluation of a patient's medicines with the aim of optimising medicines use and improving health outcomes. This entails detecting drug-related problems and recommending interventions." PCNE[62]

Based on the different sources of information at hand during the medication review, they can be classified into three types (Table 2).[62]

Table 2 Types of medication review based on information sources available, adapted from PCNE[62]

Type of medication review		Medication history	Patient interview	Clinical data
Type 1	simple	Yes	No	No
Type 2a	intermediate	Yes	Yes	No
Type 2b	intermediate	Yes	No	Yes
Type 3	advanced	Yes	Yes	Yes

Medication review has been shown to have a positive effect on drug-related outcomes (e.g., reduce DRPs)[63] and may decrease emergency department contacts after hospital discharge;[64] however, there is no evidence that medication review leads to a decrease in mortality or hospital (re)admissions.[63,64] Hospitalized patients receiving medication review by clinical pharmacists, showed proportions of 0.13 to 10.6 DRPs per patient.[65] In a systematic review, many studies showed high acceptance rates of recommendations made by pharmacists and a positive effect on the quality of prescriptions, patients' satisfaction and drug-related readmissions.[65]

Patient education in the hospital setting has been found to reduce the length of stay in transplant patients[66] and increase patients' knowledge about medication, improve adherence in older patients, and it also showed a trend toward a reduction in all-cause hospital readmission in older patients.[53,67] At hospital discharge, older patients were frequently counselled on medication dosages and medication indication, and paper-based medication lists were often handed to patients.[67] Furthermore, it is important to counsel patients on medication changes at hospital discharge, as patients do not always follow medication changes initiated after a hospitalization. Almost one quarter of changes that were made between the medication at admission and the discharge prescriptions were not followed by patients within 30 days.[8] This may be due to the fact that not all patients remember the medication changes made during hospitalization. A study found that only half of patients discharged from the hospital correctly recalled if and what medication changes were made.[68] In the community pharmacy setting, patient education led to improved patients' adherence and had a positive effect on clinical outcomes (e.g., blood pressure control, cholesterol management).[69] Overall, patient counselling by pharmacists leading to positive outcomes commonly included the following topics: indication of the medication, precautions (e.g., adverse drug reactions) and importance of medication use/adherence. Pharmacists also used written materials to support their patient counselling.[70,71] Pharmacists' recommendations regarding the medication of hospitalized patients has been shown to have positive effects on the clinical outcomes of patients in the intensive care unit, such as a reduction in mortality, length of stay and adverse drug events.[72] Clinical pharmacists' interventions on pediatric hospital inpatients were effective in reducing medication errors through interventions on e.g., inappropriate dosing, inappropriate drug selection.[73,74]

Ward rounds that include different healthcare professionals (e.g., a physician, a pharmacist and a nurse) are commonly referred to as **interprofessional ward rounds**. Pharmacists' interventions during ward rounds resulted in an improved prescribing quality with less inappropriate medication in geriatric patients.[75] Systematic reviews proclaimed that clinical pharmacists' interventions within the hospital setting lead to cost savings; however, many studies did not include the costs of the service provided in the cost analysis, and full economic evaluation would be needed to support this conjecture.[76,77]

Comprehensive involvement of pharmacists throughout patients' hospital stays, combining different interventions, has been shown to improve patient outcomes.[78-80] There are two studies with similar interventions. Both included pharmacist-led medication reconciliation at admission and discharge, patient education at discharge and follow-up telephone calls after discharge, one additionally included interprofessional ward round,[79] and both showed improved patient outcomes.[79,81] They pointed out that the multicomponent pharmacist interventions lowered hospital readmissions by 27% at 30 days after discharge[79] and reduced DRPs post-discharge.[81] A multifaceted intervention provided by clinical pharmacists decreased hospital readmissions at 30 days and at 180 days. The intervention included medication review, patient education and follow-up in primary care.[78] Furthermore, reduction in the combined outcome of hospital readmissions or emergency department visits within 30 days of discharge was observed in patients receiving a pharmacist-led intervention combining medication reconciliation, provision of patient-specific pharmaceutical care plans, patient counseling at discharge, and follow-up telephone calls.[80] Notably, all of the aforementioned studies incorporated some sort of post-discharge follow-up.

To summarize, pharmacists contributed to an improvement of patient safety. Pharmaceutical care and clinical pharmacy are two approaches to achieve this improvement, often through the described pharmaceutical interventions; however, it remains unclear which approaches pharmacists take to support patients at hospital discharge in Switzerland, to facilitate a seamless transition.

Guidelines

With the variety of interventions that can be implemented to support patients at transitions of care, healthcare professionals may find themselves facing the decision of where to allocate the often limited resources; therefore, clinical practice guidelines can offer support in regard to the care of patients. One example is the Joint FIP/WHO guideline on good pharmacy practice, which includes recommendations on medication therapy management.[82] In situations where patients are at risk of harm, such as transitions of care, they can help to improve care processes and aim to reduce potential risks. Regarding the transition at hospital discharge, guidelines recommend, among other things, that healthcare professionals should educate patients[9,83] and plan their discharge in advance.[9,83] Patients are also recommended to

receive a medication review when they have a change in their medication,[83,84] which is often the case after hospital discharge.[8]

In Switzerland, no official guidelines exist to describe the optimal process of hospital discharge; however, medication safety is receiving increasing attention in Swiss healthcare system and the pharmacist's contribution (e.g., interprofessional ward rounds, systematic medication reconciliation at admission) to improve the safe use of medicines is starting to be recognized.[85,86] In a national report on quality and safety in Swiss healthcare, the GSASA emphasized the importance of incorporating standardized processes and the collaboration of different healthcare professionals. The report endorses a body for medication safety on a national level (engaging different stakeholders and institutions), the use of digitalized solutions for the medication use process (e.g., clinical information system, computerized provider order entry) and suggests that for further improvement, a binding national medication safety strategy should be formulated.[87] Furthermore, the Swiss Patient Safety Foundation encourages hospitals to incorporate medication reconciliation in their standard processes; medication reconciliation at admission has been successfully piloted in eight Swiss hospitals.[88]

This lack of guidelines for medication management at hospital discharge in Switzerland, leaves Swiss healthcare professionals with only sparse support for improving their discharge process. For the improvement of processes in general, literature provides different approaches that can be applied to the healthcare setting, two of these approaches are lean management and Crew Resource Management (CRM).[89,90] The lean management approach was first described in the Toyota Production System, in which non-value-adding "wastes" were removed from the manufacturing time line.[89] The seven non-value-adding "wastes" described in the Toyota Production System were proposed as follows: "defects", "unnecessary motion", "overproduction", "transport of products / materials", "unnecessary waiting", "unnecessary inventory", and "inappropriate processing".[89,91] An approach increasingly applied in healthcare to improve patient safety, is the introduction of CRM trainings.[92] The CRM training has its origins in aviation, where research of air crashes showed that a substantial part could be traced back to human error. The factor of human error has also been recognized in healthcare several years ago, a milestone in this regard was the publication of "To err is human" in 2000.[93] For the development and implementation of interventions different frameworks were developed, one was proposed by the Medical Research Council to develop and evaluate complex interventions consists of four elements: (1) development, (2) feasibility and piloting, (3) evaluation, and (4) implementation.[94]

Rationale

On one hand, the presented literature shows that several issues can arise at transitions of care that can compromise patient safety. On the other hand, it also presents a variety of interventions that can be implemented with the aim of preventing these issues from arising or resolving existing issues, thus restoring patient safety. Against this background, multiple research questions manifest themselves. The rationale for this thesis was to close some of these research gaps in regard to the pharmacist's role in patient care at transitions of care in Switzerland and contribute to the improvement thereof.

Transitions of care imply vulnerabilities for patients, during which they are at risk of DRPs. The involvement of pharmacists has been shown to reduce DRPs and positively impact patient outcomes. As previously mentioned, hospital pharmacists' activities are regularly surveyed in the United States of America and in Europe.[42,47] In Switzerland, pharmacists' activities are not regularly surveyed on a national level. The first national survey mapping clinical pharmacy services was conducted in 2013. As the implementation of these services is not static, a regular repetition of the survey would enable observation over time and may help develop strategies to further improve medication safety.

As pointed out, there are no national guidelines on how to best support patients during the hospital discharge process in Switzerland. An overview of existing guidelines from other countries in comparison with local implementation might help reassure Swiss healthcare professionals to incorporate some of the recommended interventions in their discharge process, if they are not already applied. It remains unclear how pharmacists are involved at hospital discharge in Switzerland. Traditionally, patients discharged from Swiss hospitals do not have contact to the hospital pharmacy. They fill the discharge prescription in the community pharmacy of their choice. As with other clinical pharmacy services, mapping the pharmacist's involvement in activities to support patients' medication management at hospital discharge might help to shape processes and encourage hospital pharmacists to expand their activities at hospital discharge.

In order to improve medication management at hospital discharge, a comprehensive involvement of pharmacists throughout the whole hospital stay might be beneficial. To assess pharmacists' contribution to detection and reduction of DRPs at hospital discharge, an evaluation of a model where pharmacists are involved in patient care on a daily basis at different stages (admission, during hospital stay, discharge) might give an insight into how best to appoint pharmacists' resources.

Goal and aims

The goal of this thesis was to provide the basis for designing an improved process in supporting patients in their medication management at hospital discharge. The following aims were set to achieve this goal:

- To give an overview of the implementation status of clinical pharmacy in Switzerland and its development in recent years
- To depict the involvement of pharmacists in medication management at hospital discharge in Switzerland and to compare it to international guidelines
- To provide a pragmatic overview of guidelines for medication review in the hospital setting
- To describe the pattern of DRPs at hospital discharge
- To assess the effect of pharmacist-led medication reconciliation at hospital admission and interprofessional ward rounds including a pharmacist during the hospital stay on DRPs at hospital discharge

THESIS OVERVIEW

Project	Description
Part A Discharge management and the role of pharmacists	
Clinical Pharmacy Activities in Swiss Hospitals: How Have They Evolved from 2013 to 2017? *Published in Pharmacy 2020; 8: 19*	In 2013 a first description of the status of clinical pharmacy was conducted in Swiss hospitals. Clinical pharmacy services are constantly evolving and adapting to the needs and resources of patients and healthcare professionals. We therefore conducted a national survey to depict the current status of clinical pharmacy and the development thereof since the last survey.
Pharmaceutical discharge management: international guidelines and local implementation in Swiss hospitals *Published in Pharmacy 2021; 9: 33*	In order to give an overview of the support for patients in regard to the medication management at hospital discharge, we conducted a national survey with a focus on pharmacists' involvement in these processes. The findings were compared to international guidelines. To give a more detailed insight into a variety of pharmacist-led models implemented, we selected hospitals for in-depth face-to-face interviews.
Synopsis of national and international recommendations for medication review at hospital discharge *Draft of a short report*	In this summary of guidelines for medication reviews in the hospital setting, we compiled the different elements recommended to be part of such a medication review.
Part B Pharmacists' impact on drug-related problems at hospital discharge	
Pattern of drug-related problems at hospital discharge in Switzerland *Working report*	This short report gives an overview of the patterns of DRPs occurring on discharge prescription of two different Swiss hospitals with a focus on drug–drug interactions.
The impact of pharmacist-led medication reconciliation and interprofessional ward rounds on drug-related problems at hospital discharge *Submitted at BMJ Quality and Safety*	In this retrospective data analysis, we assessed the impact of a pharmacist-led medication reconciliation at hospital admission and/or an interprofessional ward round on the frequency of DRPs at hospital discharge.

PROJECTS

Part A Discharge management and the role of pharmacists

Clinical pharmacy services are constantly evolving and adapting to the needs and resources of patients and healthcare professionals. In 2013 a first description of the status of clinical pharmacy was conducted in Swiss hospitals; however, little is known of its development thereafter. Therefore, we first aimed to map the current status of clinical pharmacists' activities in Swiss hospitals by conducting a national survey (Project A1). We then described different activities to support patients at hospital discharge based on the answers provided in the survey and compared them to international guidelines. We depicted pharmacists' involvement in the activities to support patients at discharge and described in detail some of the pharmacist-led interventions (Project A2). Finally, we compiled an overview of recommendations for medication reviews based on international guidelines (Project A3).

A1 Clinical Pharmacy Activities in Swiss Hospitals: How Have They Evolved from 2013 to 2017?

In 2013, a national survey was conducted describing the implementation status of clinical pharmacy in Swiss hospitals. It found considerable differences according to the language regions, with the French- and the Italian-speaking parts showing much higher percentages of overall hospital fulltime equivalents appointed clinical pharmacy services compared to the German-speaking part. The aim of this project was to give an overview of the current implementation status of clinical pharmacy in Swiss hospitals and to compare the findings to those of the survey conducted in 2013, in order to describe developments in the intervening years. The German and the French version of the survey can be found in Appendix I and II, respectively.

Clinical Pharmacy Activities in Swiss Hospitals: How Have They Evolved from 2013 to 2017?

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Article

Clinical Pharmacy Activities in Swiss Hospitals: How Have They Evolved from 2013 to 2017?

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Abstract: The role of pharmacists is changing; in many countries, pharmacists have acquired new competencies. A survey conducted in 2013 mapped the clinical pharmacy services in Swiss hospitals by quantifying full-time equivalents (FTE) and depicting clinical pharmacy activities. The aim of this survey was to update these results and analyze the development in Swiss hospitals. An online questionnaire was sent to chief hospital pharmacists (n = 60). The questionnaire was developed based on the previous survey and on a literature search. The survey took place from June to September 2017. In the survey, 44 hospital pharmacies participated (return rate 73%). They counted 265.8 FTE for pharmacists; 31 offered clinical pharmacy services. Hospitals participating in both surveys (n = 32) showed a significant increase in FTE for hospital (+24.5%) and clinical (+62.7%) pharmacists. The number of training positions available for the certificate of proficiency in "clinical pharmacy" has increased by 5.5. Patient-related services are less commonly implemented in comparison to treatment and process-related services. In conclusion, the increase in FTE of clinical pharmacists was more pronounced than of hospital pharmacists in general. For further development and broader implementation of clinical pharmacy services, however, hospital pharmacies should increase the number of training positions and should direct more activities towards patient-related services.

Keywords: clinical pharmacy; hospital pharmacy services; human resource management; patient-related activities; survey; Switzerland

1. Introduction

The role of pharmacists has constantly changed in recent years; pharmacists have acquired new competences and taken on new responsibilities. The extent of these changes varies largely across Europe and worldwide. The World Health Organization (WHO), jointly with the International Pharmacy Federation (FIP), defined the roles for the pharmacist in the health care system [1]. The FIP itself issued consensus statements on the role and activities of hospital pharmacists [2].

Based on these statements, the European Association of Hospital Pharmacists (EAHP) worked out goals for hospital pharmacists and the services they provide. In 2014, these goals were expressed in the EAHP statements of hospital pharmacists and reflected the future towards which hospital pharmacies should proceed [3]. The EAHP statements are grouped into six sections, of which section 4 is dedicated to clinical pharmacy services (the statements on clinical pharmacy services are listed in Table 1) [4]. The degree of statement implementation is monitored on a regular basis by online surveys across Europe [3].

Table 1. European Association of Hospital Pharmacists (EAHP) statements section 4: clinical pharmacy services [4].

EAHP Statements on Clinical Pharmacy Services
4.1 Hospital pharmacists should be involved in all patient care settings to prospectively influence collaborative, multidisciplinary therapeutic decision-making; they should play a full part in decision making, including advising, implementing and monitoring medication changes in full partnership with patients, carers and other health care professionals.
4.2 All prescriptions should be reviewed and validated as soon as possible by a hospital pharmacist. Whenever the clinical situation allows, this review should take place prior to the supply and administration of medicines.
4.3 Hospital pharmacists should have access to the patients' health record. Their clinical interventions should be documented in the patients' health record and analysed to inform quality improvement interventions.
4.4 All the medicines used by patients should be entered on the patient's medical record and reconciled by the hospital pharmacist on admission. Hospital pharmacists should assess the appropriateness of all patients' medicines, including herbal and dietary supplements.
4.5 Hospital pharmacists should promote seamless care by contributing to the transfer of information about medicines whenever patients move between and within healthcare settings.
4.6 Hospital pharmacists, as an integral part of all patient care teams, should ensure that patients and carers are offered information about their clinical management options, and especially about the use of their medicines, in terms they can understand.
4.7 Hospital pharmacists should inform, educate and advise patients, carers and other health care professionals when medicines are used outside of their marketing authorisation.
4.8 Clinical pharmacy services should continuously evolve to optimise patients' outcomes.

The definition of clinical pharmacy by the Swiss Society of Public Health Administration and Hospital Pharmacists (GSASA) is as follows: "Clinical pharmacy is an area of pharmacy aimed at developing and promoting an appropriate, safe and cost-effective use of therapeutic products. In the hospital setting, clinical pharmacy includes direct patient oriented pharmaceutical activities, implemented on patient care wards in collaboration with other health care professionals" [5]. GSASA divided the tasks into three domains: patient-oriented, therapy-oriented, and process-oriented activities [5]. In Switzerland, the health care system is organized on a regional level, including the provision of hospital facilities, advanced medicine services, and administration of professional licenses. In order to become a registered pharmacist, a Master's degree in Pharmacy and a federal diploma are needed. Nationally accredited postgraduate degrees are available, but they are not mandatory for hospital pharmacists. The basic tasks of hospital pharmacists consist, amongst others, of the provision of medicines, the manufacture of medicines in small quantities and medicines-related information services. However, there are no legal obligations for a hospital to employ a pharmacist and there are no mandatory requirements for the provision of clinical pharmacy services. In Switzerland, medication safety is becoming more important and is the object of growing awareness [6]. The Federal Office of Public Health is recognizing that there is room for improvement in patient safety [7]. In this respect, the monitoring of activities that contribute to improved medication safety may be helpful for developing and planning future strategies. A first mapping of clinical pharmacy services in Switzerland was conducted in 2013 [8].

The aim of this study was, therefore, to give an update on the current state of clinical pharmacy in Swiss hospitals affiliated with GSASA, and to depict the development since the survey began in 2013.

2. Materials and Methods

2.1. Survey

The online survey contained two parts. The first part, with questions based on the survey conducted in 2013 [8], focused on the development of clinical pharmacy services and on the topics

addressed in the EAHP statements [4]. The definition of clinical pharmacy practice by the Swiss Society of Public Health Administration and Hospital Pharmacists (GSASA) was used for the online survey [5]. The first part contained 61 questions. Of these, 35 questions were identical to the previous survey, ten had minor changes in the wording, and twelve questions were new (mainly about activities related to the EAHP statements). In order to evaluate how frequently the activities related to the EAHP statements were conducted, a different scale was used than in the EAHP survey. The second part of the survey focused on hospital discharge and implemented models to support patients in their medication management in this process. Only the results of the first part—the development of clinical pharmacy services and implementation of activities according to the EAHP statement topics—are presented here. The survey was developed in German and then translated to French. Three German-speaking and one French-speaking practicing clinical pharmacist participated in a pilot to test the understandability of the questions. After the pilot, only minor changes to the wording were undertaken.

In Switzerland there were 281 hospitals in 2017; for our survey, we addressed all chief hospital pharmacists registered at the GSASA (n = 60). They received an email with a link to the online questionnaire platform (FlexiForm 2 Version 2.7.1g, University of Basel, Switzerland), asking them to participate themselves or forward the link to the person in their hospital most suited to answer the questionnaire. We limited the survey to these hospitals because we assumed that it is unlikely a hospital without a chief hospital pharmacist affiliated with the GSASA or no pharmacist at all offers any structured clinical pharmacy services. The German version of the online survey was open from June 02, to July 09, 2017; the French version from July 24, to September 03, 2017. In case of no response after two weeks, two reminder emails were sent.

2.2. Data Analysis

The data were exported from FlexiForm 2 to a Microsoft Office 2016 Excel file; the statistical analysis was conducted using IBM SPSS Statistics 24 and Microsoft Office 2016 Excel.

We analyzed full-time equivalents (FTEs) of pharmacists' activities, expressed as the sum of FTEs of all employed pharmacists ($FTE_{TotPharm}$). Separately, we analyzed the FTEs directed towards clinical pharmacy activities ($FTE_{ClinPharm}$). Subgroup analyses of the FTEs were conducted for the different hospital types and language regions in Switzerland (German, French and Italian). The degree of implementation was depicted for the spectrum of clinical pharmacy services, as well as the implementation of activities based on the EAHP statements. A direct comparison of the results of hospitals that participated in both surveys, in 2013 [8] and 2017, was drawn using a Mann–Whitney test. Statistical significance was accepted at $p < 0.05$.

3. Results

In total, 44 hospital pharmacies took part in the survey (return rate 73.3%). The participating hospitals consisted of all five university hospitals, 18 cantonal or regional hospitals, 11 private hospitals or specialized clinics, and 10 were organized in networks. The median of the beds supplied by the hospital pharmacies was 340 beds (interquartile range (IQR) 738, minimum 82, maximum 2000). Of the 44 hospitals, 32 had participated in the previous survey in 2013.

In total, 14 hospitals offered 18 training positions to obtain the nationally accredited postgraduate degree "hospital pharmacist"; in 2013, 17 hospitals offered 19 positions. For the certificate of proficiency in "clinical pharmacy", 10 hospitals offered 18.5 positions. In 2013, nine hospitals offered 13 positions.

3.1. Extent of Clinical Pharmacy Activities and Human Resources

The 44 hospitals had 265.8 $FTE_{TotPharm}$ for their employed pharmacists; on average, this equals 6.0 $FTE_{TotPharm}$ (standard deviation (SD) = 5.7, minimum 0.2, maximum 22.6). There is an average of 1.12 $FTE_{TotPharm}$ per 100 beds (SD 1.04, min. 0.09, max. 6.71). Of the 44 hospitals, 31 (70%) offered clinical pharmacy activities. Of the 13 (29.5%) hospitals that did not already offer clinical pharmacy services, four hospitals (9.1%) had plans to establish such services; the hospitals are characterized in

Table 2. The results of the sub analysis of the FTEs according to hospital type and language region are shown in Table 3.

Table 2. Characteristics of hospitals that offered clinical pharmacy, plan to offer and do not plan to offer clinical pharmacy services (n = 44).

Hospitals	$FTE_{TotPharm}$ *	Median Number of Beds (IQR) **	Frequency by Hospital Type	
Offering clinical pharmacy services (n = 31)	230.1	460.0 (950)	University hospital Cantonal or regional hospital Private hospital or specialized clinic Networks	5 10 7 9
Planning to offer clinical pharmacy services (n = 4)	18.7	370.0 (275.0)	University hospital Cantonal or regional hospital Private hospital or specialized clinic Networks	0 3 1 0
Not offering clinical pharmacy services (n = 9)	17.0	180.0 (138.5)	University hospital Cantonal or regional hospital Private hospital or specialized clinic Networks	0 5 3 1

* $FTE_{TotPharm}$ = full-time equivalents of all employed pharmacists. ** IQR = inter quartile range.

Table 3. Full-time equivalents of all pharmacists and clinical pharmacists of the participating hospitals (n = 44) according to hospital type and language region.

All Participating Hospitals 2017, n = 44				
	$FTE_{TotPharm}$ *	Average $FTE_{TotPharm}$ per 100 beds	$FTE_{ClinPharm}$ **	% $FTE_{ClinPharm}$ of $FTE_{TotPharm}$
Total	**265.8 (n = 44)**	**1.12**	**54.1 (n = 28, $n_{missing}$ = 3)**	**20.4 %**
University hospital	81.3 (n = 5)	1.02	19.6 (n = 5)	24.1
Cantonal or regional hospital	66.2 (n = 18)	0.97	7.6 (n = 10)	11.5
Private hospital or specialized clinic	27.4 (n = 11)	1.53	2.4 (n = 4, $n_{missing}$ = 3)	8.8
Networks	91.1 (n = 10)	0.99	24.5 (n = 9)	26.9
German-speaking	169.5 (n = 35)	1.12	31.9 (n = 20, $n_{missing}$ = 2)	18.8 %
French or Italian-speaking	96.3 (n = 9)	1.12	22.2 (n = 8, $n_{missing}$ = 1)	23.1 %

* $FTE_{TotPharm}$ = full-time equivalents of all employed pharmacists. ** $FTE_{ClinPharm}$ = full-time equivalents directed towards clinical pharmacy services.

The sub analysis of hospitals that participated in both surveys, 2013 and 2017 (n = 32), shows a significant increase in both $FTE_{TotPharm}$ and $FTE_{ClinPharm}$ (Table 4). Figure 1 depicts the number of hospitals that offered clinical pharmacy services, the number that planned to offer and the number that did not offer in 2017, as well as the numbers for 2013 and the change between the two surveys. In 2013, 25 hospitals offered clinical pharmacy services. Of these 25 hospitals, 23 still offered these services in 2017. Of the five hospitals that had planned to offer clinical pharmacy services in 2013, three implemented the services in 2017.

Table 4. Comparison of the full-time equivalents of all pharmacists and clinical pharmacists of participating hospitals 2013 vs. 2017 (n = 32) with sub-analysis according to hospital type and language region.

	2013 (n)	2017 (n)	Difference (%)	*p* Value †
Hospitals that participated in both surveys 2013 and 2017, n = 32				
$FTE_{TotPharm}$ *	196.4 (n = 32)	244.6 (n = 32)	+48.2 (+24.5%)	<0.01
University hospital	80.0 (n = 5)	81.3 (n = 5)	+1.3 (+1.6%)	0.50
Cantonal or regional hospital	44.1 (n = 12)	58.4 (n = 12)	+14.3 (+32.4)	0.02
Private hospital or specialized clinic	13.5 (n = 7)	18.5 (n = 7)	+5.0 (+37.0)	0.09
Networks	58.8 (n = 8)	86.6 (n = 8)	+27.8 (+47.3)	0.01
German-speaking	121.7 (n = 23)	148.3 (n = 23)	+26.6 (+21.9%)	<0.01
French or Italian-speaking	74.7 (n = 9)	96.30 (n = 9)	+21.6 (+28.9%)	0.01
$FTE_{ClinPharm}$ **	**31.1 (n = 32)**	**50.6 (n = 29 $n_{missing}$ = 3)**	**+19.5 (+62.7%)**	**0.01**
University hospital	11.4 (n = 5)	19.6 (n = 5)	+8.2 (+71.9%)	0.14
Cantonal or regional hospital	5.5 (n = 12)	7.6 (n = 12)	+2.1 (+38.2)	0.62
Private hospital or specialized clinic	1.2 (n = 7)	2.2 (n = 4, $n_{missing}$ = 3)	+ 1.0 (+83.3)	0.65
Networks	13.0 (n = 8)	21.2 (n = 8)	+ 8.2 (+63.1)	0.09
German-speaking	13.4 (n = 23)	28.4 (n = 21, $n_{missing}$ = 2)	+15.0 (+111.9%)	0.06
French or Italian-speaking	17.7 (n = 9)	22.2 (n = 8, $n_{missing}$ = 1)	+4.5 (25.4%)	0.09
Hospitals that offered clinical pharmacy services in both surveys 2013 and 2017, n = 23				
$FTE_{TotPharm}$	171.8 (n = 23)	208.5 (n = 23)	+36.7 (+21.4%)	<0.01
$FTE_{ClinPharm}$	30.6 (n = 23)	45.6 (n = 22, $n_{missing}$ = 1)	+15.0 (+49.0%)	0.03
% $FTE_{ClinPharm}$ of $FTE_{TotPharm}$	17.8%	21.9%		

* $FTE_{TotPharm}$ = full-time equivalents of all employed pharmacists. ** $FTE_{ClinPharm}$ = full-time equivalents directed towards clinical pharmacy services. † *p*-value using Mann–Whitney test).

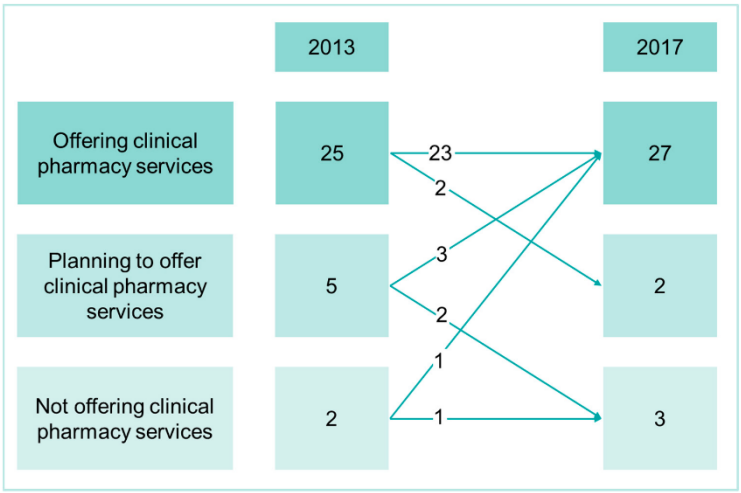

Figure 1. Number of hospitals that offered clinical pharmacy services, the number that planned to offer and the number that did not offer in 2017, as well as the numbers for 2013 (n = 32). The arrows illustrate the change between the two surveys.

3.2. *Time and Organization of Patient-Oriented Activities*

Of the 31 hospitals offering clinical pharmacy services, four (12.9%) were organized with >50% of the pharmacists' worktime on the ward, 24 (77.4%) with <50%, and in three (9.7%) the pharmacists had no activities on the ward.

In five hospitals (16.1%), interprofessional ward rounds at the patient's bedside were conducted daily, in 17 hospitals (54.8%) rounds were conducted on a weekly basis, in four hospitals (12.9%) less than weekly, and five hospitals (16.1%) reported no interprofessional ward rounds at the patient's bedside.

The frequencies of the patient-related, treatment-related, and process-related services are displayed in Figure 2.

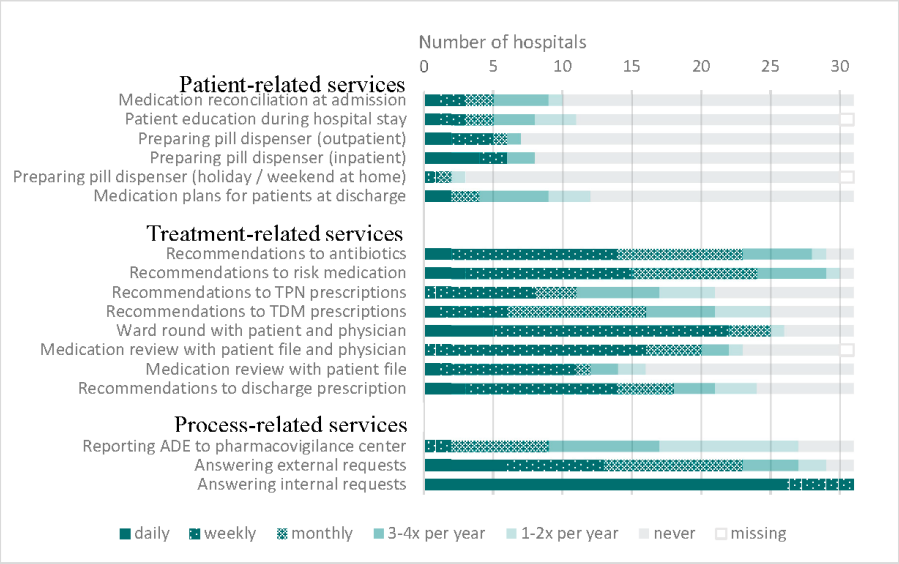

Figure 2. Patient-related, treatment-related and process-related activities in Swiss hospitals offering clinical pharmacy services (n = 31). ADE = adverse drug events, TDM = therapeutic drug monitoring, TPN = total parenteral nutrition.

3.3. *Implementation of Activities Related to the EAHP Statements in Clinical Pharmacy*

All 31 hospitals with clinical pharmacy activities reported on the frequency of the activities related to the EAHP statements (see Figure 3).

Of these 31 hospitals, 25 (80.6%) reported that pharmacists have full access to the hospital patient's medical records (24 have a full electronic health record, one has a mix of electronic and paper records); in four (12.9%) hospitals they have partial access.

Of the 31 hospitals, 28 (90.3%) pharmacies documented their pharmaceutical interventions. Of these, 10 (32.3%) documented them in more than one way (e.g., the patient's medical records and a separate classification system). Nineteen (61.3%) used the nationally recommended classification system for DRPs and interventions (the GSASA classification system [9]); nine (29.0%) documented their interventions in the patient medical records and 10 (32.3%) in different ways (e.g., a self-developed documentation system used only in their hospital). The documented interventions are analyzed for quality improvement in 16 (51.6%) hospitals.

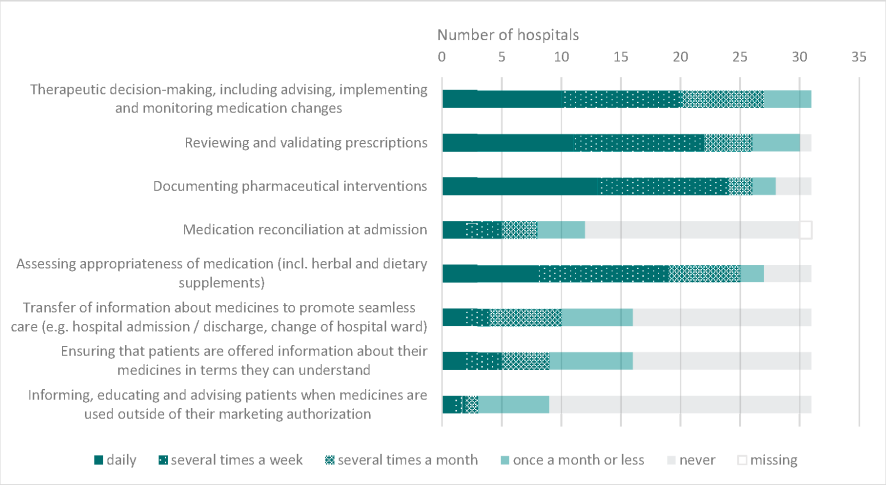

Figure 3. Activities related to the EAHP Statements in Swiss hospitals offering clinical pharmacy services (n = 31).

4. Discussion

The participating hospitals in 2017 were similar to the ones in the survey 2013: in fact, 32 of the 44 hospitals had already participated in the previous survey; this allows a comparison between the two surveys.

4.1. Development of Clinical Pharmacy in Swiss Hospitals

The $FTE_{TotPharm}$ and the $FTE_{ClinPharm}$ of hospitals that participated in both surveys (2013 and 2017) both significantly increased. The percentage increase was more pronounced for the $FTE_{ClinPharm}$ than for the $FTE_{TotPharm}$ (+62.7% vs. +24.5%, respectively), which indicates that decision-makers in these hospitals see clinical pharmacy services as an important aspect of pharmaceutical activities and worth expanding. An increase was seen in the different hospital types and language regions. Despite this considerable increase in $FTE_{ClinPharm}$, overall there was no increase in the number of pharmacists that spent >50% of their worktime on the ward.

The number of training positions for the three-year postgraduate degree "hospital pharmacy" did not change much since 2013. While the number of hospitals offering training positions decreased, the number of hospitals offering the shorter postgraduate certificate "clinical pharmacy" remained similar. However, as a positive development, the number of training positions in clinical pharmacy increased and this should result in an increase in the number of according certificates in the near future. In order to maintain or expand high-quality pharmaceutical services in Swiss hospitals, it is important that pharmacists have the possibility of postgraduate training. Therefore, the development of training positions, especially in clinical pharmacy, is needed.

Implementation of clinical pharmacy services is difficult, especially for smaller hospitals with few FTEs for pharmacists. The fact that there is no legal requirement for hospitals to offer such services or even employ a pharmacist in the hospital poses a great barrier to the implementation and development of clinical pharmacy services. Therefore, the benefit of clinical pharmacy has to be demonstrated to the hospital management to convince them to invest resources in these services [10,11]. One approach could be for hospitals to organize themselves in networks. The sub analysis by hospital type showed that hospitals organized in networks seem to have more resources available for clinical pharmacy services.

The subgroup analysis of hospitals that indicated that they offer clinical pharmacy services in both surveys, showed a significant increase in $FTE_{ClinPharm}$. In comparison to this, the number of hospitals offering clinical pharmacy services did not change markedly. This suggests that the development of clinical pharmacy services took place within hospitals that already offered such services, rather than in hospitals that did not previously offer these services.

In the questionnaire, the routine activities were grouped in three service groups: patient-related, treatment-related and process-related. As in the 2013 survey, treatment-related and process-related services were more established in 2017 than patient-related services. The latter are still sparsely implemented. Nevertheless, some developments in patient-related services are visible, such as the fact that pharmacists preparing pill dispensers for inpatients and outpatients increased, as well as pharmacists preparing medication plans for patients at discharge. A slight increase in treatment-related activities was seen in particular regarding ward rounds with the physician. The increase in patient-related and treatment-related services may be a result of the increase in clinical pharmacy activities in general. However, based on the extensive increase in $FTE_{ClinPharm}$, a more pronounced extension in patient-related and treatment-related services would have been expected.

Although the $FTE_{ClinPharm}$ has increased, there are still 13 (29.5%) hospitals that did not offer clinical pharmacy services. This could be due to a lack of resources, as the 13 hospitals are smaller hospitals.

4.2. Comparison to International Community

The average of six FTE in Swiss hospitals were comparable to European countries, where 76% of hospitals employ 1–10 pharmacists [12].

The spectrum of clinical pharmacy activities offered by Swiss hospitals is comparable to other European countries [13]. In German hospitals that offer clinical pharmacy services, 44 of 84 hospitals provide medication reconciliation at admission [14]. This trend is not seen for pharmacists in Swiss hospitals; fewer of them indicated that they were involved in this activity in 2017 than in 2013.

In Belgium, the Federal Public Service of Health advanced the implementation of clinical pharmacy services by financing a half- or full-time position for a clinical pharmacist in 58 hospitals. One of these hospitals reports that they are now involved in different clinical pharmacy activities such as medication reconciliation and medication review. In this Belgian hospital, medication reconciliation is performed by pharmacy technicians and is followed by a medication review by a clinical pharmacist. They also reported involvement in antibiotic stewardship on a daily basis [15]. Only in two Swiss hospitals did pharmacists make daily recommendations on antibiotics. Regarding the advance in implementing clinical pharmacy, financial support (e.g., from health insurance companies or other organizations interested in treatment quality and patient safety) could help, especially for smaller hospitals with limited resources.

4.3. Activities Related to EAHP Statements

Although the method of analyzing the state of implementation of the topics related to the EAHP statements was not identical to the survey conducted by the EAHP in 2016 [13], similar trends can be seen.

Swiss hospital pharmacists were notably less involved in the following four activities: "informing, educating and advising patients when medicines are used outside of their marketing authorization", "Medication reconciliation at admission", "transfer of information about medicines to promote seamless care" and "ensuring that patients are offered information about their medicines in terms they can understand". While the first three activities seemed to be more difficult for European hospital pharmacists to implement as well, the last activity mentioned seemed to be performed in half of European hospital pharmacies [13]. It can be argued that activities like the above-mentioned are more difficult to implement for pharmacists because they are traditionally conducted by physicians and nurses, whereas activities that are well acknowledged as pharmaceutical tasks, such as validation of prescriptions or assessing appropriateness of medication, are easier to implement. Hence, a change in

mentality is needed and the benefit of involving pharmacists in more activities that are not traditional pharmaceutical tasks should be recognized.

Only two Swiss hospitals are involved in medication reconciliation at admission on a daily basis; has did not increased since 2013. As mentioned above, in other European countries this activity is not widely implemented either. Pharmacist-led medication reconciliation at transition points have been shown to be beneficial in the reduction in medication discrepancies [16]. Resolving these discrepancies at admission is important, since up to half of the discrepancies found in the discharge letter can be related to inaccurate medication lists at admission [17]. Therefore, hospital pharmacists should make efforts to be more involved in obtaining the best possible medication history at admission. Involving pharmacy technicians in medication reconciliation, as is done in the Belgian hospital previously mentioned, may help to reduce the workload of clinical pharmacists and thereby facilitate the implementation of this activity.

The EAHP statement 4.3 states that pharmacists should have access to patients' health records [4]. For clinical pharmacy services, such as extensive medication review, clinical data is needed. Most Swiss hospitals providing clinical pharmacy services (80.6%) report having full access to the patients' health records in the hospital, and therefore comply with the above-mentioned statement. Fifty-nine percent of hospital pharmacists surveyed by EAHP gave a positive response to the question as to whether they had access to the patients' health record (positive response = a response of 3, 4 or 5 on a 5 point Likert scale; 1 = strongly disagree, 5 = strongly agree) [13].

Data collection is important for the visibility of activities. More than half of the pharmacists recognized this importance and pharmaceutical interventions were documented daily or several times a week. The EAHP suggested that interventions should be documented in the patients' health records; only nine (29.0%) hospitals reported doing so. Documenting interventions in the patients' health records should strongly be recommended. This way, changes are retraceable and visible to other health care professionals. Nineteen (61.3%) hospitals stated they use the GSASA classification system. Additionally, using a standardized system to classify pharmaceutical interventions is also important and allows a statistical analysis of the compiled data. European hospital pharmacists had less difficulties implementing these statements, with 56% giving a positive response to documenting their interventions in the patients' health record [13].

Half (51.6%) of the Swiss hospitals that document or classify pharmaceutical interventions use this for quality improvement analysis. Such analysis can be used, e.g., to develop new or improve existing services, and to demonstrate the resulting quality improvements.

4.4. Strengths and Limitations

One strength of our study was the high return rate, with 73% of the inquired-after chief hospital pharmacists participating. The participation rate was higher than in the survey conducted by the EAHP, where only 17 Swiss hospital pharmacists returned the questionnaire (return rate 28%) [13]. Contacting only chief hospital pharmacists ensured that we received only one response per hospital and therefore had no duplicates. Another strength was that, of the 44 participating hospital pharmacies, 32 already participated in 2013. It was therefore possible to directly compare the results to the previous survey.

Our study also had some limitations. Firstly, the responses to the survey are based on self-reporting, which allows room for reporting bias. Secondly, only the 60 chief hospital pharmacists registered at the GSASA were invited to participate in the survey; we therefore do not know if there was any clinical pharmacy activity in one of the other hospitals in Switzerland. However, as mentioned, we do not expect that a hospital without a chief hospital pharmacist affiliated with the GSASA, or no hospital pharmacist at all, is offering any structured clinical pharmacy services. Furthermore, we were able to record how often certain clinical pharmacy activities are conducted (e.g., daily or weekly ward rounds), but not how many patients were affected by these activities (e.g., on how many wards the ward rounds took place). We recommend that the survey be repeated regularly to track the development of clinical pharmacy in Swiss hospitals. To give a more detailed insight into the clinical pharmacists' impact

on medication quality and safety, the questionnaire should be amended to record more precisely the qualitative and quantitative aspects of how the FTEs are used.

5. Conclusions

In conclusion, the FTEs of hospital pharmacists in general and clinical pharmacy in particular increased in the last few years in Swiss hospitals. Contrary to these findings, there was no notable development in patient-related services, which shows that there is still room for improvement. The survey should be repeated regularly to follow up on the development. Nevertheless, the results presented should stimulate the further development of clinical pharmacy activities.

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References

1. World Health Organization. Joint FIP/WHO Guidelines on Good Pharmacy Practice: Standards for Quality of Pharmacy Services. Available online: https://apps.who.int/medicinedocs/documents/s18676en/s18676en.pdf (accessed on 20 January 2020).
2. International Pharmaceutical Federation. Revised FIP Basel Statements on the Future of Hospital Pharmacy. Available online: https://www.fip.org/files/content/pharmacy-practice/hospital-pharmacy/hospital-activities/basel-statements/fip-basel-statements-on-the-future-of-hospital-pharmacy-2015.pdf (accessed on 20 January 2020).
3. European Association of Hospital Pharmacists. European Statements of Hospital Pharmacy. Available online: https://statements.eahp.eu/ (accessed on 7 February 2020).
4. European Association of Hospital Pharmacists. The European Statements of Hospital Pharmacy. *Eur. J. Hosp. Pharm.* **2014**, *21*, 256–258. [CrossRef]
5. Schweizerischer Verein der Amts- und Spitalapotheker. Definition of Clinical Pharmacy in a Hospital Setting according to the GSASA. Available online: https://www.gsasa.ch/de/aktivitaeten/pharmazeutische-dienstleistungen/klinische-aktivitaeten/?oid=10135&lang=de (accessed on 1 November 2019).
6. Fishman, L.; Bruhwiler, L.; Schwappach, D. Medication safety in Switzerland: Where are we today? Medikationssicherheit: Wo steht die Schweiz? *Bundesgesundheitsblatt Gesundh. Gesundh.* **2018**, *61*, 1152–1158. [CrossRef] [PubMed]
7. Vincent, C.; Staines, A. Enhancing the Quality and Safety of Swiss Healthcare. Available online: https://www.bag.admin.ch/bag/en/home/versicherungen/krankenversicherung/krankenversicherung-qualitaetssicherung.html (accessed on 30 January 2020).
8. Messerli, M.; Maes, K.A.; Hersberger, K.E.; Lampert, M.L. Mapping clinical pharmacy practice in Swiss hospitals: A cross-sectional study. *Eur J Hosp Pharm* **2016**, *23*, 314–319. [CrossRef] [PubMed]
9. Maes, K.A.; Tremp, R.M.; GSASA Working Group on Clinical Pharmacy; Hersberger, K.E.; Lampert, M.L. Demonstrating the clinical pharmacist's activity: Validation of an intervention oriented classification system. *Int. J. Clin. Pharm.* **2015**, *37*, 1162–1171. [CrossRef] [PubMed]
10. Mekonnen, A.B.; McLachlan, A.J.; Brien, J.A. Effectiveness of pharmacist-led medication reconciliation programmes on clinical outcomes at hospital transitions: A systematic review and meta-analysis. *BMJ Open* **2016**, *6*, e010003. [CrossRef] [PubMed]
11. Gillespie, U.; Alassaad, A.; Henrohn, D.; Garmo, H.; Hammarlund-Udenaes, M.; Toss, H.; Kettis-Lindblad, A.; Melhus, H.; Morlin, C. A comprehensive pharmacist intervention to reduce morbidity in patients 80 years or older: A randomized controlled trial. *Arch. Int. Med.* **2009**, *169*, 894–900. [CrossRef] [PubMed]

12. Horak, P.; Underhill, J.; Batista, A.; Amann, S.; Gibbons, N. EAHP European Statements Survey 2017, focusing on sections 2 (Selection, Procurement and Distribution), 5 (Patient Safety and Quality Assurance) and 6 (Education and Research). *Eur. J. Hosp. Pharm.* **2018**, *25*, 237–244. [CrossRef] [PubMed]
13. Horák, P.; Gibbons, N.; Sýkora, J.; Batista, A.; Underhill, J. EAHP statements survey 2016: Sections 1, 3 and 4 of the European Statements of Hospital Pharmacy. *Eur. J. Hosp. Pharm.* **2017**, *24*, 258–265. [CrossRef] [PubMed]
14. Schulz, C.; Fischer, A.; Vogt, W.; Leichenberg, K.; Warnke, U.; Liekweg, A.; Georgi, U.; Langebrake, C.; Hoppe-Tichy, T.; Dörje, F.; et al. Clinical pharmacy services in Germany: A national survey. *Eur. J. Hosp. Pharm.* **2019**. [CrossRef]
15. Somers, A.; Claus, B.; Vandewoude, K.; Petrovic, M. Experience with the Implementation of Clinical Pharmacy Services and Processes in a University Hospital in Belgium. *Drugs Aging.* **2016**, *33*, 189–197. [CrossRef] [PubMed]
16. Mekonnen, A.B.; McLachlan, A.J.; Brien, J.A. Pharmacy-led medication reconciliation programmes at hospital transitions: A systematic review and meta-analysis. *J. Clin. Pharm. Ther.* **2016**, *41*, 128–144. [CrossRef] [PubMed]
17. Cornu, P.; Steurbaut, S.; Leysen, T.; De Baere, E.; Ligneel, C.; Mets, T.; Dupont, A.G. Effect of medication reconciliation at hospital admission on medication discrepancies during hospitalization and at discharge for geriatric patients. *Ann Pharm.* **2012**, *46*, 484–494. [CrossRef] [PubMed]

A2 Pharmaceutical discharge management: international guidelines and local implementation in Swiss hospitals

Pharmacists have been shown to have positive impacts on patient outcomes at hospital discharge; however, little is known about pharmacists' involvement during the discharge process in Swiss hospitals. This project aimed at depicting their involvement in the medication management at hospital discharge in Switzerland. We conducted a national online survey, as well as face-to-face interviews with selected hospitals (interview guide shown in Appendix III). As there are no national guidelines on the hospital discharge process, we compared the findings to international guidelines. In order to find already summarized evidence of interventions to support patients in their medication management at hospital discharge, we searched the Cochrane database for Cochrane reviews on the set of interventions that were described in this study (adapted from the taxonomy by Hansen et al.[51]). We also conducted a gray literature search to find guidelines containing recommendations on the interventions.

Pharmaceutical discharge management: international guidelines and local implementation in Swiss hospitals

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Pharmaceutical Discharge Management: Implementation in Swiss Hospitals Compared to International Guidelines

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Abstract: Readmissions to the hospital are frequent after hospital discharge. Pharmacist-led interventions have been shown to reduce readmissions. The objective of this study was to describe pharmacist-led interventions to support patients' medication management at hospital discharge in Switzerland and to compare them to international guidelines. We conducted a national online survey among chief hospital pharmacists focusing on medication management at hospital discharge. To put our findings in perspective, Cochrane reviews and guidelines were searched for summarised evidence and recommendations on interventions. Based on answers in the survey, hospitals with implemented models to support patients at discharge were selected for in-depth interviews. In semi-structured interviews, they were asked to describe pharmacists' involvement in the patients' pathway throughout the hospital stay. In Swiss hospitals ($n = 44$ survey participants), interventions to support patients at discharge were frequently implemented, mostly "patient education" ($n = 40$) and "communication to primary care provider" ($n = 34$). These interventions were commonly recommended in guidelines. Overall, pharmacists were rarely involved in the interventions on a regular basis. When pharmacists were involved, the services were provided by hospital pharmacies or collaborating community pharmacies. In conclusion, interventions recommended in guidelines were frequently implemented in Swiss hospitals, however pharmacists were rarely involved.

Keywords: medication management; hospital discharge; clinical pharmacy; pharmaceutical care; seamless care; hospital pharmacy services; patient-related activities; survey; Switzerland

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1. Introduction

After hospital discharge, patients are at risk for unplanned readmissions. In a large US study, including over 31 million index hospital admissions, the rate of unplanned readmissions was 11.6% [1]. A systematic review including 19 studies found that a median of 21% of readmissions are drug-related, of which a median of 69% were considered to be preventable [2]. Drug-related problems (DRPs) occur frequently after hospital discharge. Reported problems include non-adherence, inadequate dosing/duration/frequency/administration, and suboptimal drugs [3]. Medication errors occur in up to 50% of patients within 30 days of discharge [4].

Different attempts have been made to reduce hospital readmissions. It has been shown that pharmacists' interventions such as medication reconciliation or patient education can reduce hospital readmissions, adverse drug event-related hospital revisits, DRPs, and emergency room visits after discharge [5–7]. Topics of discharge medication counselling include discussing dose and dosage, providing paper-based medication lists, explaining the indication of medicines, and/or discussing adverse drug reactions [8,9]. Studies showed that medication counselling at hospital discharge was more effective where it was part of a set of different interventions (e.g., combined with medication review, medication reconciliation, or telephone follow-up) rather than as a single intervention [9]. According to a systematic review, interventions bridging transitions of care can reduce hospital

readmissions, these interventions include self-management education, telephone follow-up, and medication reconciliation [10]. Another systematic review found that complex interventions were associated with a reduction in relative risk of readmissions of 37%. This systematic review showed that interventions aimed at enhancing patient capacity for post-discharge care were effective in reducing the relative risk of readmission [11].

A survey conducted in Swiss hospital pharmacies found an average of 1.12 full-time equivalents of all employed pharmacists per 100 beds, of which 20% were allocated to clinical pharmacy services [12]. In Switzerland, a hospital pharmacy is an institution that is part of the hospital, managed by a registered pharmacist and offering pharmaceutical services to the hospital's patients; it is not publicly accessible [13]. Hospital pharmacists carry out the following activities: management of pharmaceutical products, compounding of medicines in small quantities, and patient-oriented pharmacy/clinical services [14]. For specialization, there is a postgraduate degree in hospital pharmacy and a postgraduate certificate of proficiency in clinical pharmacy. The latter enables pharmacists to conduct "direct patient oriented pharmaceutical activities, developed on patient care wards in collaboration with other healthcare professionals" [14,15]. However, little is known on how the above-mentioned resources in Swiss hospitals are used to support patients at discharge. In Switzerland, patients are normally discharged without contacting the hospital pharmacy and without medication to take home. Patients receive a discharge prescription that can be filled in a community pharmacy [16].

The aim of this study was to describe the frequencies of different interventions to support patients' medication management at discharge in Swiss hospitals. We also aimed to describe different pharmacist-led models that were implemented. As there are no official guidelines on this topic in Switzerland, we compared our findings to international guidelines.

2. Materials and Methods

2.1. Data Collection

We conducted an online survey among Swiss hospital pharmacies. The survey consisted of two parts. The first part described the development of clinical pharmacy services in Swiss hospitals and was published separately [12]. The second part focused on interventions to improve medication management at hospital discharge. To formulate questions regarding hospital discharge, literature was searched for existing discharge processes and models [17–22]. To verify the understandability of the questions, the survey was piloted with three German-speaking and one French-speaking practicing clinical pharmacists. The final version contained 73 questions. The interventions that were inquired by the questionnaire are summarized in Table 1. All chief hospital pharmacists registered at the Swiss Society of Public Health Administration and Hospital Pharmacists (GSASA) were asked by e-mail to participate (n = 60). The questionnaire was accessible from the beginning of June to the beginning of September 2017. Further details were published elsewhere [12].

Table 1. Interventions covered in the survey with a brief description; taxonomy adapted from Hansen et al. [17].

Intervention	Description
Patient education	Patient counselling on their medication (e.g., therapy duration/dosing) In-depth patient counselling on their medication (e.g., effect/benefit, therapy goal/side effects) Patient instructions (e.g., for inhalation devices/prefilled syringe) Patient counselling on red flags (symptoms that indicate a worsening of condition/medication intolerance) Patient counselling on medication prescribed before hospital admission

Table 1. *Cont.*

Intervention	Description
Discharge planning	Organization of medicines (e.g., contact with patients' community pharmacies/pill dispensers/reimbursement) Organization of rehabilitation/home care
Appointment scheduled before discharge	Assuring follow-up care (e.g., a follow-up appointment with the treating physician)
Timely follow-up	Follow-up care by a case manager
Communication to PCP	Medication changes are communicated to at least one healthcare professional (e.g., practitioner, community pharmacy) or institution (e.g., home care, nursing home)
Follow-up telephone call	Follow-up telephone call with discharged patients
Patient hotline	Hospital or hospital community pharmacy [1] offers a patient hotline for medication related questions

[1] A hospital community pharmacy is a community pharmacy with full access to the hospital's patient records. PCP = primary care provider.

To put the survey results in perspective, Cochrane reviews and international guidelines were searched for summarized evidence about the efficacy and recommendations of these interventions. We searched the Cochrane library for Cochrane reviews that evaluated interventions at hospital discharge or at transitions of care. The search string combined Medical Subject Headings (MeSH) with key search terms (see Appendix A). To find guidelines containing relevant recommendations usually published in grey literature sources, we conducted advanced Google searches using key search terms (see Appendix B). From these searches, we selected Cochrane reviews/guidelines from English-speaking countries that contained recommendations for healthcare professionals on medication management at the transition from hospital to home including every age group and excluding guidelines that were medical-condition-specific or specific to a single hospital. Two authors (FB, HS) independently screened the results of the Cochrane search and selected the relevant reviews based on the aforementioned criteria. Equally, the first 100 search results of the Google searches were screened by both authors and relevant guidelines were selected. Discrepancies were resolved by discussion. Evidence and relevant recommendations concerning the above-mentioned interventions were extracted from the selected full texts.

In order to depict in greater detail the different models implemented in Swiss hospitals to support patients in their medication management at hospital discharge, we conducted semi-structured, face-to-face interviews. Hospitals were eligible for these interviews if they indicated, in the survey, to have such a model in place. We selected hospitals with different models to support patients at discharge to present illustrative examples. In the interviews, pharmacists were asked to describe the pharmacists' involvement in the patients' pathways throughout their hospital stays. If the hospital collaborated with a community pharmacy (owned or unowned by the hospital) at discharge, they were asked to describe this collaboration. We defined a hospital community pharmacy as a pharmacy open to patients discharged from the hospital with full access to the hospital's patient records, in contrast to regular Swiss community pharmacies, which do not have access to clinical data. The interviews were audiotaped and afterwards transcribed using MAXQDA 2020 (VERBI Software GmbH, Berlin, Germany). The transcripts were validated by a second researcher.

2.2. *Data Analysis*

Descriptive statistics were used to report the results of the survey. Continuous variables were expressed as a median with 25th and 75th percentiles (p25, p75) or as a sum and categorical variables as frequencies. Pharmaceutical interventions discussed during the interviews were summarized using the taxonomy of Hansen et al. [17] or commonly

used terms (e.g., interprofessional ward round). Less common interventions were further detailed as text.

3. Results

3.1. Survey

A total of 44 hospital pharmacies participated in the survey (return rate = 73.3%). The pharmacists of all five Swiss university hospitals answered the questionnaire, as well as 18 cantonal or regional hospitals, 11 private hospitals or specialized clinics, and 10 hospitals that were organized in networks. They supplied a median of 340 beds (p25 = 200, p75 = 937.5, minimum = 82, maximum = 2000) and employed a total of 265.8 full-time equivalents of hospital pharmacists.

3.1.1. Interventions Conducted by Healthcare Professionals to Support Patients at Hospital Discharge

The participating hospitals implemented a variety of pre- and post-discharge interventions involving healthcare professionals (e.g., physicians, pharmacists, and nurses) to support patients at hospital discharge (Table 2). Some participants did not know if the interventions were implemented, whereas others reported that the interventions were not implemented in their hospital.

The evidence promoting the implementation of these interventions and the guidelines recommending the interventions are listed in Table 2. The Cochrane search yielded 444 reviews, and, after the title and abstract screening, three Cochrane reviews [23–25] were selected according to the inclusion criteria. The Google search resulted in 16 guidelines [26–41].

In one hospital, pharmacists were involved in following patient education interventions on a daily basis: patient counselling on their medication, in-depth patient counselling on their medication, patient instructions and patient counselling on what to do with medication prescribed before hospital admission. Three hospital pharmacies were involved in patient education interventions several times a month or less. In two hospitals, pharmacists were involved in the communication of medication changes to at least one primary care provider on a daily basis. In five hospitals, pharmacists were involved less frequently.

Of the 44 hospital pharmacies, 29 indicated that there are guidelines in place for the process of hospital discharge, 4 answered that there are no such guidelines, and 11 did not know. In nine hospitals, there were efforts to identify patients in need of more intensive support at discharge. In 21 hospitals, they did not stratify patients and in 14 cases participants did not know. For the identification, the hospitals used inclusion criteria ($n = 3$), scores ($n = 2$), or specific conditions ($n = 1$). The services delivered to the selected patients consisted of: organizing aftercare ($n = 3$), organization of medicines ($n = 3$), discharge planning/coordination ($n = 2$), patient education ($n = 2$), and medication review ($n = 1$).

3.1.2. Collaboration with a Community Pharmacy

Of the 44 participating hospitals, 17 (38.6%) collaborated with a community pharmacy (owned or unowned by the hospital) or had a counter in the hospital pharmacy that was open to discharged patients, and, of these, six had full access to the hospital's patient records. The frequency of predefined roles of these 17 pharmacies is depicted in Figure 1. Additionally, "obtaining specific medications from the hospital pharmacy that are not easily available otherwise" and "conducting medication reviews and making adaptions to discharge prescriptions after consultation with the physician" was mentioned as a role by one pharmacy each.

Table 2. Number of hospitals that implemented interventions [1] to support patients at hospital discharge (n = 44) and evidence promoting the implementation of these interventions.

	Intervention	Activities in Swiss Hospitals	Frequency, *n*	Evidence in Cochrane Reviews	Guidelines
Pre-discharge	Patient education	Patient counselling on their medication (e.g., therapy duration/dosing)	40	+ [23]	+ [26–31,33–41]
		In-depth patient counselling on their medication (e.g., effect/benefit, therapy goal/side effects)	32		
		Patient instructions (e.g., for inhalation devices/prefilled syringe)	33		
		Patient counselling on red flags (symptoms that indicate a worsening of condition/medication intolerance)	26		
		Patient counselling on medication prescribed before hospital admission	19		
	Discharge planning	Organization of medicines (e.g., contact with patients' community pharmacies/pill dispensers/reimbursement)	9 *	+/0 [24]	+ [26,28–40]
		Organization of rehabilitation/home care	20 *		
	Appointment scheduled before discharge	Assuring follow-up care (e.g., a follow-up appointment with the treating physician)	15 *	?	+ [28,32,33,35,36,38]
Post-discharge	Timely follow-up	Follow-up care by a case manager	7 *	?	+ [28,30,34,35,39,40,42,43]
	Communication to PCP	Medication changes are communicated to at least one healthcare professional (e.g., practitioner, community pharmacy) or institution (e.g., home care, nursing home)	34	?	+ [26–31,33,35,37–39,41]
	Follow-up telephone call	Follow-up telephone call with discharged patients	2	+/0 [25]	+ [28,30,37,38]
	Patient hotline	Hospital or hospital community pharmacy offers a patient hotline for medication related questions	10	?	+ [32,35,36,38,40]

+ = there is evidence of effectiveness in the Cochrane reviews for the intervention or the intervention is recommended by the guidelines. +/0 = there is conflicting evidence of effectiveness in the Cochrane reviews for the intervention. ? = no data was found for the intervention. * This question was only answered by pharmacists that indicated to have a case manager in their hospital (n = 24). PCP = primary care provider. [1] Interventions were conducted by any healthcare professional (e.g., physician, pharmacist, nurse).

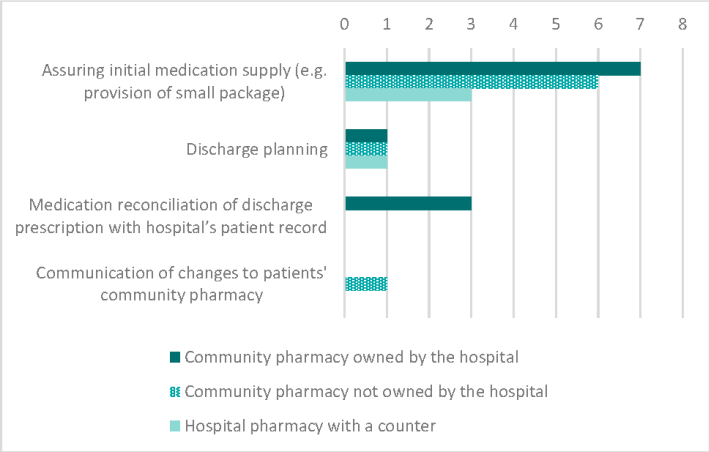

Figure 1. Frequency of predefined roles of the pharmacies that were collaborating with hospitals and that were accessible to patients at hospital discharge (multiple answers were possible), (n = 17).

Participants were asked to give a short description of the collaboration between the hospital pharmacy and the community pharmacy or the counter in the hospital pharmacy. Eleven of the 17 gave the following descriptions of the collaboration: in seven hospitals, the collaboration focused on logistic support (e.g., exchange of medication, provision of medicines at discharge), four hospitals had a close collaboration (but no further details were provided), and, in one hospital pharmacy, pharmacists answered general and patient-specific questions regarding the discharge prescription. Seven of the 17 pharmacies were contacted prior to patient discharges. Six of them received the discharge prescription in advance, one received a written report, and one was contacted in advance when there was a special order or when the patient needed an extemporaneous product (multiple answers were possible).

3.2. *Interviews*

Six hospitals that had a model implemented to support patients at discharge were contacted for an interview and all of them accepted. If they collaborated with a community pharmacy, the community pharmacy was also asked for an interview. In three out of four community pharmacies, pharmacists worked in the hospital pharmacy as well as in the community pharmacy. Table 3 gives an overview of the models implemented to support the patients' pathways throughout the stays in these hospitals.

A **medication self-management training program** was implemented in one long-term rehabilitation clinic. Patients with long lengths of stay were assessed for suitability to participate. This program aimed at promoting patients' independence and self-care. Starting two to three months before discharge, patients learned to manage their own medication. They received a prescription that they filled in the hospital community pharmacy. There the prescription was reconciled with the hospital's patient record and the medication was dispensed. At the beginning, patients were supervised by a nurse when they prepared their medication, often using a pillbox, to check the patients' capability of medication self-management. The hospital community pharmacy checked the patients' adherence using dispensing records. If the pharmacists detected or suspected an adherence problem, they either talked to the patient directly or informed the responsible nurses.

Table 3. Overview of implemented models to support patients throughout the hospital stay in interviewed hospitals ($n = 6$).

Hospital	Hospital Admission	Hospital Stay	Hospital Discharge	Follow-Up
	Interventions at Admission	**Interventions during Hospital Stay**	**Pre-Discharge Interventions**	**Post-Discharge Interventions**
Hospital 1	- Medication reconciliation - Medication review	- Interprofessional ward rounds (medical ward)	Hospital community pharmacy *#: - Medication reconciliation - Medication review - Patient education	Hospital community pharmacy *#: - Patient hotline
Hospital 2	None	- Medication self-management training program # - Group training for patients on different topics (e.g., bowel management)	Hospital community pharmacy *#: - Medication reconciliation - Patient education	Hospital community pharmacy *#: - Patient hotline
Hospital 3	None	- Interprofessional ward rounds (oncology ward) - Medication review (oncology and palliative ward)	None	None
Hospital 4	None	None	Hospital community pharmacy *#: - Medication reconciliation - Patient education	Hospital community pharmacy *#: - Patient hotline
Hospital 5	None	- Medication review (medical ward)	Hospital pharmacy#: - Medication reconciliation - Medication review	None
Hospital 6	None	- Interprofessional ward round (medical ward)	Hospital community pharmacy *#: - Patient education	Hospital community pharmacy *#: - Patient hotline

* We defined a hospital community pharmacy as a pharmacy open to patients discharged from the hospital with full access to the hospital's patient records. # Interventions are further detailed in the text below.

In one hospital, **medication reviews** of discharge prescriptions were conducted **in the hospital pharmacy**. At hospital discharge, physicians sent electronic discharge prescriptions to the hospital pharmacy. There pharmacists performed a medication reconciliation and a medication review. Any issues detected were communicated to physicians. Once all issues were resolved, pharmacists approved the discharge prescriptions, which were then given to patients to fill in a community pharmacy. If patients were discharged before a pharmacist approved the discharge prescription, issues were still communicated to the physician. In case of an urgent issue, the patient was contacted by the physician or a coach; for less urgent issues, a comment was added in the discharge letter to general practitioners.

Of the interviewed hospitals, four had a **hospital community pharmacy**, either within the hospital or close by. At discharge, patients had the choice to fill their discharge prescription there or to take it to any regular community pharmacy. If filled in the hospital community pharmacy, prescriptions were sent there in advance. In one hospital, all prescriptions were sent to the hospital community pharmacy and patients had the choice to either collect their medication there or to take their prescription to another community pharmacy. Hospital community pharmacies performed medication reconciliation. One hospital community pharmacy additionally conducted medication reviews, using risk factors to stratify the depth of the medication review. In case of DRPs and discrepancies that needed clarification, they were communicated to the physician or the nurse and sometimes resulted in changes of discharge prescriptions. At discharge, patients were counselled on their medications; the depth of the counselling depended on the complexity of the prescription. If patients had a planned discharge outside of opening hours of the hospital

community pharmacies, the medication was usually prepared in advance and picked up by a nurse or by the patient before discharge. However, if the discharge was unplanned, patients received the discharge prescription to fill in a regular community pharmacy. The hospital community pharmacies did not usually contact patients' community pharmacies, except for one that only dispensed small packages and forwarded prescriptions to the patients' community pharmacies, requesting them to follow-up on patients within a few days after discharge. The forwarded prescription contained a quick response (QR) code to reduce the workload of following institutions and to help trace any changes made by the hospital community pharmacy.

4. Discussion

The pre- and post-discharge interventions "patient education," "discharge planning," and "communication to primary care provider (PCP)" are commonly recommended by guidelines [26–41]. For the intervention: "patient education," there is evidence, reported in a Cochrane review, for effectiveness in improved knowledge and satisfaction [23]. In Swiss hospitals, these interventions are frequently performed by different healthcare professionals. Our survey showed that "patient counselling on their medication," "communication of medication changes to PCP," "patient instructions," and "in-depth patient counselling on their medication," which were part of the classified interventions, were implemented most frequently. However, while pharmacists routinely counsel at-risk patient groups on their medication at hospital discharge in 44% of American hospitals [42], only one Swiss hospital routinely involved pharmacists in patient education at discharge. Studies have shown that pharmacist-led medication counselling to older patients at hospital discharge in combination with other interventions can significantly reduce hospital readmissions for all patients [43] or specific patient groups [44], reduce visits to the emergency department [45], and improve medication adherence [44] compared to standard care where the elements were conducted by a physician or nurse or not conducted at all.

Regarding the communication of medication changes, pharmacists were involved in this task only in two hospitals daily and in five hospitals less frequently. In comparison, 39% of participants of a European-wide survey indicated that, at transitions of care, pharmacists contribute to the transfer of information on medicines [46]. Studies have shown that pharmacists provide more comprehensive information on medication changes (e.g., new or stopped medication, changed dose) to general practitioners than physicians [47] and that community pharmacies need to contact hospital physicians less often when pharmacists add information on medication changes to discharge prescriptions [16]. A reduction of interruptions by such inquiries may increase the efficiency of hospital physicians and may possibly contribute to patient safety [16]. One hospital community pharmacy that participated in our study communicated changes to patients' regular community pharmacies on a daily basis. A study has shown that community pharmacies appreciate receiving discharge prescriptions (including information on new and stopped medications) before patients come to the pharmacy [48]. They feel that, this way, they have more time to prepare the prescriptions and resolve discrepancies. Additionally, the community pharmacies in the mentioned study received the discharge summary, which was also considered to be helpful by most pharmacists [48]. It would therefore be beneficial for the quality of the communication of medication changes to involve pharmacists more often in this process. It would also be helpful to communicate changes not only to the patient's general practitioner, but also to their regular community pharmacy.

Overall, at hospital discharge, pharmacists were not regularly involved in interventions to support patients with their medication management. This may be because of a lack of resources. In Swiss hospitals, one will find only 1.12 full-time equivalents for pharmacists per 100 beds [12]. In addition to the resources, patient-centred services require adequately trained pharmacists to perform these interventions. However, Swiss hospitals only offer 18.5 training positions for the certificate of proficiency in clinical pharmacy, a postgraduate education program focusing on patient-oriented pharmaceutical activities [12]. Another

reason may be that, although medication safety is gaining importance in the Swiss Federal Office of Public Health, there are no legally binding recommendations for Swiss hospitals to implement such services [49].

One strategy of improving patient safety at hospital discharge could be a community pharmacy in or close by the hospital accessible to patients being discharged. Seventeen of the participating hospitals indicated to have such a community pharmacy or a counter in the hospital pharmacy. The main role of these pharmacies seemed to be the initial medication supply to patients at discharge. However, they were not often involved in tasks such as medication reconciliation or communication with patients' community pharmacies. Community pharmacies in close collaboration with the hospital, especially with full access to the hospitals' patient records, would be well-positioned for such services. Pharmacist-led medication reconciliation at hospital transitions has been shown to reduce medication discrepancies, all-cause readmissions, and all-cause emergency department visits [6,50].

One hospital implemented a medication self-management training program. The ability to take medication correctly after discharge is important, and helping patients to learn to do so can have a favorable impact on health outcomes. In the last few years, patient self-management has gained awareness [51], and, in a systematic review, self-management education or coaching showed a significant reduction in hospital readmissions [10]. The Society of Hospital Pharmacists of Australia recommended that patients who are enrolled in self-administration of medication programs should be counselled by a pharmacist (e.g., indication, dosage, and storage requirements) [52]. However, this service may be more suited for patients with a longer hospital stay to allow sufficient time for the observation and evaluation of included patients (as was the case in the hospital that implemented this service).

Of the six hospitals where the interviews took place, pharmacists were involved at hospital admission in only one hospital. In this hospital, pharmacists conducted a medication reconciliation and a medication review for patients with planned admission. Comprehensive involvement of pharmacists throughout the hospital stay has been shown to have positive effects on readmission within 30 days and 180 days [43]. Lack of resources may be a barrier for the implementation of medication reconciliation and medication review. A risk score could help select patients who benefit most from such services, e.g., patients with a risk for drug-related problems [53].

One strength of our study was the high return rate (73.3%) of the survey, which resulted in a representative sample for this study. In addition to the information obtained through the questionnaire, the follow-up interviews with selected hospitals gave a more detailed insight into pharmacists' involvement in the hospitals' processes. However, both the survey and the interviews relied on self-reporting, which allowed for reporting bias. It is also possible that interventions were implemented without pharmacists' knowledge. This could have resulted in underreporting of some interventions.

5. Conclusions

In conclusion, interventions such as patient counselling and communication to primary care providers are widely recommended in guidelines. While Swiss hospitals mostly implemented these interventions, pharmacists were rarely involved. Some hospitals chose to support patients being discharged through a hospital community pharmacy, which performed different interventions. As studies have shown that involving pharmacists at hospital discharge can reduce readmissions, the results presented in this study should encourage hospitals to expand the involvement of pharmacists in medication management at hospital discharge.

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Informed Consent Statement: Informed consent was obtained from all participants of the interviews. From the survey participants informed consent was not required.

Data Availability Statement: The data presented in this study are available on reasonable request from the corresponding author. The data are not publicly available due to confidentiality issues (e.g., interviews not anonymous).

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A. Cochrane Search

#1 (Continu* NEXT "of Patient Care" OR Aftercare OR Discharg* OR Handoff OR Transfer OR "Retention in Care" OR Trans* NEXT "to Adult Care" OR Trans* NEXT Care OR handover* OR "transitional care" OR "seamless care" OR patient* NEXT transition* OR "transmural care")(:ti,ab)
#2 MeSH descriptor: [Continuity of Patient Care] 2 tree(s) exploded
#3 Hospital
#4 (#1 OR #2) AND #3
#5 #4 AND "Impact of medication reconciliation for improving transitions of care"
#6 MeSH descriptor: [Aftercare] this term only
#7 MeSH descriptor: [Patient Discharge] this term only
#8 MeSH descriptor: [Patient Handoff] this term only
#9 MeSH descriptor: [Patient Transfer] this term only
#10 MeSH descriptor: [Retention in Care] this term only
#11 MeSH descriptor: [Transition to Adult Care] this term only
#12 MeSH descriptor: [Transitional Care] this term only
#13 MeSH descriptor: [Continuity of Patient Care] this term only
#14 (#1 OR #2 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13) AND #3

Appendix B. Guideline Search

- Clinical guideline and hospital discharge and *
- Guideline * continuity OR aftercare OR handoff OR transfer OR handover OR "transitional OR care" OR "seamless OR care" OR transition OR "hospital discharge" -covid-19

* Interchangeable terms: England, Wales, Scotland, Northern Ireland, Ireland, Canada, United States of America, Australia, New Zealand.

References

1. Berry, J.G.; Gay, J.C.; Maddox, K.J.; Coleman, E.A.; Bucholz, E.M.; O'Neill, M.R.; Blaine, K.; Hall, M. Age trends in 30 day hospital readmissions: US national retrospective analysis. *BMJ* **2018**, *360*, k497. [CrossRef]
2. El Morabet, N.; Uitvlugt, E.B.; van den Bemt, B.J.; van den Bemt, P.M.; Janssen, M.J.; Karapinar-Çarkit, F. Prevalence and Preventability of Drug-Related Hospital Readmissions: A Systematic Review. *J. Am. Geriatr. Soc.* **2018**, *66*, 602–608. [CrossRef]
3. Hawes, E.M.; Pinelli, N.R.; Sanders, K.A.; Lipshutz, A.M.; Tong, G.; Sievers, L.S.; Chao, S.; Gwynne, M. Post-Hospital Discharge Care: A Retrospective Cohort Study Exploring the Value of Pharmacist-Enhanced Care and Describing Medication-Related Problems. *North Carol. Med. J.* **2018**, *79*, 4–13. [CrossRef]

4. Kripalani, S.; Roumie, C.L.; Dalal, A.K.; Cawthon, C.; Businger, A.; Eden, S.K.; Shintani, A.; Sponsler, K.C.; Harris, L.J.; Theobald, C.N.; et al. Effect of a Pharmacist Intervention on Clinically Important Medication Errors After Hospital Discharge. *Ann. Intern. Med.* **2012**, *157*, 1–10. [CrossRef]
5. De Oliveira, G.S.; Castro-Alves, L.J.; Kendall, M.C.; McCarthy, R. Effectiveness of Pharmacist Intervention to Reduce Medication Errors and Health-Care Resources Utilization After Transitions of Care. *J. Patient Saf.* **2017**, 10. [CrossRef]
6. Mekonnen, A.B.; McLachlan, A.J.; Brien, J.-a.E. Effectiveness of pharmacist-led medication reconciliation programmes on clinical outcomes at hospital transitions: A systematic review and meta-analysis. *BMJ Open* **2016**, *6*, e010003. [CrossRef]
7. Daliri, S.; Hugtenburg, J.G.; Ter Riet, G.; van den Bemt, B.J.F.; Buurman, B.M.; Reimer, W.J.M.S.O.; Van Buul-Gast, M.-C.; Karapinar-Çarkit, F. The effect of a pharmacy-led transitional care program on medication-related problems post-discharge: A before—After prospective study. *PLoS ONE* **2019**, *14*, e0213593. [CrossRef] [PubMed]
8. Bonetti, A.F.; Reis, W.C.; Lombardi, N.F.; Mendes, A.M.; Netto, H.P.; Rotta, I.; Fernandez-Llimos, F.; Pontarolo, R. Pharmacist-led discharge medication counselling: A scoping review. *J. Eval. Clin. Pract.* **2018**, *24*, 570–579. [CrossRef]
9. Capiau, A.; Foubert, K.; Van Der Linden, L.; Walgraeve, K.; Hias, J.; Spinewine, A.; Sennesael, A.-L.; Petrovic, M.; Somers, A.; Belgian Society for Gerontology and Geriatrics (BSGG). Medication Counselling in Older Patients Prior to Hospital Discharge: A Systematic Review. *Drugs Aging* **2020**, *37*, 635–655. [CrossRef]
10. Tomlinson, J.; Cheong, V.-L.; Fylan, B.; Silcock, J.; Smith, H.; Karban, K.; Blenkinsopp, A. Successful care transitions for older people: A systematic review and meta-analysis of the effects of interventions that support medication continuity. *Age Ageing* **2020**, *49*, 558–569. [CrossRef]
11. Leppin, A.L.; Gionfriddo, M.R.; Kessler, M.; Brito, J.P.; Mair, F.S.; Gallacher, K.; Wang, Z.; Erwin, P.J.; Sylvester, T.; Boehmer, K.; et al. Preventing 30-day hospital readmissions: A systematic review and meta-analysis of randomized trials. *JAMA Intern. Med.* **2014**, *174*, 1095–1107. [CrossRef]
12. Studer, H.; Boeni, F.; Messerli, M.; Hersberger, K.E.; Lampert, M.L. Clinical pharmacy activities in Swiss hospitals: How have they evolved from 2013 to 2017? *Pharmacy* **2020**, *8*, 19. [CrossRef]
13. Bundesgesetz über Arzneimittel und Medizinprodukte. Available online: https://www.admin.ch/ch/d/sr/8/812.21.de.pdf (accessed on 10 January 2021).
14. Swiss Association of Public Health Administration and Hospital Pharmacists. Berufsbild des Spitalapothekers und Leitbild für Seine Weiterbildung. Available online: https://www.gsasa.ch/deliver.cfm?f=0CD89DA59212A7CBAEDB92D04866B8AB822D41B39CAE138ABE7A989FD2DB9A692B80BC5080BEBBCC6E97CABFB3488583E3A496F8AB8ED38C9B9F47BFBA04939D4D0AA14FBA9BB7ABAD1792ABEA5CCF75ED56AEBF87BB575C4E939F8DFE5E26BD5BDB7205173B05ACDFCBF495A8FC&type=.pdf (accessed on 9 January 2021).
15. pharmaSuisse. Weiterbildungsprogramm zum Fähigkeitsausweis FPH in klinischer Pharmazie. Available online: https://www.gsasa.ch/de/bildung-de/fph-klinische-pharmazie/weiterbildungsprogramm/?oid=10149&lang=de (accessed on 9 January 2021).
16. Bruhwiler, L.D.; Beeler, P.E.; Boni, F.; Giger, R.; Wiedemeier, P.G.; Hersberger, K.E.; Lutters, M. A RCT evaluating a pragmatic in-hospital service to increase the quality of discharge prescriptions. *Int. J. Qual. Health Care* **2019**. [CrossRef]
17. Hansen, L.O.; Young, R.S.; Hinami, K.; Leung, A.; Williams, M.V. Interventions to reduce 30-day rehospitalization: A systematic review. *Ann. Intern. Med.* **2011**, *155*, 520–528. [CrossRef]
18. Coleman, E.A.; Parry, C.; Chalmers, S.; Min, S.J. The care transitions intervention: Results of a randomized controlled trial. *Arch. Intern. Med.* **2006**, *166*, 1822–1828. [CrossRef]
19. Bobay, K.; Bahr, S.J.; Weiss, M.E.; Hughes, R.; Costa, L. Models of discharge care in Magnet(R) hospitals. *J. Nurs. Adm.* **2015**, *45*, 485–491. [CrossRef]
20. Pedersen, C.A.; Schneider, P.J.; Scheckelhoff, D.J. ASHP national survey of pharmacy practice in hospital settings: Dispensing and administration–2014. *Am. J. Health-Syst. Pharm.* **2015**, *72*, 1119–1137. [CrossRef] [PubMed]
21. Cawthon, C.; Walia, S.; Osborn, C.Y.; Niesner, K.J.; Schnipper, J.L.; Kripalani, S. Improving care transitions: The patient perspective. *J. Health Commun.* **2012**, *17* (Suppl. S3), 312–324. [CrossRef]
22. Pedersen, C.A.; Schneider, P.J.; Scheckelhoff, D.J. ASHP national survey of pharmacy practice in hospital settings: Monitoring and patient education–2012. *Am. J. Health-Syst. Pharm.* **2013**, *70*, 787–803. [CrossRef]
23. Johnson, A.; Sandford, J.; Tyndall, J. Written and verbal information versus verbal information only for patients being discharged from acute hospital settings to home. *Cochrane Database Syst. Rev.* **2003**, *2003*, CD003716. [CrossRef]
24. Goncalves-Bradley, D.C.; Lannin, N.A.; Clemson, L.M.; Cameron, I.D.; Shepperd, S. Discharge planning from hospital. *Cochrane Database Syst. Rev.* **2016**, *1*, CD000313. [CrossRef]
25. Mistiaen, P.; Poot, E. Telephone follow-up, initiated by a hospital-based health professional, for postdischarge problems in patients discharged from hospital to home. *Cochrane Database Syst. Rev.* **2006**, CD004510. [CrossRef]
26. National Institute for Health and Care Exellence. Transition between Inpatient Hospital Settings and Community or Care Home Settings for Adults with Social Care Needs. Available online: https://www.nice.org.uk/guidance/ng27/evidence/full-guideline-pdf-2185185565 (accessed on 17 September 2020).
27. Royal Pharmaceutical Society. Keeping Patients Safe When They Transfer between Care Providers—Getting the Medicines Right. Available online: https://www.rpharms.com/Portals/0/RPS%20document%20library/Open%20access/Publications/Keeping%20patients%20safe%20transfer%20of%20care%20report.pdf (accessed on 17 September 2020).

28. Alper, E.; O'Malley, T.A.; Greenwald, J. UptoDate: Hospital Discharge and Readmission. Available online: https://www.uptodate.com/contents/hospital-discharge-and-readmission#H19 (accessed on 17 September 2020).
29. Head of Clinical Services–Community Hospitals and Transitional Care, Lincolnshire Community Health Services. Admission, Discharge and Transfer Policy for Community Hospitals. Available online: https://www.lincolnshirecommunityhealthservices.nhs.uk/application/files/7115/4221/1756/P_CS_06_Admission_Discharge_and_Transfer_Policy.pdf (accessed on 17 September 2020).
30. Health Service Executive National Integrated Care Advisory Group. Integrated Care Guidance: A Practical Guide to Discharge and Transfer from Hospital. Available online: https://www.hse.ie/eng/about/who/qid/resourcespublications/nationalintegratedcareguidance.pdf (accessed on 17 September 2020).
31. Aneurin Bevan University Health Board. Discharge Policy. Available online: http://www.wales.nhs.uk/sitesplus/documents/866/FOI%2017076%20Enclosure.pdf (accessed on 17 September 2020).
32. Head of Capacity & Corporate Nursing. Policy & Procedure for Discharge Practices. Available online: https://hgs.uhb.nhs.uk/wp-content/uploads/Discharge-Practices-Policy.pdf (accessed on 17 September 2020).
33. Change Agent Team, National Leadership and Innovation Agency for Healthcare. Passing the Baton: A Practical Guide to Effective Discharge Planning. Available online: https://www.adss.cymru/en/blog/post/passing-the-baton-a-practical-guide-to-effective-discharge-planning (accessed on 17 September 2020).
34. Agency for Healthcare Research and Quality. Care Transitions from Hospital to Home: IDEAL Discharge Planning. Available online: https://www.ahrq.gov/sites/default/files/wysiwyg/professionals/systems/hospital/engagingfamilies/strategy4/Strat4_Implement_Hndbook_508_v2.pdf (accessed on 17 September 2020).
35. Registered Nurses' Association of Ontario. Care Transitions—Clinical Best Practice Guidelines. Available online: https://rnao.ca/sites/rnao-ca/files/Care_Transitions_BPG.pdf (accessed on 17 September 2020).
36. Health Quality Ontario. Adopting a Common Approach to Transitional Care Planning: Helping Health Links Improve Transitions and Coordination of Care. Available online: http://www.hqontario.ca/Portals/0/documents/qi/health-links/bp-improve-package-traditional-care-planning-en.pdf (accessed on 17 September 2020).
37. The Society of Hospital Pharmacists of Australia. Compiled Quick Guides SHPA. Available online: https://www.shpa.org.au/sites/default/files/uploaded-content/website-content/SOP/quick_guides_e-book_2013.pdf (accessed on 17 September 2020).
38. The Society of Hospital Pharmacists of Australia. Chapter 6: Facilitating Continuity of Medication Management on Transition between Care Settings. Available online: https://www.shpa.org.au/sites/default/files/uploaded-content/website-content/SOP/sop_clinical_pharmacy_s26-s28_chapter6.pdf (accessed on 17 September 2020).
39. New Zealand HealthCare Pharmacists' Association. Clinical Pharmacy Guidelines. Available online: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiFvaujlvDrAhVKDuwKHbs1Dmc4ChAWMAV6BAgGEAE&url=http%3A%2F%2Fwww.nzhpa.org.nz%2Fmedia%2F1379%2Fclinguide_07.pdf&usg=AOvVaw33_bwFGOQJ9MR5NxKT_JW6 (accessed on 17 September 2020).
40. Health & Social Care Joint Unit and Change Agents Team. Discharge from Hospital: Pathway, Process and Practice. Available online: http://www.wales.nhs.uk/sitesplus/documents/829/DoH%20-%20Discharge%20Pathway%202003.PDF (accessed on 17 September 2020).
41. Department of Health, Government of South Australia. Continuity in Medication Management—A Handbook for South Australian Hospitals. Available online: https://www.sahealth.sa.gov.au/wps/wcm/connect/e055bd8044fd8fc2aff7efcfa5ded0ab/Pharmaceutical+Reform+Handbook+V7_Print+version.pdf?MOD=AJPERES&ampCACHEID=ROOTWORKSPACE-e055bd8044fd8fc2aff7efcfa5ded0ab-n5iXGmp (accessed on 17 September 2020).
42. Pedersen, C.A.; Schneider, P.J.; Ganio, M.C.; Scheckelhoff, D.J. ASHP national survey of pharmacy practice in hospital settings: Monitoring and patient education—2018. *Am. J. Health-Syst. Pharm.* **2019**, *76*, 1038–1058. [CrossRef] [PubMed]
43. Ravn-Nielsen, L.V.; Duckert, M.L.; Lund, M.L.; Henriksen, J.P.; Nielsen, M.L.; Eriksen, C.S.; Buck, T.C.; Pottegard, A.; Hansen, M.R.; Hallas, J. Effect of an in-hospital multifaceted clinical pharmacist intervention on the risk of readmission: A randomized clinical trial. *JAMA Intern. Med.* **2018**, *178*, 375–382. [CrossRef] [PubMed]
44. Bonetti, A.; Bagatim, B.; Mendes, A.; Rotta, I.; Reis, R.; Fávero, M.; Fernandez-Llimós, F.; Pontarolo, R. Impact of discharge medication counseling in the cardiology unit of a tertiary hospital in Brazil: A randomized controlled trial. *Clinics* **2018**, *73*. [CrossRef]
45. Gillespie, U.; Alassaad, A.; Henrohn, D.; Garmo, H.; Hammarlund-Udenaes, M.; Toss, H.; Kettis-Lindblad, A.; Melhus, H.; Morlin, C. A comprehensive pharmacist intervention to reduce morbidity in patients 80 years or older: A randomized controlled trial. *Arch Intern. Med.* **2009**, *169*, 894–900. [CrossRef] [PubMed]
46. Horák, P.; Gibbons, N.; Sýkora, J.; Batista, A.; Underhill, J. EAHP statements survey 2016: Sections 1, 3 and 4 of the European Statements of Hospital Pharmacy. *Eur. J. Hosp. Pharm.* **2017**, *24*, 258–265. [CrossRef] [PubMed]
47. Ooi, C.E.; Rofe, O.; Vienet, M.; Elliott, R.A. Improving communication of medication changes using a pharmacist-prepared discharge medication management summary. *Int. J. Clin. Pharm.* **2017**, *39*, 394–402. [CrossRef]
48. McCarthy, L.M.; Li, S.; Fernandes, O.; Cameron, K.; Lui, P.; Wong, G.; Pariser, P.; Farrell, J.; Luke, M.J.; Guilcher, S.J.T. Enhanced communication between inpatient and community pharmacists to optimize medication management during transitions of care. *J. Am. Pharm. Assoc.* **2019**, *59*, 79–86.e1. [CrossRef]

49. Vincent, C.; Staines, A. Enhancing the Quality and Safety of Swiss Healthcare. Available online: https://www.bag.admin.ch/bag/en/home/versicherungen/krankenversicherung/krankenversicherung-qualitaetssicherung.html (accessed on 30 January 2020).
50. Mekonnen, A.B.; McLachlan, A.J.; Brien, J.A. Pharmacy-led medication reconciliation programmes at hospital transitions: A systematic review and meta-analysis. *J. Clin. Pharm. Ther.* **2016**, *41*, 128–144. [CrossRef]
51. Vanwesemael, T.; Boussery, K.; Dilles, T. Self-administration of medication in hospital: A literature review. *Nurs. Sci. Q.* **2020**, *33*, 249–257. [CrossRef] [PubMed]
52. Davis, A.; Muir, P.; Allardice, J.-A.; Clark, K.; Groves, J.; Molenaar, M.; Robson, G. SHPA guidelines for self-administration of medication in hospitals and residential care facilities. *J. Pharm. Pract. Res.* **2002**, *32*, 324–325. [CrossRef]
53. Stampfli, D.; Boeni, F.; Gerber, A.; Battig, V.A.D.; Weidmann, R.; Hersberger, K.E.; Lampert, M.L. Assessing the ability of the Drug-Associated Risk Tool (DART) questionnaire to stratify hospitalised older patients according to their risk of drug-related problems: A cross-sectional validation study. *BMJ Open* **2018**, *8*, e021284. [CrossRef] [PubMed]

A3 Synopsis of national and international recommendations for medication review at hospital discharge

In the previous project, we looked at recommendations appearing in the taxonomy of Hansen et al.[51] In this taxonomy, medication reviews are not listed as an intervention to be conducted at hospital discharge; however, they are recommended to be conducted for patients with medication changes.[95] Since changes are common during hospitalizations, medication reviews may help to reduce negative patient outcomes. The aim of this project was to give an overview of international guidelines and the elements that should be addressed during a medication review. In order to achieve this aim, we conducted a pragmatic open Internet search and compiled an overview of recommendations for medication reviews.

Synopsis of national and international recommendations for medication review in the hospital setting

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Draft of a short report

Synopsis of national and international recommendations for medication review in the hospital setting

Background and Objective

In-hospital medication reviews conducted by a pharmacist in combination with other interventions (e.g., discharge counseling, motivational interviews, follow-up) can have a positive effect on patient outcomes, such as readmission and preventable adverse drug events.[1,2] The Pharmaceutical Care Network Europe (PCNE) proposed a definition and classification of different types of medication reviews.[3] In studies reporting on pharmacist-led medication reviews of hospitalized patients, it often remains unclear what type of review according to PCNE was applied, how the medication reviews were performed or if a specific guideline was followed. The objective of this project was therefore to generate an overview of existing guidelines for in-hospital medication reviews.

Setting and Method

In order to find guidelines containing recommendations on medication reviews conducted in the hospital setting, NFe and HSt independently and in a sequential manner pursued a twofold strategy for a grey literature search. On one hand, we searched websites of pharmaceutical associations and societies for guidelines on medication reviews with a focus on reviews conducted in the hospital. On the other hand, we conducted an open Internet search using a combination of the following search terms: medication review, medication/medicine use review, guideline, guidance, hospital. Guidelines were included if they contained recommendations for medication reviews specifically for the hospital setting or if they were not limited to one specific setting. Guidelines were required to be available in full-text and be written in English or German. They were excluded if they were only applicable to the community pharmacy setting or they were not open access. Relevant guidelines were selected and compiled in an overview, using an iterative process to develop the categories with which recommended elements of medication reviews were described. The search was first conducted in April 2018 by NFe, who then created the first version of the overview.[4] HSt searched for updates of the guidelines in January 2020. After some minor adjustments to the categories, HSt created the second and final version of the overview.

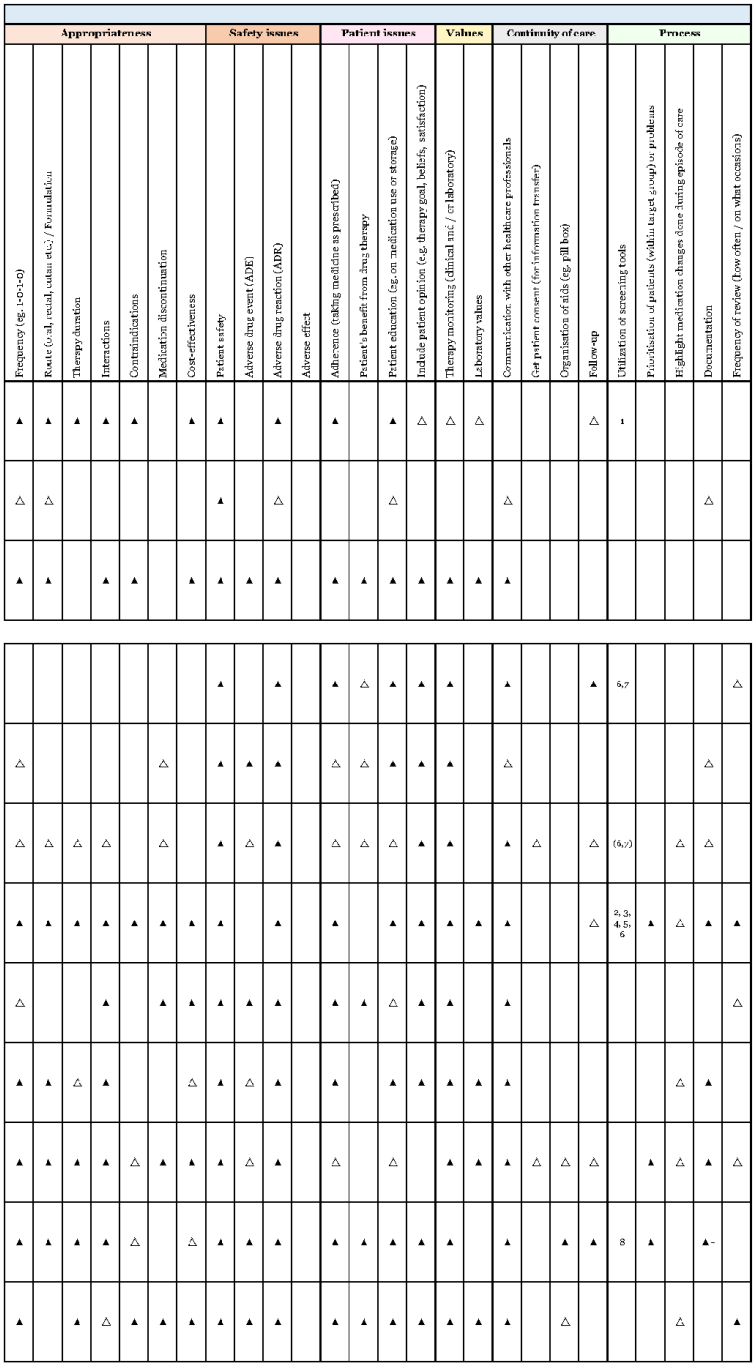
Results

We identified three international guidelines (PCNE[5], European Association of Hospital Pharmacists (EAHP)[6], International Pharmaceutical Federation/World Health Organization (FIP/WHO)[7]) and nine national guidelines (National Institute for Health and Care Excellence (NICE)[8-10], Federal Union of German Associations of Pharmacists (ABDA)[11], Royal Pharmaceutical Society (RPS)[12], American Society of Hospital Pharmacists (ASHP)[13], The Society of Hospital Pharmacists of Australia (SHPA)[14], Canadian Pharmacists Association (CPhA)[15], National Prescribing Centre (NPC)[16]). An overview of recommendations on medication reviews included in these guidelines from associations and societies is shown in Figure 1. In four guidelines (PCNE[5], NPC[16], NICE[8], CPhA[15]), medication review was the only subject; the other eight also focused on further subjects (e.g., best practice recommendations in pharmacy in general or hospital/clinical pharmacy[6,7,13]). In the overview, we differentiated between elements that were recommended within the scope of a medication review and elements that were either recommended by the guideline, but not within the scope of the medication review or only vaguely recommended/mentioned. Here follow three illustrative examples of the latter: (1) Two guidelines (NICE 2016[9] and 2015[10]) both recommended that "medication reconciliation" should happen at transitions of care, but did not specify that it should also happen directly before a medication review, (2) one guideline (ABDA 2014[11]) differentiated between medication reviews and medication management—although medication reviews were part of medication management, "follow-up" was described only in the context of medication management, (3) one position paper (PCNE 2016[5]) described different types of medication review—for some types, "patients need to be present" whereas other types take place without direct patient contact.

As mentioned, some guidelines distinguished between different types of medication review. PCNE 2016[5], for instance, differentiated between simple (Type 1), intermediate (Type 2a and 2b) and advanced (Type 3) medication reviews, depending on the sources of information available. Although for simple medication reviews only the medication history is needed, intermediate medication reviews are additionally based on a patient interview (Type 2b) or clinical data (Type 2b), and advanced medication reviews on all three sources of information. Similarly, NPC 2008[16] describes three different types of medication review, each with a different purpose. Type 1 aims at solving technical issues related to prescriptions, Type 2 approaches issues in patients' medication-taking behavior and Type 3 addresses issues arising from patients' medication use with regard to their clinical conditions. The ABDA 2014 guideline[11] refers to the different types described by PCNE.

	Guide		Terms					Medication review																	
								Patient characteristics						Reconciliation			Appropriateness							
	International (I), National (N)	Only about medication review	Healthcare setting	Target audience	Training of professional (performing medication review)	Medication review targeting specific patient group	Patient should be present	Lifestyle (e.g. smoking or alcoholism)	Diagnoses	Physical capacity (eg. swallowing difficulties)	Mental capacity (eg. forgetfulness)	Nutritional status	Allergies	Medication reconciliation	Most possible medication history (including ≥ two sources)	Medication history	Appropriateness (unspecified)	Indication / Each medication matches an indication	Effectiveness	Untreated condition	Under treated condition	Drug choice Appropriate for indication & patient, evidence based	Dosage
Pharmaceutical Care Network Europe (PCNE) [5] (Europe, 2016, 2013) - Position Paper on the PCNE definition of Medication Review 2016 - PCNE Medication review types and problems that can be detected	I	y	o	p			△						▲		▲		△	▲	▲	▲	▲			▲
European Association of Hospital Pharmacists (EAHP) [6] (Europe, 2015) The European Statements of Hospital Pharmacy	I	n	h	p	△								△	▲		△	▲		△					△
Fédération Internationale Pharmaceutique, World Health Organization (FIP/WHO) [7] (Global, 2011) Good Pharmacy Practice	I	n	o	p				▲	▲	▲	▲		▲			▲	▲	▲	▲	▲			▲	▲
National Institute for Health and Care Excellence (NICE) [8] (United Kingdom, 2017) Medication review	N	y	o	hp		▲	△									▲	▲	▲	▲				▲	
National Institute for Health and Care Excellence (NICE) [9] (United Kingdom, 2016) Medicines optimisation	N	n	o	hp	△	▲	▲							△		△	▲	▲	▲	▲				▲
National Institute for Health and Care Excellence (NICE) [10] (United Kingdom, 2015) Medicines optimisation: the safe and effective use of medicines to enable the best possible outcomes	N	n	o	hp, sop, pat	△	▲	▲		△				△	△		▲	▲	▲	▲				▲	△
Bundesvereinigung Deutscher Apothekerverbände (ABDA) [11] (Germany, 2014) Grundsatzpapier zur Medikationsanalyse und zum Medikationsmanagement	N	n	o	p		▲	▲		▲	▲	▲		▲	▲		▲	▲	▲	▲	▲			▲	▲
Royal Pharmaceutical Society (RPS) [12] (Great Britain, 2013) Medicines Optimisation: Helping patients to make the most of medicines	N	n	o	hp			▲	▲	▲					△			▲	▲					▲	
American Society of Hospital Pharmacists (ASHP) [13] (USA, 2013) ASHP Guidelines: Minimum Standard for Pharmacies in Hospitals	N	n	h	p	△				△				▲	▲		△	▲	△	▲				△	▲
The Society of Hospital Pharmacists of Australia (SHPA) [14] (Australia, 2013) Compiled Quick Guides SHPA	N	n	h	p			▲	▲	▲	△		▲	▲	△	△	▲	▲	▲					▲	▲
Canadian Pharmacists Association (CPhA) [15] (Canada, 2012) PharmaCheck Guide - A Guide for Pharmacists to Aid in Identifying and Resolving Medication Issues	N	y	o	p		▲	▲	▲	△	▲	▲		▲	△		▲	▲	▲	▲	▲	▲	▲	▲	▲
National Prescribing Centre, National Health Service (NPC) [16] (Great Britain, 2008) A Guide to Medication Review	N	y	o	hp	△	▲	▲		▲	▲	▲			▲		▲	▲	▲	▲	▲	▲			▲

Figure 1 Overview of elements recommended to be addressed in medication reviews by guidelines (n=12)



Symbols
▲ = recommended
▲+= recommended + providing extra material (e.g., documentation sheet)
△ = vaguely recommended / mentioned

Abbreviations
post-hosp. = post-hospitalization
I = international, N = national
y = yes, n = no
h = hospital, o = overall
p = pharmacist, hp = health professional
pat = patient, scp = social care practitioner
gov = government, doc = doctor

Tools
1 = Beers Criteria
2 = Medication Appropriateness Index (MAI)
3 = Cipolle
4 = Priscus
5 = Fit for The Aged (FORTA)
6 = Screening Tool of Older Persons' potentially inappropriate Prescriptions (STOPP)
7 = Screening Tool to Alert Doctors to the Right Treatment (START)
8 = PharmaCheck Patient Screening Tool
9 = British National Formulary (BNF)
10 = NO TEARS
11 = online resources

Figure 1 Overview of elements recommended to be addressed in medication reviews by guidelines (n=12), (continued)

Medication appropriateness and patient safety were addressed in all guidelines. Reconciling patients' medication before medication reviews was recommended in four guidelines and in one it was specifically recommended to obtain a best possible medication history. In five guidelines medication reconciliation was mentioned or recommended in other situations than medication review and in two guidelines it was not addressed at all. Other elements that were frequently recommended include therapy monitoring and communication with other healthcare professionals.

Discussion

The search strategy yielded three international and nine national guidelines on medication review from different English- and German-speaking countries and enabled compilation of an overview of elements frequently recommended to be considered or addressed during medication reviews. Differences in healthcare settings in different countries might explain why we found more national than international guidelines.

Many guidelines recommend obtaining a medication history for the medication review; however, only one specified that it should be the best possible medication history, which is a history based on systematic and structured approach and should rely on at least two sources of information. Medication reconciliation was mentioned in many guidelines, but only four stated that it should take place in combination with the medication review. Studies have shown that obtaining a best possible medication history or conducting medication reconciliation leads to a more complete and accurate medication history.[17,18] One can argue that medication reviews and subsequent recommendations need to be based on a complete and accurate medication history. Therefore, performing a medication reconciliation and obtaining a best possible medication history should be an indispensable part of medication reviews and should be advocated by all guidelines.

Although assessing the appropriateness of medicines was recommended by nearly all guidelines, the extent of specific aspects listed varied considerably. One possible explanation might be that guidelines which need to be viable for different settings or different healthcare professionals may not be as detailed as guidelines addressing only one setting or guidelines specifically intended for one type of healthcare professionals, such as pharmacists. The different sources of information available is an important factor influencing those elements that can be addressed during medication reviews and those that cannot. In comparison to most community pharmacies, who only provide simple and intermediate medication reviews (PCNE Type 1 and 2a)[19], most pharmacists providing clinical pharmacy services in Swiss hospitals have full access to the hospital's patient records[20], which would enable them also to provide

advanced medication reviews (PCNE Type 3). As issues needing clinical data for their identification are not detectable in a regular community pharmacy in Switzerland, hospitals pharmacists should be reassured to provide intermediate and advanced medication reviews (PCNE Type 2b and 3). The outcomes of medication reviews should subsequently be communicated to all healthcare professionals for whom such information might be relevant. Communication to other healthcare professionals was recommended in the majority of the guidelines. In contrast, obtaining patient consent for the communication was only mentioned in two guidelines. None of the guidelines we included in this overview indicated the level of evidence for the recommendations that were made.

This overview focused on pharmacists-led medication reviews or medication reviews conducted by healthcare professionals in general. In a further study, a comparison of guidelines issued for other healthcare professionals (physicians, nurses) or different settings (community pharmacy, nursing homes) might provide further insight into recommendations on medication reviews.

Conclusion

As expected, most guidelines exist at a national level and only a few at an international level. The structured overview may help to identify core elements in order to establish a best practice standard for medication reviews in hospitals. Elements that were frequently recommended and should therefore be addressed in a medication review are medication appropriateness (e.g., medication indication), patient safety, therapy monitoring, and communication with other healthcare professionals. In contrast, medication reconciliation or obtaining the best possible medication history, which would be expected to be an integral part of medication reviews, is recommended less frequently. Medication reviews can be conducted with or without a patient's presence; however, the problems that can be detected vary depending on the sources available.

References

1. Schnipper JL, Kirwin JL, Cotugno MC, et al. Role of pharmacist counseling in preventing adverse drug events after hospitalization. *Arch Intern Med* 2006;166(5):565-71. doi: 10.1001/archinte.166.5.565
2. Ravn-Nielsen LV, Duckert ML, Lund ML, et al. Effect of an in-hospital multifaceted clinical pharmacist intervention on the risk of readmission: A randomized clinical trial. *JAMA Intern Med* 2018;178(3):375-82. doi: 10.1001/jamainternmed.2017.8274
3. Griese-Mammen N, Hersberger KE, Messerli M, et al. Pcne definition of medication review: Reaching agreement. *International Journal of Clinical Pharmacy* 2018;40(5):1199-208. doi: 10.1007/s11096-018-0696-7
4. Studer H, Felder N, Hersberger KE, et al. Medication reviews in hospitals: An overview of published guidelines. Presented at the 47th escp symposium on clinical pharmacy personalised

pharmacy care. 24–26 october 2018, belfast, northern ireland. *International Journal of Clinical Pharmacy* 2019;41(1):289-383. doi: 10.1007/s11096-018-0759-9
5. Pharmaceutical Care Network Europe. Pcne working group on medication review 2016 [Available from: https://www.pcne.org/working-groups/1/medication-review accessed 09.03.2018.
6. European Association of hospital pharmacists. The european statements of hospital pharmacy. *Eur J Hosp Pharm* 2015;21(5):256-58.
7. International Pharmaceutical Federation, World Health Organization. Good pharmacy practice - joint fip/who guidelines on gpp: Standards for quality of pharmacy services. *WHO Technical Report Series* 2011;No. 961
8. National Institute for Health and Care Exellence. Medication review 2017 [Available from: https://pathways.nice.org.uk/pathways/medicines-optimisation/medication-review#content=view-node%3Anodes-medicines-review accessed 17.01.2018.
9. National Institute for Health and Care Exellence. Medicines optimisation 2016 [Available from: https://www.nice.org.uk/guidance/ng5 accessed 17.01.2018.
10. National Institute for Health and Care Exellence. Medicines optimisation: The safe and effective use of medicines to enable the best possible outcomes 2015 [Available from: https://www.nice.org.uk/guidance/ng5 accessed 17.01.2018.
11. Bundesvereinigung Deutscher Apothekerverbände ABDA. Grundsatzpapier zur medikationsanalyse und zum medikationsmanagement 2014 [Available from: https://www.abda.de/themen/arzneimitteltherapiesicherheit/foerderinitiative-pharmazeutische-betreuung/medikationsmanagement/.
12. Royal Pharmaceutical Society. Medicines optimisation: Helping patients to make the most of medicines 2013 [Available from: https://www.rpharms.com/resources/ultimate-guides-and-hubs/medicines-optimisation-hub accessed 29.03.2018.
13. American Society of Health-System Pharmacists. Ashp guidelines: Minimum standard for pharmacies in hospitals 2013 [Available from: https://www.ashp.org/-/media/assets/policy-guidelines/docs/guidelines/minimum-standard-pharmacies-hospitals.ashx accessed 17.09.2020.
14. The Society of Hospital Pharmacists of Australia. Compiled quick guides shpa 2013 [Available from: https://www.shpa.org.au/sites/default/files/uploaded-content/website-content/SOP/quick_guides_e-book_2013.pdf accessed 17.09.2020.
15. Canadian Pharmacists Association. Pharmacheck guide - a guide for pharmacists to aid in identifying and resolving medication issues 2012 [Available from: https://www.pharmacists.ca/cpha-ca/assets/File/membership/PharmaCheckGuideforPharmacists2012EN.pdf accessed 11.03.2021.
16. Clyne W, Blenkinsopp A, Seal R. A guide to medication review 2008 - national prescribing centre 2008 [Available from: https://www.cff.org.br/userfiles/52%20-%20CLYNE%20W%20A%20guide%20to%20medication%20review%202008.pdf accessed 11.03.2021.
17. Leguelinel-Blache G, Arnaud F, Bouvet S, et al. Impact of admission medication reconciliation performed by clinical pharmacists on medication safety. *Eur J Intern Med* 2014;25(9):808-14. doi: 10.1016/j.ejim.2014.09.012 [published Online First: 2014/10/04]
18. Giannini O, Rizza N, Pironi M, et al. Prevalence, clinical relevance and predictive factors of medication discrepancies revealed by medication reconciliation at hospital admission: Prospective study in a swiss internal medicine ward. *BMJ Open* 2019;9(5):e026259. doi: 10.1136/bmjopen-2018-026259
19. Imfeld-Isenegger TL, Soares IB, Makovec UN, et al. Community pharmacist-led medication review procedures across europe: Characterization, implementation and remuneration. *Res Social Adm Pharm* 2020;16(8):1057-66. doi: 10.1016/j.sapharm.2019.11.002 [published Online First: 2019/11/18]
20. Studer H, Boeni F, Messerli M, et al. Clinical pharmacy activities in swiss hospitals: How have they evolved from 2013 to 2017? *Pharmacy* 2020;8(1):19. doi: 10.3390/pharmacy8010019

Part B Pharmacists' impact on drug-related problems at hospital discharge

DRPs occur frequently at hospital discharge. To obtain an impression of frequent DRPs in Swiss hospitals, we first described the patterns of DRPs discovered on discharge prescriptions in two different hospitals, a regional hospital and the cantonal hospital (Project B1). DRPs at hospital discharge may be the result of issues that could have been detected at hospital admission or during the hospital stay. Therefore, as a second step, we compared the effect of a pharmacist-led medication reconciliation at admission and / or interprofessional ward rounds during the hospital stay on the frequency of DRPs at hospital discharge (Project B2).

B1 Pattern of drug-related problems at hospital discharge in Switzerland

Two hospitals routinely documented all DRPs they identified on discharge prescriptions. They both had access to the hospital's patient records. We retrospectively described the pattern of the discovered DRPs with a focus on drug-drug interventions.

Patterns of drug-related problems at hospital discharge in Switzerland

This working report is a round-up of results from two small studies that were presented as poster 1) and 2).

1) **Patterns of drug-related problems at hospital discharge with a focus on drug-drug interactions**
International Journal of Clinical Pharmacy 2019; 42: 217-92

2) **Drug-related problems on hospital discharge prescriptions – a retrospective data analysis**
International Journal of Clinical Pharmacy 2020; 42: 813-31

Working report

Patterns of drug-related problems at hospital discharge in Switzerland

Background and Objective

Drug-related problems (DRPs) at hospital discharge, such as adverse drug events or potential drug-drug interaction, occur frequently.[1,2] Solving these DRPs may require pharmacists to contact the treating hospital physician.[3] A discharge prescription review by a pharmacist prior to hospital discharge could reduce these DRPs.[3,4] The aim of this data analysis was to depict the patterns of DRPs at hospital discharge in order to make some suggestions about which DRPs should be addressed with priority.

Setting and Method

The retrospective data analysis was conducted in two hospitals in Switzerland, one regional (267 beds) and one cantonal (180 beds) hospital. In both hospitals, pharmacists reviewed discharge prescriptions. In the regional hospital, all discharge prescriptions were sent to the hospital pharmacy and reviewed there by pharmacists. In the cantonal hospital, only the discharge prescriptions of those patients filling their prescription in the hospital's community pharmacy were reviewed by pharmacists. Both hospitals documented all DRPs discovered on these prescriptions; however, they did not use the same classification system. The regional hospital used a hospital internal classification system with 16 different categories. The cantonal hospital used an adapted version of the GSASA classification system[5] with four main categories and thirteen sub-categories. The data analysis was conducted using DRPs documented between June 2016 to May 2018.

The main outcome was the patterns of the different DRPs documented in the two hospitals. The secondary outcome was the frequency of drug-drug interactions.

Results

Pattern of DRPs at the regional hospital

The pharmacists of the regional hospital reviewed 9539 prescriptions and discovered 2539 DRPs (average 0.27 DRP per prescription). The pattern of DRPs at the regional hospital is shown in Table 1. Overall, 70.2% of DRPs discovered by the pharmacist led to a change of the discharge prescription. A fifth (20.4%) of pharmacists' recommendations following the DRPs were not accepted by physicians, for 3.9% of DRPs a comment was added to the discharge letter to the general practitioner, and for 2.1% the outcome was unclear.

Table 1 Pattern of DRPs discovered on prescriptions at a regional hospital in Switzerland (n=2539 DRPs) and the frequency of subsequent changes in the discharge prescription

Main category and sub-category	Frequency of DRPs	Frequency of DRPs leading to changes in the discharge prescription
	Number	**Number (%)**
Missing medication	363	211 (58.1%)
Dose too high	354	217 (61.3%)
Duplication	252	223 (88.5%)
Interaction	221	178 (80.5%)
Missing dosage	220	183 (83.2%)
No substitution back to home medication	217	141 (65.0%)
Dose too low	139	83 (59.7%)
Dosage unclear	137	117 (85.4%)
Indication unclear	103	64 (62.1%)
Therapy duration	88	58 (65.9%)
Timing or interval of medication taking	82	67 (81.7%)
Contraindication	80	51 (63.8%)
Product or galenic choice	78	53 (67.9%)
Dose adaption to kidney function	59	40 (67.8%)
Medication name misspelled	23	17 (73.9%)
Various	112	71 (63.4%)
Missing	11	8 (72.7%)
Total	2539	1782 (70.2%)

Pattern of DRPs at the cantonal hospital

The pharmacists of the cantonal hospital did not document how many prescriptions were reviewed during the study period. Nevertheless, they discovered 2754 DRPs, the pattern of which is shown in Table 2. In the cantonal hospital, 69.5% of the pharmacists' recommendations following the DRPs led to a change in the discharge prescription. For 12.7% of the DRPs, the physician was informed, but the outcome is unknown. In 6.5% of the cases, the DRP could be resolved directly with the patient. For 6.2% of DRPs a comment was added to the discharge letter to the general practitioner, 4.5% of the recommendations were not accepted by physicians, and for 0.4% the outcome was not documented.

Table 2 Pattern of DRPs discovered on prescriptions at a cantonal hospital in Switzerland (n=2754 DRPs) and the frequency of subsequent changes in the discharge prescription

Main category and sub-category	Frequency of DRPs	Frequency of DRPs leading to changes in the discharge prescription
	Number	Number (%)
1) Medication reconciliation problem at hospital admission	**706**	**495 (70.1%)**
1.1 Incorrect medication recorded	176	154
1.2 Omission of a medication	271	128
1.3 Incorrect strength/dose recorded	259	213
2) Prescribing problem during the hospital stay or at discharge	**1959**	**1402 (71.6%)**
2.1 Incorrect or lack of substitution back to patient's home medication	180	171
2.2 No restart of medication that was paused during the hospital stay	97	78
2.3 Missing/inappropriate dosage	619	437
2.4 Missing/inappropriate therapy duration	186	158
2.5 Medication not indicated or duplication	273	184
2.6 Untreated indication	261	197
2.7 No concordance with guideline or contraindication	69	39
2.8 Interaction	139	78
2.9 Adverse effect	42	24
2.10 Medication not suitable or of limited suitability	91	36
Missing sub-category	2	0
3) Incomplete patient documentation	**61**	**4 (6.6%)**
4) Other	**27**	**14 (51.9%)**
Missing	**1**	**0**
Total	**2754**	**1915 (69.5%)**

Comparison of the two hospitals

As the two hospitals used different classification systems to document their DRPs, we grouped the categories into common topics arising in both classification systems, in order to estimate the overall frequency of the problems. This comparison is shown in Table 3.

Table 3 Common topics of DRP categories from both hospitals with the frequency of DRPs within these topics in each hospital (regional: n=1710, cantonal: n=1826)

Problem topic	Grouped categories	Frequency, n (%)	Grouped categories	Frequency, n (%)
	Regional hospital (n=1710)		**Cantonal hospital (n=1826)**	
Dosage problem	Dose too high Missing dosage Dose too low Dosage unclear Dose adaption to kidney function	909 (53.2%)	1.3 Incorrect strength/dose recorded 2.3 Missing/inappropriate dosage	878 (48.1%)
Missing medication	Missing medication	363 (21.2%)	1.2 Omission of a medication 2.2 No restart of medication that was paused during the hospital stay 2.6 Untreated indication	629 (34.4%)
Substitution back to home medication	No substitution back to home medication	217 (12.7%)	2.1 Incorrect or lack of substitution back to patient's home medication	180 (9.9%)
Interaction	Interaction	221 (12.9%)	2.8 Interaction	139 (7.6%)

Secondary outcomes

There were 221 of 2539 DRPs due to drug-drug interactions at the regional hospital, which included 261 drug combinations (missing information on involved drug combinations, n=8). In the cantonal hospital, there were 139 of 2754 DRPs due to drug-drug interactions, which included 177 drug combinations (missing information, n=1). The most frequent medication combinations involved in these interactions at both hospitals were: A) thyroid therapy with mineral supplements, B) antibacterials for systemic use with mineral supplements, C) antibacterials for systemic use with psychoanaleptics, D) thyroid therapy with vitamins, E) psycholeptics with psychoanaleptics (Table 4). Interactions of the combinations A), B) and D) were often a problem of complexation, C) and E) were often a problem of QT interval prolongation.

Table 4 Frequency of the medication combinations involved in the interactions in the two hospitals (regional hospital: total n=261 combinations; cantonal hospital: total n=177)*

Medication combination (ATC code)	Frequency in regional hospital, n (%)	Frequency in cantonal hospital, n (%)
Thyroid therapy (H03) with mineral supplements (A12)	42 (16.1%)	12 (6.8%)
Antibacterials for systemic use (J01) with mineral supplements (A12)	19 (7.3%)	19 (10.7%)
Antibacterials for systemic use (J01) with psychoanaleptics (N06)	11 (4.2%)	10 (5.6%)
Thyroid therapy (H03) with vitamins (A11)#	11 (4.2%)	3 (1.7%)
Psycholeptics (N05)§ with psychoanaleptics (N06)$	11 (4.2%)	3 (1.7%)

*Combinations are shown if they appeared at least 10 times in one of the hospitals
#The category A11 includes multivitamin products
§Psycholeptics = e.g., anxiolytics, hypnotics and sedatives
$Psychoanaleptics = e.g., antidepressants

Discussion

The results presented here show that the two Swiss hospitals were both able to implement an intervention to identify DRPs on discharge prescriptions; however, they did not use the same classification system, thus hampering a direct comparison. Nevertheless, we identified topics that appear in both classification systems and found that in both hospitals problems are most frequently related to dosage, followed by missing medications. Other studies also found dosage problems to be frequent in patients' prescriptions after hospital discharge.[6,7] Although some problems with dosage can be discovered with the information provided on the discharge prescription (e.g., daily dose higher than licensed or recommended for patient's age), others can only be detected with access to clinical data (e.g., no dose adjustment to renal function). In regard to problems related to missing medications, other studies have described the omission of medication to be a frequent discrepancy detected during medication reconciliation at hospital discharge.[8,9] In order to facilitate the comparison of documented DRPs, it should be recommended that pharmacies use a validated classification system for documentation; such a classification system has been developed for the Swiss healthcare setting, the GSASA classification system.[5] The analysis of drug-drug interactions revealed two frequent types: complexation and risk of QT-interval prolongation. Although the problem of complexation can easily be solved in community pharmacies after discharge, hospital pharmacists should focus

on the second type of drug-drug interactions before discharge. Risk of QT-interval prolongation may require an electrocardiogram, which either exists in hospitals' patient records or can be ordered by treating hospital physicians. For DRPs needing clarification with the hospital physicians, it may be beneficial for pharmacists to address them within the hospital setting. Hospital pharmacists may have fewer barriers to contact treating hospital physicians than community pharmacists. In addition, they often have access to hospitals' patient records[10], which also allows the detection of DRPs needing access to clinical data. The overall high acceptance rate of pharmacists' recommendations for changes on the discharge prescriptions implies that the interventions were perceived to be relevant by physicians.

Conclusion

Pharmacists with access to hospitals' patient records were able to detect a variety of DRPs on discharge prescriptions. Their subsequent recommendations to physicians often led to changes in the discharge prescription, which implies their relevance. It shows the benefits of including pharmacists in the discharge process. For the documentation of DRPs, it should be recommended that pharmacists use a validated classification system (e.g., the GSASA classification system) to facilitate a direct comparison between hospitals.

References

1. Alqenae FA, Steinke D, Keers RN. Prevalence and nature of medication errors and medication-related harm following discharge from hospital to community settings: A systematic review. *Drug Safety* 2020;43(6):517-37. doi: 10.1007/s40264-020-00918-3
2. Egger SS, Drewe J, Schlienger RG. Potential drug-drug interactions in the medication of medical patients at hospital discharge. *Eur J Clin Pharmacol* 2003;58(11):773-8. doi: 10.1007/s00228-002-0557-z
3. Brühwiler LD, Beeler PE, Boni F, et al. A rct evaluating a pragmatic in-hospital service to increase the quality of discharge prescriptions. *Int J Qual Health Care* 2019 doi: 10.1093/intqhc/mzz043 [published Online First: 2019/05/16]
4. De Oliveira GS, Castro-Alves LJ, Kendall MC, et al. Effectiveness of pharmacist intervention to reduce medication errors and health-care resources utilization after transitions of care: A meta-analysis of randomized controlled trials. *J Patient Saf* 2017 doi: 10.1097/pts.0000000000000283
5. Maes KA, Tremp RM, GSASA Working group on clinical pharmacy, et al. Demonstrating the clinical pharmacist's activity: Validation of an intervention oriented classification system. *Int J Clin Pharm* 2015;37(6):1162-71. doi: 10.1007/s11096-015-0179-z [published Online First: 2015/08/21]
6. Neeman M, Dobrinas M, Maurer S, et al. Transition of care: A set of pharmaceutical interventions improves hospital discharge prescriptions from an internal medicine ward. *Eur J Intern Med* 2016 doi: 10.1016/j.ejim.2016.11.004
7. Daliri S, Hugtenburg JG, Ter Riet G, et al. The effect of a pharmacy-led transitional care program on medication-related problems post-discharge: A before—after prospective study. *PLOS ONE* 2019;14(3):e0213593. doi: 10.1371/journal.pone.0213593

8. Bonaudo M, Martorana M, Dimonte V, et al. Medication discrepancies across multiple care transitions: A retrospective longitudinal cohort study in italy. *PLOS ONE* 2018;13(1):e0191028. doi: 10.1371/journal.pone.0191028
9. Salameh LK, Abu Farha RK, Abu Hammour KM, et al. Impact of pharmacist's directed medication reconciliation on reducing medication discrepancies during transition of care in hospital setting. *Journal of Pharmaceutical Health Services Research* 2019;10(1):149-56. doi: 10.1111/jphs.12261
10. Studer H, Boeni F, Messerli M, et al. Clinical pharmacy activities in swiss hospitals: How have they evolved from 2013 to 2017? *Pharmacy* 2020;8(1):19. doi: 10.3390/pharmacy8010019

B2 The impact of pharmacist-led medication reconciliation and interprofessional ward rounds on drug-related problems at hospital discharge

To assess the effect of pharmaceutical interventions at hospital admission and during the hospital stay on DRPs at discharge, we evaluated a model implemented in the cantonal hospital of Zug. There, pharmacists were involved in the care of patients throughout the entire hospital stay. The model consisted of: (1) pharmacist-led medication reconciliation at hospital admission, (2) interprofessional ward rounds during hospital stay, and (3) medication review, medication reconciliation and patient education at hospital discharge. To assess the effect of the different pharmacist-led interventions prior to discharge, a group comparison of patients was conducted, according to the services patients received. For the retrospective analysis of the impact of the pharmaceutical interventions at hospital admission and during the hospital stay, data were extracted from the hospital's patient record, from the hospital's community pharmacy's patient record and from the hospital's clearing office. The extracted patient information was then linked with the documented DRPs (Figure 1). The details of the characteristics of the DRPs included in this study and an overview of the classification system used for the documentation of DRPs are shown in the additional study material (Table 3) and are published elsewhere.[96] The ethics proposal and approval can be found in Appendix IV and V, respectively.

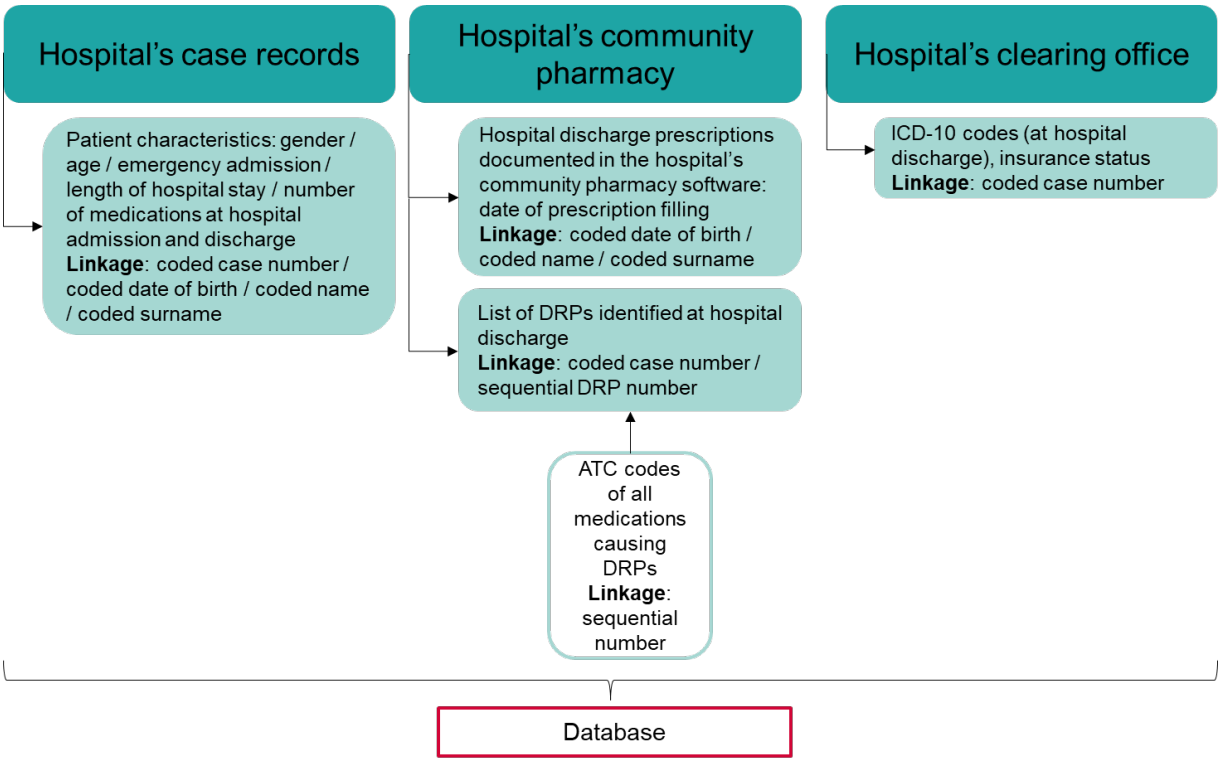


Figure 1 Overview of information sources used for the database ; ATC code = Anatomical Therapeutic Chemical Classification System; DRPs = drug-related problems; ICD-10 codes = International Statistical Classification of Diseases and Related Health Problems 10th revision

The impact of pharmacist-led medication reconciliation and interprofessional ward rounds on drug-related problems at hospital discharge

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The impact of pharmacist-led medication reconciliation and interprofessional ward rounds on drug-related problems at hospital discharge

Abstract

Background During transitions of care, including hospital discharge, patients are at risk of drug-related problems (DRPs). We investigated whether pharmacist-led services, specifically medication reconciliation or interprofessional ward rounds reduce DRPs at discharge.

Methods In this retrospective, single-center cohort study, we analyzed routinely collected data of patients discharged from the internal medicine wards of a regional Swiss hospital that filled their discharge prescriptions in the hospital's community pharmacy between June 2016 and May 2019. In comparison to the standard medication history taken by hospital physicians, patients with a planned hospital admission received a pharmacist-led medication reconciliation. During their hospital stay, patients had regular ward rounds (physician and nurse) and once a week interprofessional ward rounds (physician, nurse and clinical pharmacist).

At hospital discharge, pharmacists performed medication reviews on the discharge prescriptions filled at the hospital's community pharmacy and documented all identified DRPs. The data used for this study was retrieved from the hospital's patient records, community pharmacy records, and hospital's clearing office, and was linked to one database. Multivariable Poisson regression analyzed the independent effects of medication reconciliation and interprofessional ward rounds as single or combined service on the frequency of DRPs.

Results Overall, 4545 patients with 6072 hospital stays were included in the analysis. In 1352 stays (22.3%) one or more DRPs were detected. The combination of pharmacist-led medication reconciliation and interprofessional ward rounds was associated with a statistically significant decrease by 67% of the number of DRPs (relative risk [RR]: 0.33; 95% relative risk [RR]: 0.16, 0.65). Pharmacist-led medication reconciliation alone showed a trend towards fewer DRPs (RR: 0.75; 95% CI: 0.54, 1.03).

Conclusions Our results support the implementation of pharmacist-led medication reconciliation at admission in combination with interprofessional ward rounds to reduce DRPs at hospital discharge.

Introduction

Patient safety is at risk at transitions of care, especially at hospital admission and hospital discharge, and it can be impaired by drug-related problems (DRPs).[1,2] DRPs are defined as "an event or circumstance involving drug therapy that actually or potentially interferes with desired health outcomes".[3] They include medication errors, adverse drug reactions, as well as adverse drug events and frequently occur in patients discharged from the hospital. A recent systematic review showed that adult patients discharged from hospital to community settings experienced a median rate of medication errors, unintentional medication discrepancies, and adverse drug events of 53% [IQR 33–60.5, n=5 studies], 50% [IQR 39–76, n=11 studies], and in 19% [IQR 16-24, n=7 studies], respectively.[2]

Different approaches have been developed to reduce DRPs at transitions of care. Pharmacist-led transition of care services, such as medication reconciliation at hospital admission and/or discharge, patient counseling, and patient-centered follow-up have shown to reduce medication errors,[4] emergency room visits,[4] and hospital readmissions after discharge.[5,6] Medication reconciliation is "the formal process in which health care professionals' [sic] partner with patients to ensure accurate and complete medication information transfer at interfaces of care".[7] This process aims at obtaining a Best Possible Medication History (BPMH) and at reducing unintentional discrepancies.[7] Frequent discrepancies discovered during medication reconciliation include omission of (chronic) medications,[6,8,9] lack of documentation,[8] addition of new medicines,[9] and formulary substitution back to patients home medication.[6] Pharmacist-led medication reconciliation can reduce medication discrepancies at hospital transitions.[9,10]

An additional approach to reduce DRPs in the hospital setting is the involvement of pharmacists in patient care during the hospital stay. This approach showed positive effects on various patient outcomes.[11,12] In critically ill patients, a significant reduction in mortality and adverse drug events was seen in the intervention group that included a pharmacist in patient care.[11] Pharmacists' activities, including attending ward rounds, performing educational sessions, being involved in medication safety programs, or reviewing prescriptions in pediatric patients led to a reduction of medication errors[12] and to an improvement of the quality of prescribing.[13] Frequent DRPs identified by clinical pharmacists that led to an immediate change in the patient's medication regimen during the ward rounds were: inappropriate dose, indicated medicine not prescribed and prescribed medicine not indicated.[14]

A national survey conducted in Switzerland revealed that only approximately 10% of hospitals offering clinical pharmacy services, conducted pharmacist-led medication reconciliation at hospital admission regularly (at least weekly). In contrast, interprofessional ward rounds including a pharmacist were regularly (at least weekly) conducted in selected wards in approximately 70% of the hospitals.[15] At hospital discharge, patients are usually given a discharge prescription that can be filled in a community pharmacy, which does not have routine access to clinical data of patients. It remains unclear how pharmacists should be integrated throughout the hospitalization process to best support patients at hospitals discharge. In Switzerland, one example of a comprehensive pharmacist-led service is provided at the cantonal hospital of Zug, where pharmacists are involved throughout the entire hospital stay. These pharmacists documented their activities performed during this service.

The main aim of this study was to analyze the impact of single activities and their combination (pharmacist-led medication reconciliation at admission and interprofessional ward rounds during hospital stay) on the number of DRPs at hospital discharge. The secondary aim was to describe the influence of these pharmacist-led activities on the pattern of DRPs.

Methods

Study design

In this retrospective, single-center cohort study, we analyzed routinely collected data of inpatients discharged from the cantonal hospital of Zug (180 beds) in Switzerland. The study included adult patients (≥ 18 years) discharged from the internal medicine wards between 1st of June 2016 and 31st of May 2019 who filled their discharge prescriptions in the hospital's community pharmacy. Patients were excluded if their DRPs were documented inconclusively.

The pharmacists of the cantonal hospital of Zug routinely performed structured medication reconciliation in patients admitted to the hospital, conducted interprofessional ward rounds during the hospital stay and performed medication reconciliation followed by medication reviews at hospital discharge.

Medication reconciliation at admission: At hospital admission, pharmacy technicians, specifically trained in medication reconciliation, regularly took medication histories of most patients with planned admission by using a structured form and at least two different sources of information (e.g. patients own medication, medication history from the general practitioner, patient interview). Subsequently, a pharmacist, specifically trained in medication reconciliation, reviewed the recorded medication and forwarded the resulting BPMH together with potential medication

recommendations to the responsible hospital physician. In contrast, for patients with unplanned hospital admissions (emergency admissions), the medication history was taken without a structured form by a physician in the emergency department.

Interprofessional ward rounds: During the patient's hospital stay, ward rounds were conducted by physicians and nurses on a daily basis. Once a week, they were accompanied by a clinical pharmacist who focused on identifying and resolving potential and manifest DRPs. Henceforth, the ward rounds accompanied by a pharmacist will be referred to as interprofessional ward rounds.

Medication reconciliation and medication review at discharge: Prior to hospital discharge, all patients were asked if they agreed to fill their discharge prescriptions in the hospital's community pharmacy. Pharmacists screened all discharge prescriptions filled in the hospital's community pharmacy using predefined risk factors for DRPs (≥5 medicines, ≥65 years, lack of instructions on therapy duration, ≥1 discrepancy between prescription and home medication, or one of the following medicines: anti-infectives, antiepileptics, oral anticoagulants, antiplatelets) and performed medication reconciliation followed by a medication review based on the risk score (0-1 risk factors = simple medication review, 2 risk factors = intermediate review, ≥3 risk factors = advanced medication review; according to types of medication review defined by the Pharmaceutical Care Network Europe[16]). Pharmacists documented all DRPs discovered in a classification system (adapted GSASA classification system[17]). All patients who filled their prescription in the hospital's community pharmacy were counselled on their discharge medications by the pharmacy team. Further details on the methods have been reported elsewhere.[18]

These different situations with involvement of pharmacists in patient care at admission and during the hospital stay led to different workflows and produced different patient paths. From the different exposure to pharmacist-led services, we defined four study groups (Best Care, Medication Reconciliation [MedRec], Ward Round, and Standard Care) (Figure 1).

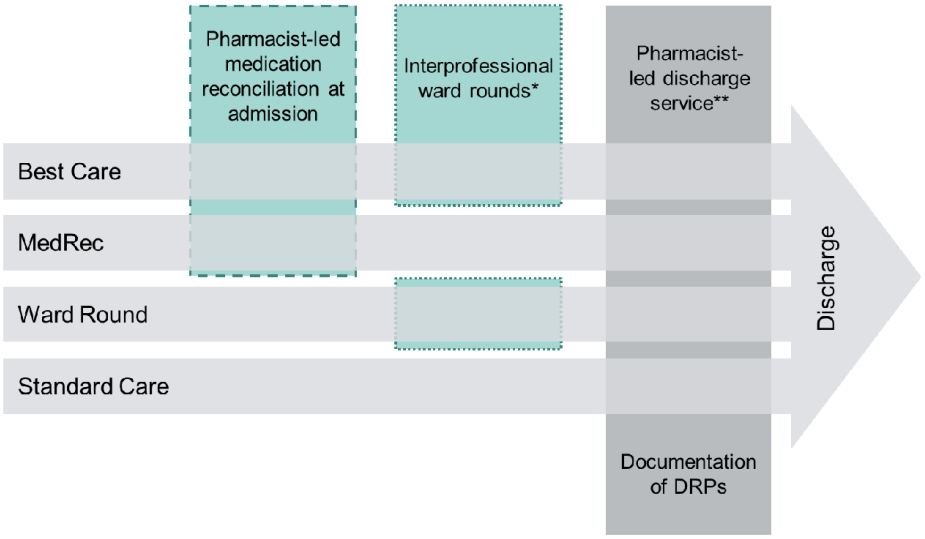

*Figure 1 Patient paths at the cantonal hospital of Zug from admission to discharge corresponding to the four defined study groups (dashed border = pharmacist-led service at admission, dotted border = pharmacist-led service during hospital stay). DRPs = drug-related problems; MedRec = Medication Reconciliation at admission; *Interprofessional ward rounds = ward rounds including a pharmacist, physician and nurse; **Pharmacist-led discharge service included medication reconciliation at discharge, medication review and discharge counselling.*

Outcomes

The primary outcome of this study was the number of DRPs at hospital discharge in the four study groups. The secondary outcome was the pattern of the causes of DRPs stratified by the four study groups.

Data analysis

The database used for this analysis was based on information retrieved from the hospital's patient records, the hospital's community pharmacy records and the hospital's clearing office (details shown in Supplement A). For each hospital stay the number of Elixhauser comorbidities[19,20] was calculated. For the primary outcome, a multivariable Poisson regression model was used with the number of DRPs at discharge as dependent variable and the following independent variables: study group, age at discharge, gender, type of admission, length of stay, number of medicines at discharge and insurance status. The effect sizes were expressed as relative risks (RR) with 95% confidence intervals (CIs). A multivariable logistic regression compared stays without DRPs at hospital discharge to stays with at least one DRP. The independent variables were the same as those mentioned above, and the effect sizes were expressed as odds ratios (OR) with 95% CIs. Distributions of continuous

variables are presented as means with standard deviations (SD) if normally distributed, otherwise as medians with interquartile ranges (IQR). For categorical variables, counts and percentages were calculated. Statistical significance was accepted at a P-value of ≤0.05. The analysis was conducted on hospital stays (one stay corresponded to one discharge prescription). It was possible for patients to have more than one stay during the study period. Analyses were performed using R Version 3.6.1. (R Foundation for Statistical Computing, Vienna, Austria).

Ethics

The study was approved by the ethics committee of Northwest and Central Switzerland (EKNZ: 2018-01462; 30.08.2018).

Results

In total, 6087 hospital stays fulfilled the inclusion criteria for this study. Fifteen stays were excluded due to inconclusive documentation of DRPs, leaving 6072 hospital stays of 4545 individual patients for analysis. Patient characteristics are presented in Table 1. During the medication reviews at hospital discharge, pharmacists detected a total of 1876 DRPs in the study population. In 1352 (22.3%) hospital stays, at least one DRP was reported. The distribution of the number of DRPs per hospital stay stratified by the four study groups is presented in Table 2.

Table 1 Characteristics of hospital stays (n=6072) overall and stratified by the four study groups: Best Care, MedRec (Medication reconciliation), Ward Round and Standard Care

		Study groups			
	Study population (n=6072)	Best Care (n=72)	MedRec (n=232)	Ward Round (n=1262)	Standard Care (n=4506)
Age at discharge, median [IQR]	75 [61, 83]	79 [64, 82]	75 [63, 82]	76 [62, 84]	75 [61, 83]
Female, n (%)	3012 (49.6)	42 (58.3)	134 (57.8)	618 (49.0)	2218 (49.2)
Planned admission, n (%)	592 (9.7)	62 (86.1)	206 (88.8)	66 (5.2)	258 (5.7)
Length of stay (in days), median [IQR]	4.6 [2.9, 7.5]	6.15 [3.15, 8.12]	3.2 [2.1, 6.1]	6.65 [4.1, 10.1]	4.1 [2.7, 6.8]
Number of medicines at admission, median [IQR]	5 [3, 9]	7 [4, 11]	7.5 [5, 11]	6 [3, 10]	5 [2, 9]
Number of medicines at discharge, median [IQR]	7 [4, 10]	8 [6, 12]	8 [5, 11]	8 [5, 11]	7 [4, 10]
Number of Elixhauser comorbidities [19,20], median [IQR]	2 [1, 4]	3 [2, 5]	2 [1, 4]	3 [2, 4]	2 [1, 4]
Frequency of specific Elixhauser comorbidities*, n (%)					
Hypertension (uncomplicated and complicated)	3065 (50.5)	45 (62.5)	111 (47.8)	672 (53.2)	2237 (49.6)
Cardiac arrhythmias	1565 (25.8)	19 (26.4)	43 (18.5)	325 (25.8)	1178 (26.1)
Renal failure	1529 (25.2)	21 (29.2)	50 (21.6)	374 (29.6)	1084 (24.1)
Fluid and electrolyte disorders	1181 (19.4)	12 (16.7)	25 (10.8)	323 (25.6)	821 (18.2)
Diabetes (uncomplicated and complicated)	1070 (17.6)	17 (23.6)	35 (15.1)	271 (21.5)	747 (16.6)
Congestive heart failure	984 (16.2)	14 (19.4)	24 (10.3)	242 (19.2)	704 (15.6)
Chronic pulmonary disease	736 (12.1)	8 (11.1)	29 (12.5)	193 (15.3)	506 (11.2)
Cancer	695 (11.4)	12 (16.7)	43 (18.5)	143 (11.3)	497 (11.0)
Health insurance status, n (%)					
Standard	4412 (72.7)	72 (100.0)	149 (64.2)	1251 (99.1)	2940 (65.2)
Semi-private	29 (0.5)	0 (0.0)	3 (1.3)	0 (0.0)	26 (0.6)
Private	1631 (26.9)	0 (0.0)	80 (34.5)	11 (0.9)	1540 (34.2)

* Elixhauser comorbidities occurring in more than 10% of patients in the overall study population

Table 2 Distribution of the number of DRPs at hospital discharge per stay stratified by the four study groups (n=6072 hospital stays)

		Study groups			
	Study population (n=6072)	Best Care (n=72)	MedRec (n=232)	Ward Round (n=1262)	Standard Care (n=4506)
Number of stays without DRP at discharge, n (%)	4720 (77.7)	64 (88.9)	189 (81.5)	956 (75.8)	3511 (77.9)
Number of stays with at least one DRP, n (%)	1,352 (22.3%)	8 (11.1)	43 (18.5)	306 (24.2)	995 (22.1)
Number of DRPs at discharge per stay, n (%)					
1	956 (15.7)	7 (9.7)	28 (12.1)	215 (17.0)	706 (15.7)
2	301 (5.0)	1 (1.4)	14 (6.0)	70 (5.5)	216 (4.8)
3	67 (1.1)	0 (0.0)	1 (0.4)	17 (1.3)	49 (1.1)
4	21 (0.3)	0 (0.0)	0 (0.0)	3 (0.2)	18 (0.4)
5	4 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	4 (0.1)
6	3 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	2 (0.0)

Primary outcome

The Poisson regression model and the logistic regression model both showed a statistically significant association with fewer DRPs and no DRPs, respectively, at hospital discharge in the Best Care group (Table 2). The MedRec group showed a substantial trend, regarding the Poisson model nearly reaching statistical significance. Each additional medicine was associated with a 10%-increase in the relative risk for more DRPs at discharge, and each additional year of patient age increased the relative risk by 2%. Two further models (i) controlling for renal failure and (ii) for the number of Elixhauser comorbidities[19,20] instead of the number of medicines as independent variables, both showed similar associations (Supplement B and C, respectively).

Table 2 Poisson regression model with the number of drug-related problems as outcome, and logistic regression model for the stays with no versus least one drug-related problem, n=6072 stays

	Poisson regression model for the number of DRPs at discharge	Logistic regression model for the number stays with no versus at least one DRP at discharge
	Relative risk (95% CI)	Odds ratio (95% CI)
Study group, Standard Care	**1.00 [Reference]**	**1.00 [Reference]**
Study group, Best Care	**0.33 (0.16, 0.65)**	**0.37 (0.17, 0.82)**
Study group, MedRec	**0.75 (0.54, 1.03)**	**0.78 (0.51, 1.19)**
Study group, Ward Round	**0.96 (0.85, 1.08)**	**1.00 (0.85, 1.18)**
Age, per additional year	1.02 (1.02, 1.02)	1.02 (1.01, 1.02)
Sex, male	1.00 [Reference]	1.00 [Reference]
Sex, female	0.96 (0.88, 1.05)	0.91 (0.80, 1.03)
Admission type, emergency	1.00 [Reference]	1.00 [Reference]
Admissions type, planned	0.99 (0.80, 1.22)	0.90 (0.68, 1.19)
Length of stay, per additional day	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)
Number of medicines at discharge, per additional medicine	1.10 (1.09, 1.11)	1.12 (1.10, 1.13)
Insurance status, standard	1.00 [Reference]	1.00 [Reference]
Insurance status, half-private	0.67 (0.32,1.44)	0.64 (0.23,1.78)
Insurance status, private	0.97 (0.87, 1.08)	1.00 (0.86, 1.16)

CI = confidence interval, DRP = drug-related problem, MedRec = Medication Reconciliation, bold = study groups

Secondary outcome

On the discharge prescriptions of the 6072 hospital stays, pharmacists detected a total of 1876 DRPs (mean=0.31 DRPs per hospital stay). The analysis of the causes of these DRPs (Figure 2) showed that in the Best Care group none of the DRPs were caused by medication reconciliation problems at hospital admission, while in the MedRec group three were caused by medication reconciliation problems (5.1%), 97 (23.0%) in the Ward Round group and 338 (24.4%) in the Standard Care group.

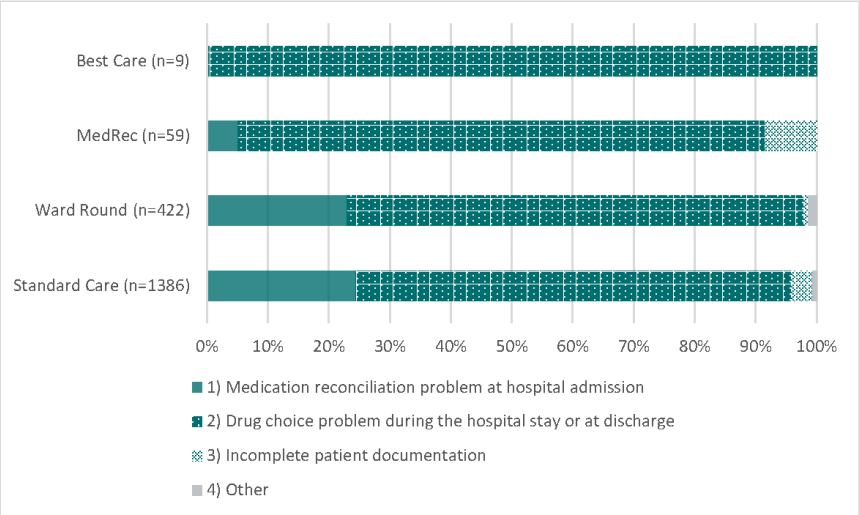

Figure 2 Causes of DRPs within the four study groups, shown as percentages (n=1876 DRPs)

Discussion

In this retrospective single-center cohort study, we found a significant association of the combined pharmacist-led services (medication reconciliation at admission and interprofessional ward round during hospital stay) with a reduction of DRPs at hospital discharge. Pharmacist-led medication reconciliation at admission as a single service showed a trend to a reduction of DRPs at hospital discharge. Both these groups (Best Care and MedRec) received a structured pharmacist-led medication reconciliation at hospital admission, while in the Ward Round and Standard Care group the medication history was taken by the hospital physicians.

These findings are in line with the literature. Medication reconciliation at transitions of care was effective in identifying medication discrepancies,[21,22] and in reducing unintentional medication discrepancies.[22] The combination of medication reconciliation and patient education at discharge reduced readmissions.[6] Undetected medication discrepancies at hospital admission often result in persisting discrepancies during the hospital stay and even until hospital discharge.[23] Even though some of these medication discrepancies might be of negligible clinical significance during the hospital stay, their clinical importance likely increases if they persist after hospital discharge.[24] Studies found that 21%-42% of the discrepancies detected in patients' medications at admission were judged to be clinically relevant, a few were rated as serious or life-threatening.[21,22]

Regarding the study group that only received interprofessional ward rounds, our findings did not show a reduction in DRPs at hospital discharge compared to the control group. We believe that pharmacists' interventions during ward rounds focus more on patient's acute health problems than on the optimization of discharge prescriptions. Furthermore, if pharmacists' interventions during the ward rounds are based on a medication list that is not accurate, they may not be able to detect and resolve issues that are due to a medication reconciliation problem at admission. In the Ward Round group, approximately a quarter of DRPs were related to medication reconciliation problems at admission. In the present study, we did not evaluate the effect of interprofessional ward rounds on DRPs *during* the hospital stay. But other studies that included pharmacists in ward rounds, had shown an improved quality of medication prescribing[13] and a reduction in adverse events and mortality.[11]

We found associations between the number of DRPs and other independent variables included in the regression models, namely the number of medicines at discharge, age, renal function and comorbidities. But out of these well-known risk factors[25,26] only the number of medicines at discharge can be influenced by pharmacists.[25] We observed an association per additional medicine at discharge. Therefore, checking for opportunities for deprescribing should be promoted.

In our study, medication reconciliation and obtaining the best possible medication history at hospital admission was undertaken by pharmacy technicians under the supervision of clinical pharmacists. Other studies have successfully involved pharmacy technicians in the medication reconciliation process.[6,27] Involving properly trained pharmacy technicians in medication reconciliation can help to free pharmacist resources for clinical tasks such as subsequent medication reviews. It can also help to implement the process at a lower cost.[28] Implementation of a risk score at admission to select patients that most benefit from subsequent pharmacist-led interventions might also help optimize the use of limited resources.[29]

Concerning the frequency and the pattern of DRPs at hospital discharge, we found that pharmacists were able to identify a total of 1876 DRPs, resulting in one of three discharge prescriptions with at least one DRP. Most of the DRPs were caused by prescribing problems during the hospital stay or at discharge. Comparing the whole study population with the Best Care group reveals a 50% reduction of patients with one or more DRPs at hospital discharge from 22.3% to 11.1%. A study from New Zealand found a similar rate as we discovered in the overall study population, with a frequency of 25% of discharge prescriptions with at least one DRP.[30] However, since the studies used different documentation tools for DRPs, this comparison has to be interpreted with caution. Furthermore, in our study, the data collection was part of the

routine discharge process and it was not especially collected for study purpose, which might have led to an under-reporting of DRPs, as some minor problems of low clinical relevance may not always have been documented as DRPs.

Overall, our study further confirms the benefits of pharmacist-led services at transitions of care. As observed in the regression models, medication reconciliation at admission as single activity was associated with a trend to a reduction of DRPs at discharge and interprofessional ward rounds were not, we hypothesize that medication reconciliation plays a key role in the reduction of DRPs. Conducting systematic medication reconciliation at transitions of care is also endorsed by the Swiss Patient Safety Foundation and international recommendations of the World Health Organization and the International Pharmaceutical Federation. They recognize the risk that medication discrepancies pose to medication safety during transitions of care and advocate the involvement of pharmacists in this process and an enhanced transfer of information from the hospital to the primary care providers.[31-33]

Strengths and limitations

The strengths of this study were the large sample size with over 6000 hospital stays and the fact that the study was conducted with routinely collected real-life data. The investigated services were not implemented for the purpose of the study, but were part of the routine process, which highlights the feasibility of the services. The limitations of our study should be taken into account when interpreting our results. First, this was a single center study, which limits the generalizability of the findings. Second, the sample sizes of the study groups differed substantially. However, despite the small size of the Best Care group, the results still suggested a statistically significant reduction in DRPs at hospital discharge.

Conclusion

The findings of this study showed that pharmacists frequently detected DRPs at hospital discharge. Moreover, a combination of pharmacist-led medication reconciliation at hospital admission and interprofessional ward rounds during the stay showed an independent significant association with a reduction of the number of DRPs on the discharge prescription. The pharmacist-led medication reconciliation at hospital admission seemed to play a key role in this reduction, as it showed a substantial trend for a reduction of DRPs as a single activity. These results should stimulate the inclusion of pharmacists in the patients' paths and clinicians' workflows throughout the hospital stay, especially at transitions of care, to improve patient safety.

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Competing interests

The authors declare that there are no competing interests.

Data availability statement

Data are available from the corresponding author upon reasonable request.

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References

1. Parekh N, Ali K, Page A, et al. Incidence of medication-related harm in older adults after hospital discharge: A systematic review. *J Am Geriatr Soc* 2018;66(9):1812-22. doi: 10.1111/jgs.15419
2. Alqenae FA, Steinke D, Keers RN. Prevalence and nature of medication errors and medication-related harm following discharge from hospital to community settings: A systematic review. *Drug Safety* 2020;43(6):517-37. doi: 10.1007/s40264-020-00918-3
3. Pharmaceutical Care Network Europe. Drug-related problems [Available from: https://www.pcne.org/working-groups/2/drug-related-problem-classification accessed 19.02.2021.
4. De Oliveira GS, Castro-Alves LJ, Kendall MC, et al. Effectiveness of pharmacist intervention to reduce medication errors and health-care resources utilization after transitions of care: A meta-analysis of randomized controlled trials. *J Patient Saf* 2017 doi: 10.1097/pts.0000000000000283
5. Rodrigues CR, Harrington AR, Murdock N, et al. Effect of pharmacy-supported transition-of-care interventions on 30-day readmissions: A systematic review and meta-analysis. *Annals of Pharmacotherapy* 2017;51(10):866-89. doi: 10.1177/1060028017712725
6. Zemaitis CT, Morris G, Cabie M, et al. Reducing readmission at an academic medical center: Results of a pharmacy-facilitated discharge counseling and medication reconciliation program. *Hospital Pharmacy* 2016;51(6):468-73. doi: 10.1310/hpj5106-468
7. World Health Organization. The high 5s project - implementation guide 2014 [Available from: https://www.who.int/patientsafety/implementation/solutions/high5s/h5s-guide.pdf?ua=1 accessed 28.01.2021.
8. Bonaudo M, Martorana M, Dimonte V, et al. Medication discrepancies across multiple care transitions: A retrospective longitudinal cohort study in italy. *PLOS ONE* 2018;13(1):e0191028. doi: 10.1371/journal.pone.0191028
9. Salameh LK, Abu Farha RK, Abu Hammour KM, et al. Impact of pharmacist's directed medication reconciliation on reducing medication discrepancies during transition of care in hospital setting. *Journal of Pharmaceutical Health Services Research* 2019;10(1):149-56. doi: 10.1111/jphs.12261

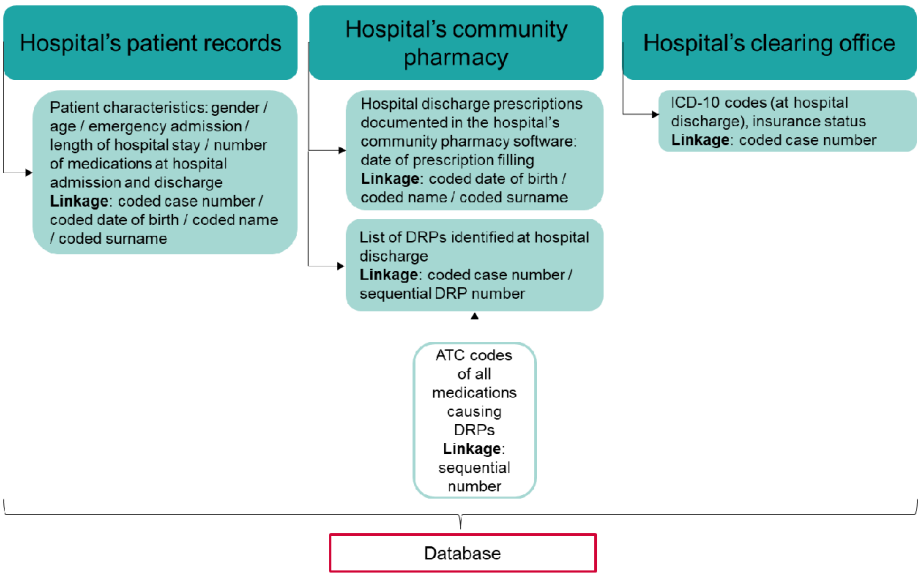
10. Mekonnen AB, McLachlan AJ, Brien JA. Pharmacy-led medication reconciliation programmes at hospital transitions: A systematic review and meta-analysis. *Journal of clinical pharmacy and therapeutics* 2016;41(2):128-44. doi: 10.1111/jcpt.12364
11. Lee H, Ryu K, Sohn Y, et al. Impact on patient outcomes of pharmacist participation in multidisciplinary critical care teams: A systematic review and meta-analysis. *Critical Care Medicine* 2019;47(9):1243-50. doi: 10.1097/ccm.0000000000003830
12. Naseralallah LM, Hussain TA, Jaam M, et al. Impact of pharmacist interventions on medication errors in hospitalized pediatric patients: A systematic review and meta-analysis. *International Journal of Clinical Pharmacy* 2020;42(4):979-94. doi: 10.1007/s11096-020-01034-z
13. Mulvogue K, Roberts JA, Coombes I, et al. The effect of pharmacists on ward rounds measured by the stopp/start tool in a specialized geriatric unit. *Journal of clinical pharmacy and therapeutics* 2017;42(2):178-84. doi: 10.1111/jcpt.12489
14. Reinau D, Furrer C, Stampfli D, et al. Evaluation of drug-related problems and subsequent clinical pharmacists' interventions at a swiss university hospital. *Journal of clinical pharmacy and therapeutics* 2019;44(6):924-31. doi: 10.1111/jcpt.13017 [published Online First: 2019/08/14]
15. Studer H, Boeni F, Messerli M, et al. Clinical pharmacy activities in swiss hospitals: How have they evolved from 2013 to 2017? *Pharmacy* 2020;8(1):19. doi: 10.3390/pharmacy8010019
16. Griese-Mammen N, Hersberger KE, Messerli M, et al. Pcne definition of medication review: Reaching agreement. *International Journal of Clinical Pharmacy* 2018;40(5):1199-208. doi: 10.1007/s11096-018-0696-7
17. Maes KA, Tremp RM, GSASA Working group on clinical pharmacy, et al. Demonstrating the clinical pharmacist's activity: Validation of an intervention oriented classification system. *Int J Clin Pharm* 2015;37(6):1162-71. doi: 10.1007/s11096-015-0179-z [published Online First: 2015/08/21]
18. Imfeld-Isenegger TL, Studer H, Ceppi MG, et al. Detection and resolution of drug-related problems at hospital discharge focusing on information availability – a retrospective analysis. *accepted at ZEFQ*
19. Elixhauser A, Steiner C, Harris DR, et al. Comorbidity measures for use with administrative data. *Medical Care* 1998;36(1):8-27.
20. Quan H, Sundararajan V, Halfon P, et al. Coding algorithms for defining comorbidities in icd-9-cm and icd-10 administrative data. *Med Care* 2005;43(11):1130-9. doi: 10.1097/01.mlr.0000182534.19832.83 [published Online First: 2005/10/15]
21. Giannini O, Rizza N, Pironi M, et al. Prevalence, clinical relevance and predictive factors of medication discrepancies revealed by medication reconciliation at hospital admission: Prospective study in a swiss internal medicine ward. *BMJ Open* 2019;9(5):e026259. doi: 10.1136/bmjopen-2018-026259
22. Leguelinel-Blache G, Arnaud F, Bouvet S, et al. Impact of admission medication reconciliation performed by clinical pharmacists on medication safety. *Eur J Intern Med* 2014;25(9):808-14. doi: 10.1016/j.ejim.2014.09.012 [published Online First: 2014/10/04]
23. Cornu P, Steurbaut S, Leysen T, et al. Effect of medication reconciliation at hospital admission on medication discrepancies during hospitalization and at discharge for geriatric patients. *Ann Pharmacother* 2012;46(4):484-94. doi: 10.1345/aph.1Q594
24. Nilsson N, Lea M, Lao Y, et al. Medication discrepancies revealed by medication reconciliation and their potential short-term and long-term effects: A norwegian multicentre study carried out on internal medicine wards. *European Journal of Hospital Pharmacy* 2015;22(5):298-303. doi: 10.1136/ejhpharm-2015-000686
25. Morath B, Mayer T, Send AFJ, et al. Risk factors of adverse health outcomes after hospital discharge modifiable by clinical pharmacist interventions: A review with a systematic approach. *Brit J Clin Pharmaco* 2017;83(10):2163-78. doi: 10.1111/bcp.13318
26. Kaufmann CP, Stampfli D, Hersberger KE, et al. Determination of risk factors for drug-related problems: A multidisciplinary triangulation process. *BMJ Open* 2015;5(3):e006376. doi: 10.1136/bmjopen-2014-006376

27. Daliri S, Hugtenburg JG, Ter Riet G, et al. The effect of a pharmacy-led transitional care program on medication-related problems post-discharge: A before—after prospective study. *PLOS ONE* 2019;14(3):e0213593. doi: 10.1371/journal.pone.0213593
28. Phatak A, Prusi R, Ward B, et al. Impact of pharmacist involvement in the transitional care of high-risk patients through medication reconciliation, medication education, and postdischarge call-backs (ipitch study). *J Hosp Med* 2016;11(1):39-44. doi: 10.1002/jhm.2493
29. Stampfli D, Boeni F, Gerber A, et al. Assessing the ability of the drug-associated risk tool (dart) questionnaire to stratify hospitalised older patients according to their risk of drug-related problems: A cross-sectional validation study. *BMJ Open* 2018;8(6):e021284. doi: 10.1136/bmjopen-2017-021284 [published Online First: 2018/06/29]
30. Braund R, Coulter CV, Bodington AJ, et al. Drug related problems identified by community pharmacists on hospital discharge prescriptions in new zealand. *International Journal of Clinical Pharmacy* 2014;36(3):498-502. doi: 10.1007/s11096-014-9935-8
31. Stiftung Patientensicherheit Schweiz. Statement on medication safety at transitions of care [erklaerung sichere medikation an schnittstellen] 2017 [Available from: https://www.patientensicherheit.ch/fileadmin/user_upload/1_Projekte_und_Programme/progress_sichere_med._schnittstellen/progress_sms_d/Erklaerung_Sichere_Medikation_FIN_01.pdf accessed 16.12.2020.
32. World Health Organization. The high 5s project - standard operating protocol 2014 [Available from: https://www.who.int/patientsafety/implementation/solutions/high5s/h5s-sop.pdf accessed 20.05.2021.
33. International Pharmaceutical Federation. Medicines reconciliation: A toolkit for pharmacists 2021 [Available from: https://www.fip.org/file/4949 accessed 20.05.2021.

Supplement

Supplement A: Development and validation of the database

The database used for this analysis was based on information retrieved from the hospital's patient records, hospital's community pharmacy records and hospital's clearing office. The overview below shows the information that was extracted from the records and the information used for the linkage.



The output tables of database used for the analyses were validated by two research pharmacists of the study team, who had temporary reading access to the records. For the validation a random sample of 1% of patient stays was selected.

Supplement B: Poisson regression model and logistic regression model additionally including renal failure as independent variable (n=6072 stays)

	Poisson regression model for the number of DRPs at discharge	Logistic regression model for the number stays with no or at least one DRP at discharge
	Relative risk (95% CI)	Odds ratio (95% CI)
Study group, Standard Care	**1.00 [Reference]**	**1.00 [Reference]**
Study group, Best Care	**0.33 (0.17, 0.65)**	**0.37 (0.17,0.82)**
Study group, MedRec	**0.75 (0.55, 1.04)**	**0.78 (0.51, 1.20)**
Study group, Ward Round	**0.96 (0.85, 1.08)**	**1.00 (0.85, 1.18)**
Age, per additional year	1.02 (1.01, 1.02)	1.02 (1.01, 1.02)
Sex, male	1.00 [Reference]	1.00 [Reference]
Sex, female	0.96 (0.88, 1.06)	0.91 (0.81, 1.04)
Admission type, emergency	1.00 [Reference]	1.00 [Reference]
Admissions type, planned	0.99 (0.80, 1.22)	0.90 (0.67, 1.19)
Length of stay, per additional day	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)
Number of medicines at discharge, per additional medicine	1.10 (1.09, 1.11)	1.11 (1.10, 1.13)
Insurance status, standard	1.00 [Reference]	1.00 [Reference]
Insurance status, half-private	0.69 (0.33, 1.47)	0.66 (0.24, 1.85)
Insurance status, private	0.97 (0.87, 1.08)	1.01 (0.87, 1.17)
Renal failure	1.11 (1.00, 1.22)	1.21 (1.05, 1.40)

CI = confidence interval, DRP = drug-related problem, MedRec = Medication Reconciliation, bold = study groups

Supplement C: Poisson regression model and logistic regression model including the number of Elixhauser comorbidities per patient (instead of the number of medicines) as independent variable (n=6072 stays)

	Poisson regression model for the number of DRPs at discharge	Logistic regression model for the number stays with no or at least one DRP at discharge
	Relative risk (95% CI)	Odds ratio (95% CI)
Study group, Standard Care	**1.00 [Reference]**	**1.00 [Reference]**
Study group, Best Care	**0.35 (0.18,0.69)**	**0.39 (0.18,0.86)**
Study group, MedRec	**0.82 (0.59,1.12)**	**0.84 (0.55,1.28)**
Study group, Ward Round	**0.97 (0.87,1.10)**	**1.02 (0.86,1.20)**
Age, per additional year	1.02 (1.02,1.02)	1.02 (1.02,1.03)
Sex, male	1.00 [Reference]	1.00 [Reference]
Sex, female	1.00 (0.91,1.09)	0.95 (0.84,1.07)
Admission type, emergency	1.00 [Reference]	1.00 [Reference]
Admissions type, planned	1.02 (0.83,1.26)	0.95 (0.72,1.25)
Length of stay, per additional day	1.01 (1.00,1.02)	1.01 (1.00,1.02)
Insurance status, standard	1.00 [Reference]	1.00 [Reference]
Insurance status, half-private	0.74 (0.35,1.58)	0.70 (0.26,1.89)
Insurance status, private	0.98 (0.88,1.10)	1.01 (0.88,1.18)
Number of Elixhauser comorbidities per patient	1.09 (1.06,1.12)	1.11 (1.07,1.15)

CI = confidence interval, DRP = drug-related problem, MedRec = Medication Reconciliation, bold = study groups

Additional study material – characteristics of the DRPs

Table 3 Number and categories of drug-related problems identified at hospital discharge by the hospital's community pharmacy (n=1876) and the number of drug-related problems leading to a change in the discharge prescription, published elsewhere[96]

Main category and sub-category	Frequency of DRPs*	Frequency of DRPs leading to changes in the discharge prescription
	Number	**Number (%)**
1) Medication reconciliation problem at hospital admission	**438**	**319 (72.8%)**
1.1 Incorrect medication recorded	114	100
1.2 Omission of a medication	184	105
1.3 Incorrect strength/dose recorded	140	114
2) Prescribing problem during the hospital stay or at discharge	**1367**	**1012 (74.0%)**
2.1 Incorrect or lack of substitution back to patient's home medication	136	127
2.2 No restart of medication that was paused during the hospital stay	58	52
2.3 Missing/inappropriate dosage	409	304
2.4 Missing/inappropriate therapy duration	135	121
2.5 Medication not indicated or duplication	182	116
2.6 Untreated indication	182	144
2.7 No concordance with guideline or contraindication	46	22
2.8 Interaction	98	67
2.9 Adverse effect	29	14
2.10 Medication not suitable or of limited suitability	72	34
Missing subcategory	20	11
3) Incomplete patient documentation	**56**	**5 (8.9%)**
4) Other	**15**	**8 (53.3%)**
Total	**1876**	**1344 (71.6%)**

*DRPs = drug-related problems

Additional study material – overview of the classification system used for the documentation of DRPs

Adapted GSASA (Swiss Society of Public Health Administration and Hospital Pharmacists) classification and illustrative examples of DRPs detected at hospital discharge in the cantonal hospital Zug.

Cause of pharmaceutical intervention – main categories and subcategories			
MAIN CATEGORIES AND SUBCATEGORIES	**DESCRIPTION OF CATEGORY**	**EXAMPLES**	
1) Medication reconciliation problem at hospital admission	**The DRP identified at hospital discharge, was caused by an inaccuracy from medication reconciliation at hospital admission**		
1.1 Incorrect medication recorded	The patient's home medication was incorrectly recorded at hospital admission	Prednisolone 20 mg recorded at hospital admission instead of dexamethasone 20 mg.	
1.2 Omission of a medication	The patient's home medication was not recorded at hospital admission	Apixaban not recorded at hospital admission in a patient with atrial fibrillation.	
1.3 Incorrect strength / dose recorded	The dose/strength of the patient's home medication was incorrectly recorded at hospital admission	Lamotrigine 100 mg (1-1-2) instead of lamotrigine 50 mg (1-1-2).	
2) Prescribing problem during the hospital stay or at discharge	**The DRP identified at hospital discharge, was caused by an inaccuracy in medication prescribing during the hospital stay or at discharge prescription**		
2.1 Incorrect or lack of substitution back to patient's home medication	The substitution from hospital medication to the patient's home medication was incorrect or lacking.	Levothyroxine 75 mcg (1 tablet daily) substituted to levothyroxine 50 mcg (1.5 tablets daily) during the hospital stay and levothyroxine 75 mcg (1.5 tablets daily) prescribed at hospital discharge.	
2.2 No restart of medication, that was paused during the hospital stay	A medication was paused at hospital admission and was not restarted at hospital discharge	Discontinuation of folic acid in a patient treated with methotrexate. Rivaroxaban 10mg was substituted to dalteparin 5000 during the hospital stay in an immobile patient, but no thrombosis prophylaxis was prescribed at hospital discharge.	
2.3 Missing / inappropriate dosage	The dosage of a medication is lacking or the dosage is inappropriate on the discharge prescription	Methotrexate prescribed once daily instead of once weekly. Tacrolimus prescribed once daily instead of twice daily.	
2.4 Missing / inappropriate therapy duration	Therapy duration is too long/short or missing on the discharge prescription	Prescription of antibiotic / antifungal / antiviral agents without information about the therapy duration.	

1

		Prescription of rivaroxaban 15 mg (twice) daily for six weeks instead of three weeks in a patient with pulmonary embolism.
2.5 Medication not indicated or duplication	Medication use without an indication or inappropriate use of two medications from the same therapeutic class	Prescription of bisoprolol and atenolol at the same time. Prescription of potassium chloride for an indefinite period in a patient with a potassium level in the normal range.
2.6 Untreated indication	Preventive, therapeutic, or concomitant medication not prescribed for a valid indication	Patient with atrial fibrillation, but without prescription of an anticoagulant for the prevention of a stroke. Patient with documented glaucoma, but without prescription of eye drops for the glaucoma treatment.
2.7 No concordance with guidelines or contraindication	Medication selection does not comply with treatment guidelines Patients show a contraindication to the therapy due to his/her medical conditions	Prescription of metoclopramide in a patient with Parkinson disease, switch to domperidone suggested.
2.8 Interaction	Combination of a medication with another medication or with food representing a potential or manifest negative outcome	Simultaneous intake of fluoroquinolones or levothyroxine and polyvalent cations (e.g. calcium, magnesium, potassium).
2.9 Adverse effect	Response to a medication that is noxious and unintended and occurs at doses normally used in man for the prophylaxis, diagnosis or therapy of disease, or modification of physiological function	Prescription of co-amoxicillin in a patients with known penicillin allergy.
2.10 Medication not suitable or of limited suitability	The prescribed medication is not the ideal option for a specific patient condition.	Prescription of naproxen as long-term treatment in a 93-years old patient.
3) Incomplete patient documentation	**Lack of patient information in the hospital record**	Initiation of mirabegron during the hospital stay, but no diagnosis added to the hospital case record.
4) Other		Prescription of salmon calcitonin nasal spray 100 IU/dose, which has been withdrawn from the market.
Outcome of intervention		
1) Change in the discharge letter to the general practitioner (GP)	The information regarding the change in the patient's therapy was added to the discharge letter delivered to the GP.	
2) Change of the discharge prescription and medication list	A pharmaceutical intervention results in a change of the discharge prescription and the patient's medication list.	

3) Not accepted	The physician did not accept or implement a change in a patient's therapy proposed by the pharmacist.	
4) Information to the physician, result unknown	A change in the patient's therapy was proposed to the physician, but the pharmacist was not informed whether the physician implemented the change.	
5) Information to patient	The patient was informed of a change in the therapy that did not need the approval from the physician.	

3

GENERAL DISCUSSION AND CONCLUSION

Hospitalizations and their associated transitions of care can impair patient safety. Among the issues that can arise during transitions of care, drug-related problems (DRPs) are of special importance, potentially leading to patient harm. As mentioned, pharmacists can contribute to detecting and preventing DRPs at transitions of care and thereby improve patient safety; however, the role of pharmacists at hospital discharge and the impact of pharmacist-led services in Swiss hospitals remain unclear. The goal of this thesis was to provide the basis for designing an improved process to support patients in their medication management at hospital discharge. In order to achieve this goal, we first conducted a national survey to describe the current status of implementation of clinical pharmacy in Swiss hospitals, its development in recent years, and medication management support at hospital discharge. The first part of the survey focused on the development of clinical pharmacy services and the second part on medication management. Approximately three-quarters of the participants in the survey had already participated in a previous survey conducted in 2013. This allowed direct comparison of how resource allocation and the provided pharmaceutical services changed in these hospitals between 2013 and 2017. With the second part of the survey, focusing on medication management at hospital discharge, we were able to describe the current status of medication management at hospital discharge in Switzerland and pharmacists' role in it. Given the lack of Swiss national guidelines, we compared our finding with international guidelines. Face-to-face interviews in selected hospitals enabled us to give more detailed descriptions of pharmacist-led discharge medication management models. The overview of guidelines on medication review within the hospital setting allowed us to identify elements that were commonly recommended to be part of such a medication review. We then depicted the patterns of DRPs on discharge prescriptions identified through medication reviews by pharmacists at hospital discharge in two hospitals. Linking the identified DRPs from one of the hospitals (cantonal hospital of Zug) to information contained in the hospital's patient records, the community pharmacy records, and the clearing office allowed to evaluate the effect of pharmacist-led medication reconciliation and interprofessional ward rounds on the frequency of DRPs on prescriptions at hospital discharge. The findings of each project are discussed in detail in the respective project, the general discussion will focus on how the main findings contributed to the overall goal and relate them to the results of the other projects.

Part A Discharge management and the role of pharmacists

Clinical pharmacy services are not static: they are constantly evolving and adapting to the environment in which they are provided. With Part A, we first aimed to give an overview of the implementation status of clinical pharmacy in Switzerland and its development in recent

years. The direct comparison of hospitals that had already participated in the previous survey enabled us to identify an increase in full-time equivalents for both hospital pharmacists and clinical pharmacists, although the increase was more prominent among the latter. The gap in full-time equivalents appointed to clinical pharmacy services between the different language regions observed in 2013 was considerably reduced in 2017. Clinical pharmacists' resources were used more frequently for process- and treatment-related services than for patient-centered services. This was best exemplified in the sparse involvement of pharmacists in medication management at hospital discharge. In general, our study reflects that pharmacists are recognized as a valuable source of information in regard to pharmacotherapy. In line with that, nearly all surveyed pharmacists indicated that they answered requests from internal healthcare professionals on a daily basis, yet the study we conducted also showed that most hospitals did not provide the possibility for pharmacists to use this knowledge in direct patient contact at hospital discharge, losing the opportunity to educate patients about the medication to be used post discharge. As limited resources are a barrier to the implementation of clinical pharmacy services, selecting the right patient for the right service may help to reduce the workload and facilitate initiating such services. In regard to medication reviews in the hospital setting, which are often recommended to include patient education,[82,95,97-100] only half of the identified guidelines recommend that they should be targeting specific patient groups[19,84,95,99-101] and even less recommend prioritizing specific patients within the target group or specific problems identified during the review.[95,99,102] The application of tools to select patients at risk of DRPs could assist in targeting patients that most benefit from such services. One tool that has been proposed for medication reviews of hospitalized elderly patients is a self-administered questionnaire that helps to stratify patients at risk of DRPs and assist the selection of the type of medication review to be conducted.[103] Patients could also be selected according to risk factors accessible in the hospital's patient records. Examples of risk factors showing a strong association with DRPs included polypharmacy or specific drugs (e.g., antithrombotics or antidiabetics).[104] Using a self-administered patient questionnaire or a computer program that identifies patients according to predefined risk factors in the hospital's patient records (or a combination of the two) would help identify DRPs, while saving pharmacist resources.

The findings of the survey of clinical pharmacy services suggested that the increase in full-time equivalents of clinical pharmacists took place mainly in hospitals that already offered clinical pharmacy services rather than in hospitals newly launching such services therefore efforts should be made to motivate those hospitals without pharmacist-led services to engage in providing them. Participants indicating not to have invested in clinical pharmacy often worked at smaller hospitals, which might be due to limited resources. Organizing themselves into networks could help smaller hospitals to share costs associated with providing clinical pharmacy services. As the questionnaire was only sent to chief hospital pharmacists affiliated with the Swiss Association of Public Health Administration and Hospital Pharmacists (GSASA), efforts should also be made to engage the over 200 other hospitals that we do not expect to have any clinical pharmacy services in place. Regularly monitoring the development

of clinical pharmacy services and disseminating the findings can help hospital pharmacies to compare their own activities with those of other hospitals and may assist in detecting areas where clinical activities are not yet well established. It might even be a way of motivating hospital pharmacies to initiate clinical pharmacy services where they are not yet implemented at all. However, to achieve notable advances in the implementation of clinical pharmacy services, they should be endorsed by all stakeholders in patient care, including not only healthcare professionals but also national authorities. Having legally binding requirements for patient safety that corroborate the role of pharmacists could bring considerable progress.

As our overarching goal was to provide the basis for designing an improved process for hospital discharge, a valuable perspective on clinical pharmacy services may be gained from applying the principles of lean management to healthcare. The seven non-value-adding "wastes" described in the Toyota Production System and their respective translation to the clinical setting were proposed by Green et al. as follows: "defects" (e.g., hospital readmissions, dispensing errors), "unnecessary motion" (e.g., unnecessary movement of hospital staff), "overproduction" (e.g., excessive tests), "transport of products/materials" (e.g., borrowing equipment from other wards), "unnecessary waiting" (e.g., waiting for medication/results/patients), "unnecessary inventory" (e.g., excessive stock), and "inappropriate processing" (e.g., duplication of tasks/work, repeatedly asking the same questions).[89,91] In our study, errors in medication histories and their potentially negative outcome in patients, could correspond to "defects". As mentioned, pharmacist-led medication reconciliation at admission leads to more complete and accurate medication histories.[3] Involving pharmacists in this task could reduce the "waste" due to errors in medication histories. However, according to the survey we conducted in Swiss hospitals, only one hospital involves pharmacists on a daily basis in medication reconciliation at hospital admission. The aforementioned benefits of involving pharmacists in medication reconciliation at hospital admission should motivate hospitals to implement this service. When applying the principles of lean healthcare, it can be argued that pharmacist not having access to the hospital's electronic patient records also leads to "waste". In the survey, several pharmacists indicated that they regularly (daily or weekly) make recommendations on risk medication, antibiotics or discharge prescriptions. In order to perform these tasks to their full potential, pharmacists need access to clinical data, such as diagnosis or laboratory results (e.g., renal function). Having to call the treating physician or the responsible nurse or even having to go to the ward to read the patient records to obtain this information could be classified as "waste" due to "inappropriate processing" or "unnecessary motion" depending on the process in place. In the surveyed hospitals, 80% of pharmacists offering clinical pharmacy services have full access to the hospital's patient records and in all but one these are fully electronic. For the other 20%, it should be recommended to grant pharmacists access in order to augment the efficiency in the aforementioned tasks. If the records are still handwritten or exist only as analogue documents, hospitals should incorporate them into an electronic hospital information system.

Part B Pharmacists' impact on drug-related problems at hospital discharge

DRPs are one of the issues that need to be addressed during transitions of care, as they have the potential to cause patient harm.[21] Studies have shown that involving pharmacists at hospital discharge allows the identification and clarification of a variety of DRPs.[5,27,28] The frequency of DRPs at hospital discharge in Switzerland and the impact of pharmacist-led services in Swiss hospitals is only sparsely described. The first aim of Part B was to describe the pattern of DRPs at hospital discharge. The second aim was to assess the effect of a pharmacist-led medication reconciliation at hospital admission and interprofessional ward rounds during the hospital stay on DRPs at hospital discharge. When focusing on DRPs due to drug-drug interactions, we found that the five most frequent drug combinations causing interactions can be placed in two groups: complexation and QT-interval prolongation. The first can often easily be solved in a regular community pharmacy or through a change in prescribing practices in the hospital (e.g., standard prescribing time for mineral supplements moved to lunchtime instead of mornings would avoid the complexation of e.g., thyroid therapy). In contrast, the second group is more complex; efforts should therefore be made to identify and manage the latter within the hospital setting.

Our results showed that the combination of pharmacist-led medication reconciliation at hospital admission and interprofessional ward rounds including clinical pharmacists during the hospital stay was associated with a reduction of the frequency of DRPs at hospital discharge. Although overall 23% of DRPs were classified as being related to medication reconciliation at admission, they were mostly found in patients that did not receive a pharmacist-led medication reconciliation. Medication reconciliation can help reduce medication discrepancies, which can pose a threat to patient safety as they may cause patient harm.[55,59] As mentioned, the framework to develop and evaluate complex interventions provided by the Medical Research Council consists of four elements: (1) development, (2) feasibility and piloting, (3) evaluation, and (4) implementation.[94] Whereas the development and feasibility was undertaken and assessed beforehand in a pilot study of the Swiss Patient Safety Foundation,[88] our study aimed to evaluate the effectiveness of the multicomponent pharmacist-led service, after it was implemented in daily practice. According to the framework, the evaluation step consists of three aspects: assessing effectiveness, understanding change process, and assessing cost-effectiveness. Our retrospective data analysis addressed the first aspect, the effectiveness. Our analysis showed that pharmacist-led services were associated with a reduction of DRPs at hospital discharge. Medication reconciliation seemed to play a key role in the reduction of the overall number of DRPs and in the number of DRPs caused by medication reconciliation problems at admission (e.g., omission of patient's home medication). According to the framework, the next steps would now be to assess the different aspects of the evaluation step, followed by the different aspects of the implementation step, consisting of dissemination, surveillance/monitoring, and long-term follow-up.[94] Although the intervention is already implemented in daily practice,

dissemination (e.g., to all patients admitted to the hospital) was deemed not to be possible with the available resources.[88] These next steps would show if there is a need for a new cycle, restarting with the step (1) development (or adaption) of the intervention, as sometimes more than one cycle may be needed.[94] Using several iterations when developing and implementing interventions has also been described in other frameworks.[105,106] The plan-do-study-act method is a quality improvement method that suggests using several cycles and starting small scale, in order to quickly reach an insight into the feasibility and to adapt the intervention based on the feedback received.[105] This method has been successfully used to implement medication reconciliation at transitions of care to improve processes.[107]

When implementing a new service, such as the pharmacist-led services implemented at the cantonal hospital of Zug, another aspect to consider is the collaboration between the healthcare professionals involved in providing the service. A study investigating barriers to the implementation of comprehensive medication reviews by multiprofessional teams including a ward-based pharmacist found that amongst other barriers, physicians may feel criticized by pharmacists or may tend not to listen to pharmacists.[108] From that perspective, it is crucial that each profession understands its role and the role of the others[88,109] and that the collaboration is based on good communication, both formal and informal.[109] Institutions should facilitate efficient communication by providing appropriate tools, ideally incorporated in information systems that allow timely and complete exchange of information relevant to patients' treatments.[109] With respect to hospital discharge, this can refer to the timely and accurate transmission of discharge letters and discharge prescriptions. This was the case in our study (Project B2), as the community pharmacy at the cantonal hospital of Zug received the discharge prescription in advance and had time to perform a medication review. In contrast, according to the national survey (Project A2), less than half of the community pharmacies in close collaboration with the hospital received the discharge prescription prior to patient discharge. Concerning medication reconciliation at transitions of care, the Swiss Patient Safety Foundation advocates that such a service should be built on interprofessional collaboration with healthcare professional's roles within the process well defined.[56] Furthermore, other important elements described as the foundation of collaboration are trust and respect, as well as acquaintanceship and power, which influence each other.[109] Hepler and Strand have already elucidated the need for interprofessional cooperation when providing pharmaceutical care,[34] interprofessional collaboration is also endorsed in a Committee of Ministers of the Council of Europe resolution.[36] In order to attain fruitful interprofessional collaboration in practice, it should already start at the education level. Interprofessional education has been acknowledged as a way to foster later collaborative practice.[110]

The study population and the documented DRPs that were used for the retrospective analysis in Project B2 were additionally used in a simulation study assessing the detectability and resolvability of the documented DRPs using different information sources.[96] In this retrospective evaluation, 60% of DRPs that were discovered on discharge prescriptions using clinical information from hospitals' patient records were judged to be also identifiable through

a simple medication review that can be conducted simply with the medication history. However, this indicated that 40% of DRPs would have been missed if patients had been discharged directly and had filled their prescription in a regular community pharmacy. In Switzerland, community pharmacies do not routinely have access to clinical data. Making clinical data available to community pharmacies could provide them with the information needed to detect the 40% of DRPs otherwise missed. In a survey conducted among Swiss community pharmacists, most desired to have more health-related data in conjunction with discharge prescriptions (e.g., diagnosis, reason for admission, laboratory values), but did not regard it as essential information.[111] In a focus group discussion, participating pharmacists debating which information was relevant for community pharmacists filling discharge prescriptions, all participants agreed that they would like to be informed about medication change; however, the majority did not desire to know the reason for changes. They mentioned feeling uncertain if they were capable of validating treatment decisions.[111] Similarly, Dutch community pharmacists and general practitioners were of mixed opinions when discussing whether certain clinical information (e.g., laboratory values) should be included a hospital discharge report for community pharmacies. They expressed concerns about community pharmacists lacking the necessary skills for the interpretation of such information.[112] In Switzerland, further education programs are available (e.g., certificate of advanced studies in clinical pharmacy[113]) that enable pharmacists to interpret clinical data with more assertiveness when evaluating treatment plans. However, of the 60% of DRPs that were judged to be identifiable in regular community pharmacies, 85% were deemed to need contact with the prescribing physician in order to solve them.[96]

The three different retrospective analyses of DRPs at hospital discharge in the cantonal hospital of Zug (pattern of DRPs, group comparison and simulation study) revealed that the comprehensive involvement of pharmacists has several benefits and can thereby contribute to improved patient safety at hospital discharge. Having pharmacists review the discharge prescriptions and performing medication reconciliation and medication reviews with full access to the hospital's patient record allowed them to identify and resolve (with or without contacting the hospital physician) a multitude of DRPs at hospital discharge. Where such a model of comprehensive involvement was not implemented, a majority of DRPs could also be detected by community pharmacists; however, 40% were deemed to remain undetected. The comprehensive involvement was associated with a reduction in the number of DRPs at hospital discharge. Furthermore, pharmacists can help prevent the DRPs that do occur from reaching patients or being communicated to the next setting, which potentially reduces patient harm. The model implemented in the cantonal hospital of Zug could function as a role model of comprehensive pharmacist involvement for other hospitals to follow. A community pharmacy in or close by the hospital provides the ideal platform for pharmacist-led services to support patients in the discharge medication management and therefore ease the transition of care at hospital discharge. Nonetheless, the implemented model leaves some room for improvement in regard to the communication to the ambulatory setting. The face-to-face interviews revealed an illustrative example of pharmacists' contribution to improving

communication to the ambulatory setting, more precisely to community pharmacies (Project A2). One of the interviewed hospital community pharmacies (a community pharmacy partly owned by the collaborating hospital) sent all discharge prescriptions (including a QR code) filled there to the patient's regular community pharmacy. The information contained in the QR code helps the traceability of changes made by this hospital community pharmacy. Pharmacists of the mentioned hospital community pharmacy also requested the patient's regular community pharmacy to contact the patient for a follow-up within a few days after discharge, which can contribute to a seamless transition. This approach could be incorporated into the model already existing at the cantonal hospital of Zug, thus further improving the hospital's discharge process and the transition of care from the hospital setting to the ambulatory setting. Where adequate, this updated prescription containing information on medication changes could additionally be sent to the patient's general practitioner and other healthcare professionals involved in the care of the discharged patient.

A community pharmacy in close collaboration with the hospital, especially one with full access to the hospital's patient record, is ideally positioned to support patients at hospital discharge; however, as the results of our survey showed (Project A2), many hospitals do not have one. In the absence of a close collaboration with a community pharmacy with full access to the hospital's patient records, the hospital pharmacy itself can fill this gap, as was demonstrated in the retrospective analysis of DRPs at the regional hospital (Project B1). An example of a pharmacist-led discharge prescription review in the hospital setting without direct patient contact was evaluated in a Swiss hospital that is not in close collaboration with a community pharmacy.[29] The study showed that if a clinical pharmacist reviewed discharge prescriptions and added information on medication changes before the patient fills it in their regular community pharmacy, then community pharmacists perform less interventions and have to contact the hospital physician less often to resolve problems.[29] A similar intervention was tested in France, where hospital pharmacists added explanations to the discharge prescription, such as indication or reason for medication changes. Community pharmacists were highly satisfied with this service and it resulted in fewer medication shortages for patients.[12]

Returning to the principles of lean healthcare and the seven "wastes",[89,91] errors in discharge prescriptions could be assigned to "waste" due to "defects". Pharmacists reviewing discharge prescriptions in two Swiss hospitals (a regional and a cantonal hospital) with full access to the hospital's patient records discovered a multitude of DRPs, of which some were attributed to missing or incomplete information (e.g., information on dosage or therapy duration). There are different approaches through which these problems could be prevented, for instance training courses for prescribing physicians to improve the quality of discharge prescriptions. An approach for electronically prepared prescriptions could be a warning message when a prescription is completed and no information on dosage is filled in or when the therapy duration is not specified for medicines with typically limited therapy duration, such as antibiotics. Another issue pharmacists found on discharge prescriptions was

duplication of medicines or medicines without indication. In electronically prepared prescriptions, the problem of duplication could be tackled with a warning message appearing when a prescription is saved containing medication duplication. In contrast, solving the problem of medicines without indication needs a clinical assessment. Those medications that truly do not have an indication and are therefore unnecessary treatments could be classified as "wastes" due to "overproduction". With the current process implemented at the cantonal hospital of Zug, pharmacists aim to detect and resolve DRPs on discharge prescriptions; however, efforts should also be made to prevent the DRPs appearing on the prescription in the first place.

An approach increasingly applied in healthcare to improve patient safety is the introduction of crew resource management (CRM) trainings.[92] The CRM training has its origins in aviation, where research of air crashes showed that a substantial part could be traced back to human error. Three main topics identified on this subject were faulty or insufficient leadership, interpersonal communications, and decision making.[90] CRM trainings were initiated as countermeasures to human error and error management. In this regard, the "error management troika" was proposed as follows: avoidance of error, trapping incipient errors before they are committed, and mitigating the consequences of those errors that occur and are not trapped.[90] Applying these principles to the hospital pharmacy setting, one could argue that pharmacists' review of discharge prescriptions would be a method of trapping errors (or in our case, DRPs) before they reach the patient. The findings of our retrospective group comparison concerning DRPs at discharge showed that pharmacists' activities before discharge (medication reconciliation at admission and interprofessional ward round) can contribute to the avoidance of DRPs. Such activities would correspond to the first measure in the set of countermeasures to human errors. These findings should consolidate the activities performed by pharmacists and might even encourage hospital managers and decision-makers of other hospitals to introduce this or a similar model that comprehensively involves pharmacists in the medication management throughout the patient's stay in their hospital.

To advocate a non-punitive error culture is another approach to error management described in CRM. One way to tackle this is by introducing a Critical Incidence Reporting System (CIRS). A CIRS allows an anonymous reporting of critical incidents or near misses. The medication safety report by the GSASA summarized that although several Swiss hospitals have introduced a CIRS, pharmacists are not systematically involved in the discussion of reported drug-related incidents.[87] Human errors have been described as being not only inevitable but also a valuable source of information.[90] In this regard, the GSASA classification system can be used in a way analogous to the CIRS system, to document and analyze DRPs. The analysis of the documented DRPs can then be used for quality improvements. Finding the source or the cause of a DRP can help to adapt and improve the process in order to reduce the risk for the same DRP to occur again. Chief hospital pharmacists should foster a medication safety culture in their hospital pharmacy and encourage pharmacists in their team to document and

analyze DRPs encountered, for instance during interprofessional ward rounds or review of discharge prescriptions.

Limitations

The limitations of each individual project were separately detailed within the respective projects; this section focuses on overall limitations of the thesis.

Most researchers involved in the presented projects were pharmacists and as the main focus of the thesis was the pharmacist's contribution to medication management prior to and at hospital discharge, the findings might have been presented in a way that favors of the pharmacist's role.

One researcher was involved in all stages of the studies, including conceptualization, methodology, investigation, analysis, and interpretation. This might have led to observer bias.[114]

Both the survey and the retrospective data analysis were conducted in Swiss hospitals. As Switzerland has a distinctive healthcare system,[115,116] the findings might not generalize to other countries. The data for the group comparison of DRPs at hospital discharge were collected at a single site with a unique model of comprehensive involvement of pharmacists in place; hence, the findings might similarly be of limited generalizability to other hospitals. However, they might inspire other hospitals to follow the model presented in this study.

As the data presented on clinical pharmacy services and medication management at hospital discharge were obtained through questionnaires, there is a risk of obsequiousness bias[117] (participants might have answered the way they perceived to be desired by the investigators) or bias due to social desirability[118] (responding more in line with social norms than according to the actual situation).

In the retrospective group comparison evaluating pharmacist-led interventions prior to discharge on the frequency of DRPs at hospital discharge, the depth of the medication review depended on the complexity of the discharge prescription. All prescriptions received were screened for the presence of a set of predefined risk factors. This could have led to a risk of diagnostic suspicion bias, described as the intensity of diagnostic processes (in our case medication review) depending on the awareness of patients' prior exposure to a assumed cause (e.g., taking high-risk medication).[117] Furthermore, pharmacist-led medication reconciliation was mainly conducted in patients with planned hospital admission, leading to differences in group size, and is likely to have influenced the patient characteristics of study groups.

Conclusion

This thesis has provided data that can serve as a basis to improve processes for the support of patients' medication management at hospital discharge. The results describe processes at hospital discharge with a focus on the role of pharmacists.

The findings of the national survey of clinical pharmacy services showed an increase in full-time equivalents for both hospital and clinical pharmacists. These resources are used more frequently to provide process- and treatment-related services than patient-centered services. A welcome development since the previous survey conducted in 2013 was the fact that the gap between the different language regions was closing. The results should stimulate the implementation of clinical pharmacy services in hospitals where they are not yet offered.

In regard to medication management at hospital discharge, the interventions recommended by international guidelines are frequently implemented in Swiss hospitals; however, our study showed that pharmacists are rarely involved at hospital discharge. These findings should encourage hospitals to expand clinical pharmacy services and promote the involvement of pharmacists in discharge management.

Our studies found several international guidelines on hospital discharge management and medication review in the hospital setting. Nevertheless, Swiss guidelines on this topic are lacking. As there is no such guideline for Switzerland, recommendations from international guidelines should be used to develop a national guideline for Swiss hospitals.

During medication reviews at hospital discharge, hospital pharmacists and community pharmacists can identify and prevent a variety of DRPs on discharge prescriptions presupposing that they are granted access to the hospital's patient records. To ease the transition at hospital discharge, a close collaboration with a community pharmacy can present an ideal environment for a pharmacist-led discharge service; such collaboration should therefore be endorsed. In our study, we analyzed the model implemented in the cantonal hospital of Zug, where such a pharmacist-led discharge service is in place in the hospital's community pharmacy. In this hospital, a considerable part of the DRPs discovered on the discharge prescriptions by pharmacists would be missed in a regular community pharmacy without access to clinical data. Following this example, a close collaboration with and full access to clinical data for community pharmacies should be promoted to enable patient-centered discharge services such as medication reconciliation and medication reviews.

A comprehensive involvement of pharmacists throughout the hospitalization (pharmacist-led medication reconciliation at admission and interprofessional ward rounds during the hospital stay) was associated with a reduction of the frequency of DRPs at hospital discharge. Our findings support pharmacists becoming an integral part of patient care throughout the whole hospitalization; pharmacist-led medication reconciliation at hospital admission especially should be endorsed. Other hospitals should be motivated to follow the example set by the

comprehensive involvement of pharmacists in the cantonal hospital of Zug and to reflect whether and to what extent they can incorporate this model in their processes.

Finally, in addition to the aforementioned conclusions and in order to advance the development of pharmacist-led services, policymakers should be encouraged to strengthen the role of pharmacists by incorporating them in a binding national medication safety strategy.

Outlook

To allow continuous monitoring of the implementation of clinical pharmacy services in Swiss hospitals, the mapping of such services should regularly be repeated, following the example of the surveys in the United States of America and at European level.[42,47] Some of the questions might need slight adaptations, for instance questions regarding interprofessional ward rounds or medication review, in order to elicit not only how often pharmacists are occupied with these activities (e.g., daily, weekly etc.) but also on how many wards or for how many patients they are undertaken. This would allow a more profound picture of how many patients benefit from the aforementioned clinical pharmacy activities.

The overview of guidelines on interventions to support patients in their medication management at hospital discharge and of elements recommended to address during medication reviews in the hospital setting may provide backing to healthcare professionals planning to incorporate or adapt any of the described interventions. They might also encourage the development of such guidelines for the discharge process adapted to the Swiss healthcare setting.

Concerning the patterns of DRPs at hospital discharge, we only described the patterns based on data provided from two Swiss hospitals. The two hospitals did not use the same classification systems for DRPs, which hampered a direct comparison. In order to document DRPs in the hospital setting in Switzerland, the GSASA provides a classification system often referred to as the GSASA classification system.[32] Endorsing the use of the GSASA classification system in its official form across all Swiss hospitals would allow unhindered comparison of DRPs on a national level. Providing an electronic database for their collection on a national basis would further simplify such a comparison. The collection of information on DRPs can provide insights into which areas in the prescribing process need improvement. Adding an estimation of the clinical relevance (e.g., $CLEO_{de}$ [119]) to the documentation of DRPs and their subsequent interventions could help to prioritize which problems in the prescribing process to address first.

In our retrospective group comparison, we found an association between a reduction in the frequency of DRPs at hospital discharge and patients receiving both pharmacist-led medication reconciliation at admission and interprofessional ward rounds including a clinical pharmacist during hospital stay. Nevertheless, with the data available the pharmacist-led interventions at hospital discharge (medication reconciliation, medication review and patient counseling) could not be evaluated. To allow such an evaluation, a prospective study that also

included patients choosing to fill their discharge prescription elsewhere would be an added value. If another hospital with few or no pharmacist-led services in place were to decide to introduce such services, or a part of the services, as those implemented in the cantonal hospital of Zug, this would provide a welcome opportunity to assess the impact in a randomized manner, leading to study groups of the same size and with similar patient characteristics. In a prospective study, information on the clinical relevance of the DRPs at discharge could also be collected and analyzed.

A similar model as is implemented in the cantonal hospital of Zug could be conceivable in a hospital that is not in close collaboration with a community pharmacy, presupposing that the changes on the discharge prescriptions are communicated to the ambulatory setting (e.g., patient's regular community pharmacy). In that case, other healthcare professionals in the hospital or ambulatory setting need to adopt the part of patient counseling, if the hospital pharmacists themselves do not have direct patient contact at hospital discharge to provide the counseling.

The model implemented in the cantonal hospital of Zug was only one of several models implemented to support patients at hospital discharge in Swiss hospitals, as was shown in the survey describing pharmaceutical discharge management. In order to gain more insight into how best to support patients at hospital discharge, the impact of these other models should also be analyzed. As mentioned, communication to the ambulatory setting is an important aspect of transitions of care. Therefore, one example that might be worth examining is the hospital community pharmacy that communicated changes made on discharge prescriptions to the patient's regular community pharmacy, with the request to contact the patient within a few days for a follow-up.

Overall, the findings presented in this thesis exemplify the benefits of pharmacist-led services throughout the hospital stay and contribute to understanding discharge management in Swiss hospitals. Furthermore, they should stimulate further research in the field of pharmacist-led services at transitions of care. Future endeavors should focus on strengthening the role of pharmacists in processes throughout the hospital stay to enable seamless transitions of care.

REFERENCES

1. World Health Organization. Medication without harm - global patient safety challenge on medication safety 2017 [Available from: https://www.who.int/patientsafety/medication-safety/medication-without-harm-brochure/en/ accessed 12.04.2021.
2. World Health Organization. The high 5s project - implementation guide 2014 [Available from: https://www.who.int/patientsafety/implementation/solutions/high5s/h5s-guide.pdf?ua=1 accessed 28.01.2021.
3. Ooi CE, Rofe O, Vienet M, et al. Improving communication of medication changes using a pharmacist-prepared discharge medication management summary. *Int J Clin Pharm* 2017;39(2):394-402. doi: 10.1007/s11096-017-0435-5 [published Online First: 2017/03/13]
4. Ensing HT, Koster ES, van Berkel PI, et al. Problems with continuity of care identified by community pharmacists post-discharge. *Journal of clinical pharmacy and therapeutics* 2017;42(2):170-77. doi: 10.1111/jcpt.12488
5. Daliri S, Hugtenburg JG, Ter Riet G, et al. The effect of a pharmacy-led transitional care program on medication-related problems post-discharge: A before—after prospective study. *PLOS ONE* 2019;14(3):e0213593. doi: 10.1371/journal.pone.0213593
6. Meyer-Massetti C, Hofstetter V, Hedinger-Grogg B, et al. Medication-related problems during transfer from hospital to home care: Baseline data from switzerland. *International Journal of Clinical Pharmacy* 2018;40(6):1614-20. doi: 10.1007/s11096-018-0728-3
7. Kattel S, Manning DM, Erwin PJ, et al. Information transfer at hospital discharge: A systematic review. *Journal of Patient Safety* 2020;16(1):e25-e33. doi: 10.1097/pts.0000000000000248
8. Weir DL, Motulsky A, Abrahamowicz M, et al. Challenges at care transitions: Failure to follow medication changes made at hospital discharge. *The American Journal of Medicine* 2019;132(10):1216-24.e5. doi: 10.1016/j.amjmed.2019.05.003
9. National Institute for Health and Care Exellence. Transition between inpatient hospital settings and community or care home settings for adults with social care needs 2015 [Available from: https://www.nice.org.uk/guidance/ng27/evidence/full-guideline-pdf-2185185565 accessed 17.09.2020.
10. Royal Pharmaceutical Society. Keeping patients safe when they transfer between care providers - getting the medicines right 2012 [Available from: https://www.rpharms.com/Portals/0/RPS%20document%20library/Open%20access/Publications/Keeping%20patients%20safe%20transfer%20of%20care%20report.pdf accessed 17.09.2020.
11. Department of Health, Government of South Australia. Continuity in medication management – a handbook for south australian hospitals 2010 [Available from: https://www.sahealth.sa.gov.au/wps/wcm/connect/e055bd8044fd8fc2aff7efcfa5ded0ab/Pharmaceutical+Reform+Handbook+V7_Print+version.pdf?MOD=AJPERES&CACHEID=ROOTWORKSPACE-e055bd8044fd8fc2aff7efcfa5ded0ab-n5iXGmp accessed 17.09.2020.

12. Van Hollebeke M, Talavera-Pons S, Mulliez A, et al. Impact of medication reconciliation at discharge on continuity of patient care in france. *International Journal of Clinical Pharmacy* 2016;38(5):1149-56. doi: 10.1007/s11096-016-0344-z
13. Knight DA, Thompson D, Mathie E, et al. 'Seamless care? Just a list would have helped!' Older people and their carer's experiences of support with medication on discharge home from hospital. *Health expectations : an international journal of public participation in health care and health policy* 2013;16(3):277-91. doi: 10.1111/j.1369-7625.2011.00714.x [published Online First: 2011/08/16]
14. Fialova D, Desplenter F. Aging of the population, clinical pharmacy services, and interdisciplinary cooperation in the optimization of pharmacotherapy in older patients. *Drugs Aging* 2016;33(3):163-7. doi: 10.1007/s40266-016-0361-6 [published Online First: 2016/03/25]
15. Federal Statistical Office. Gesundheit - taschenstatistik 2020 2020 [Available from: https://www.bfs.admin.ch/bfs/en/home/statistics/catalogues-databases/publications.assetdetail.15464462.html accessed 27.02.2021.
16. World Health Organization. Medication safety in polypharmacy 2019 [Available from: https://apps.who.int/iris/bitstream/handle/10665/325454/WHO-UHC-SDS-2019.11-eng.pdf?ua=1 accessed 2017.02.2021.
17. Morath B, Mayer T, Send AFJ, et al. Risk factors of adverse health outcomes after hospital discharge modifiable by clinical pharmacist interventions: A review with a systematic approach. *Brit J Clin Pharmaco* 2017;83(10):2163-78. doi: 10.1111/bcp.13318
18. Kaufmann CP, Stampfli D, Hersberger KE, et al. Determination of risk factors for drug-related problems: A multidisciplinary triangulation process. *BMJ Open* 2015;5(3):e006376. doi: 10.1136/bmjopen-2014-006376
19. National Institute for Health and Care Exellence. Medicines optimisation 2016 [Available from: https://www.nice.org.uk/guidance/ng5 accessed 17.01.2018.
20. Royal Pharmaceutical Society. Medicines optimisation: Helping patients to make the most of medicines 2013 [Available from: https://www.rpharms.com/resources/ultimate-guides-and-hubs/medicines-optimisation-hub accessed 29.03.2018.
21. Parekh N, Ali K, Page A, et al. Incidence of medication-related harm in older adults after hospital discharge: A systematic review. *J Am Geriatr Soc* 2018;66(9):1812-22. doi: 10.1111/jgs.15419
22. Falconer N, Barras M, Martin J, et al. Defining and classifying terminology for medication harm: A call for consensus. *European Journal of Clinical Pharmacology* 2019;75(2):137-45. doi: 10.1007/s00228-018-2567-5
23. Krähenbühl-Melcher A, Schlienger R, Lampert M, et al. Drug-related problems in hospitals. *Drug Safety* 2007;30(5):379-407. doi: 10.2165/00002018-200730050-00003
24. Pharmaceutical Care Network Europe. Drug-related problems [Available from: https://www.pcne.org/working-groups/2/drug-related-problem-classification accessed 19.02.2021.
25. Van Mil FJW, Westerlund T, Brown L, et al. Medical care and drug-related problems: Do doctors and pharmacists speak the same language? *Int J Clin Pharm* 2016;38(2):191-4. doi: 10.1007/s11096-016-0249-x [published Online First: 2016/01/23]
26. Reinau D, Furrer C, Stampfli D, et al. Evaluation of drug-related problems and subsequent clinical pharmacists' interventions at a swiss university hospital. *Journal of*

clinical pharmacy and therapeutics 2019;44(6):924-31. doi: 10.1111/jcpt.13017 [published Online First: 2019/08/14]
27. Ensing HT, Koster ES, Dubero DJ, et al. Collaboration between hospital and community pharmacists to address drug-related problems: The homecome-program. *Res Social Adm Pharm* 2019;15(3):267-78. doi: 10.1016/j.sapharm.2018.05.001 [published Online First: 2018/05/19]
28. Freyer J, Kasprick L, Sultzer R, et al. A dual intervention in geriatric patients to prevent drug-related problems and improve discharge management. *International Journal of Clinical Pharmacy* 2018;40(5):1189-98. doi: 10.1007/s11096-018-0643-7
29. Brühwiler LD, Beeler PE, Boni F, et al. A rct evaluating a pragmatic in-hospital service to increase the quality of discharge prescriptions. *Int J Qual Health Care* 2019 doi: 10.1093/intqhc/mzz043 [published Online First: 2019/05/16]
30. Hakkarainen KM, Hedna K, Petzold M, et al. Percentage of patients with preventable adverse drug reactions and preventability of adverse drug reactions – a meta-analysis. *PLoS ONE* 2012;7(3):e33236. doi: 10.1371/journal.pone.0033236
31. Basger BJ, Moles RJ, Chen TF. Application of drug-related problem (drp) classification systems: A review of the literature. *European Journal of Clinical Pharmacology* 2014;70(7):799-815. doi: 10.1007/s00228-014-1686-x
32. Maes KA, Tremp RM, GSASA Working group on clinical pharmacy, et al. Demonstrating the clinical pharmacist's activity: Validation of an intervention oriented classification system. *Int J Clin Pharm* 2015;37(6):1162-71. doi: 10.1007/s11096-015-0179-z [published Online First: 2015/08/21]
33. Maes KA, Studer H, Berger J, et al. Documentation of pharmaceutical care: Validation of an intervention oriented classification system. *J Eval Clin Pract* 2017 doi: 10.1111/jep.12817
34. Hepler CD, Strand LM. Opportunities and responsibilities in pharmaceutical care. *Am J Hosp Pharm* 1990;47:533-43.
35. Allemann SS, van Mil JW, Botermann L, et al. Pharmaceutical care: The pcne definition 2013. *Int J Clin Pharm* 2014;36(3):544-55. doi: 10.1007/s11096-014-9933-x [published Online First: 2014/04/22]
36. Committee of Ministers of the Council of Europe. Resolution cm/res(2020)3 on the implementation of pharmaceutical care for the benefit of patients and health services 2020 [Available from: https://rm.coe.int/09000016809cdf26 accessed 25.03.2021.
37. Claeys C, Foulon V, De Winter S, et al. Initiatives promoting seamless care in medication management: An international review of the grey literature. *International Journal of Clinical Pharmacy* 2013;35(6):1040-52. doi: 10.1007/s11096-013-9844-2
38. American College of Clinical Pharmacy. The definition of clinical pharmacy. *Pharmacotherapy* 2008;28(6):816–17.
39. Swiss Association of Public Health Administration and Hospital Pharmacists. Definition of clinical pharmacy in a hospital setting according to the gsasa 2012 [Available from: https://www.gsasa.ch/de/aktivitaeten/pharmazeutische-dienstleistungen/klinische-aktivitaeten/?oid=10135&lang=de accessed 01.11.2019.
40. European Association of Hospital Pharmacists. The european statements of hospital pharmacy. *Eur J Hosp Pharm* 2014;21:256-58. doi: 10.1136/ejhpharm-2014-000526
41. European Association of Hospital Pharmacists. Development - european statements of hospital pharmacy 2014 [Available from: http://statements.eahp.eu/statements/development accessed 24.02.2021.

42. Horak P, Peppard J, Sykora J, et al. Eahp european statements baseline survey 2015: Results. *Eur J Hosp Pharm* 2016;23(2):69-75. doi: 10.1136/ejhpharm-2016-000889 [published Online First: 2016/03/01]
43. Horák P, Gibbons N, Sýkora J, et al. Eahp statements survey 2016: Sections 1, 3 and 4 of the european statements of hospital pharmacy. *Eur J Hosp Pharm* 2017;24(5):258-65. doi: 10.1136/ejhpharm-2017-001334
44. Horak P, Underhill J, Batista A, et al. Eahp european statements survey 2017, focusing on sections 2 (selection, procurement and distribution), 5 (patient safety and quality assurance) and 6 (education and research). *Eur J Hosp Pharm* 2018;25(5):237-44. doi: 10.1136/ejhpharm-2018-001659 [published Online First: 2019/06/04]
45. European Association of Hospital Pharmacists. European statements of hospital pharmacy [Available from: https://statements.eahp.eu/ accessed 22.02.2021.
46. Schneider PJ, Pedersen CA, Scheckelhoff DJ. Ashp national survey of pharmacy practice in hospital settings: Dispensing and administration-2017. *Am J Health-Syst Pharm* 2018;75(16):1203-26. doi: 10.2146/ajhp180151 [published Online First: 2018/06/16]
47. Pedersen CA, Schneider PJ, Ganio MC, et al. Ashp national survey of pharmacy practice in hospital settings: Monitoring and patient education—2018. *American Journal of Health-System Pharmacy* 2019;76(14):1038-58. doi: 10.1093/ajhp/zxz099
48. Pedersen CA, Schneider PJ, Ganio MC, et al. Ashp national survey of pharmacy practice in hospital settings: Prescribing and transcribing—2019. *American Journal of Health-System Pharmacy* 2020;77(13):1026-50. doi: 10.1093/ajhp/zxaa104
49. Messerli M, Maes KA, Hersberger KE, et al. Mapping clinical pharmacy practice in swiss hospitals: A cross-sectional study. *Eur J Hosp Pharm* 2016;23(6):314-19. doi: 10.1136/ejhpharm-2015-000868
50. Mekonnen AB, McLachlan AJ, Brien JA. Pharmacy-led medication reconciliation programmes at hospital transitions: A systematic review and meta-analysis. *Journal of clinical pharmacy and therapeutics* 2016;41(2):128-44. doi: 10.1111/jcpt.12364
51. Hansen LO, Young RS, Hinami K, et al. Interventions to reduce 30-day rehospitalization: A systematic review. *Annals of internal medicine* 2011;155(8):520-8. doi: 10.7326/0003-4819-155-8-201110180-00008
52. Bethishou L, Herzik K, Fang N, et al. The impact of the pharmacist on continuity of care during transitions of care: A systematic review. *Journal of the American Pharmacists Association* 2020;60(1):163-77.e2. doi: 10.1016/j.japh.2019.06.020
53. Tomlinson J, Cheong VL, Fylan B, et al. Successful care transitions for older people: A systematic review and meta-analysis of the effects of interventions that support medication continuity. *Age Ageing* 2020 doi: 10.1093/ageing/afaa002 [published Online First: 2020/02/12]
54. Penm J, Vaillancourt R, Pouliot A. Defining and identifying concepts of medication reconciliation: An international pharmacy perspective. *Res Social Adm Pharm* 2019;15(6):632-40. doi: 10.1016/j.sapharm.2018.07.020 [published Online First: 2018/08/14]
55. Leguelinel-Blache G, Arnaud F, Bouvet S, et al. Impact of admission medication reconciliation performed by clinical pharmacists on medication safety. *Eur J Intern Med* 2014;25(9):808-14. doi: 10.1016/j.ejim.2014.09.012 [published Online First: 2014/10/04]
56. Stiftung Patientensicherheit Schweiz. Schriftreihe 7 - der systematische medikationsabgleich im akutspital 2015 [Available from:

https://www.patientensicherheit.ch/programme-progress/sichere-medikation-an-schnittstellen/ accessed 25.03.2021.
57. Bonaudo M, Martorana M, Dimonte V, et al. Medication discrepancies across multiple care transitions: A retrospective longitudinal cohort study in italy. *PLOS ONE* 2018;13(1):e0191028. doi: 10.1371/journal.pone.0191028
58. Beckett RD, Crank CW, Wehmeyer A. Effectiveness and feasibility of pharmacist-led admission medication reconciliation for geriatric patients. *Journal of Pharmacy Practice* 2012;25(2):136-41. doi: 10.1177/0897190011422605
59. Giannini O, Rizza N, Pironi M, et al. Prevalence, clinical relevance and predictive factors of medication discrepancies revealed by medication reconciliation at hospital admission: Prospective study in a swiss internal medicine ward. *BMJ Open* 2019;9(5):e026259. doi: 10.1136/bmjopen-2018-026259
60. Mekonnen AB, McLachlan AJ, Brien JA. Effectiveness of pharmacist-led medication reconciliation programmes on clinical outcomes at hospital transitions: A systematic review and meta-analysis. *BMJ Open* 2016;6(2):e010003. doi: 10.1136/bmjopen-2015-010003
61. Redmond P, Grimes TC, McDonnell R, et al. Impact of medication reconciliation for improving transitions of care. *Cochrane Database Syst Rev* 2018;8:CD010791. doi: 10.1002/14651858.CD010791.pub2 [published Online First: 2018/08/24]
62. Griese-Mammen N, Hersberger KE, Messerli M, et al. Pcne definition of medication review: Reaching agreement. *International Journal of Clinical Pharmacy* 2018;40(5):1199-208. doi: 10.1007/s11096-018-0696-7
63. Huiskes VJ, Burger DM, van den Ende CH, et al. Effectiveness of medication review: A systematic review and meta-analysis of randomized controlled trials. *BMC Fam Pract* 2017;18(1):5. doi: 10.1186/s12875-016-0577-x
64. Christensen M, Lundh A. Medication review in hospitalised patients to reduce morbidity and mortality. *Cochrane Database Syst Rev* 2016;2:CD008986. doi: 10.1002/14651858.CD008986.pub3
65. Graabaek T, Kjeldsen LJ. Medication reviews by clinical pharmacists at hospitals lead to improved patient outcomes: A systematic review. *Basic Clin Pharmacol Toxicol* 2013;112(6):359-73. doi: 10.1111/bcpt.12062
66. Maldonado AQ, Weeks DL, Bitterman AN, et al. Changing transplant recipient education and inpatient transplant pharmacy practices: A single-center perspective. *American Journal of Health-System Pharmacy* 2013;70(10):900-04. doi: 10.2146/ajhp120254
67. Capiau A, Foubert K, Van Der Linden L, et al. Medication counselling in older patients prior to hospital discharge: A systematic review. *Drugs & Aging* 2020;37(9):635-55. doi: 10.1007/s40266-020-00780-z
68. Eibergen L, Janssen MJA, Blom L, et al. Informational needs and recall of in-hospital medication changes of recently discharged patients. *Research in Social and Administrative Pharmacy* 2018;14(2):146-52. doi: 10.1016/j.sapharm.2017.01.006
69. Milosavljevic A, Aspden T, Harrison J. Community pharmacist-led interventions and their impact on patients' medication adherence and other health outcomes: A systematic review. *Int J Pharm Pract* 2018;26(5):387-97. doi: 10.1111/ijpp.12462
70. Okumura LM, Rotta I, Correr CJ. Assessment of pharmacist-led patient counseling in randomized controlled trials: A systematic review. *Int J Clin Pharm* 2014;36(5):882-91. doi: 10.1007/s11096-014-9982-1

71. Bonetti AF, Reis WC, Lombardi NF, et al. Pharmacist-led discharge medication counselling: A scoping review. *J Eval Clin Pract* 2018;24(3):570-79. doi: 10.1111/jep.12933
72. Lee H, Ryu K, Sohn Y, et al. Impact on patient outcomes of pharmacist participation in multidisciplinary critical care teams: A systematic review and meta-analysis. *Critical Care Medicine* 2019;47(9):1243-50. doi: 10.1097/ccm.0000000000003830
73. Naseralallah LM, Hussain TA, Jaam M, et al. Impact of pharmacist interventions on medication errors in hospitalized pediatric patients: A systematic review and meta-analysis. *International Journal of Clinical Pharmacy* 2020;42(4):979-94. doi: 10.1007/s11096-020-01034-z
74. Drovandi A, Robertson K, Tucker M, et al. A systematic review of clinical pharmacist interventions in paediatric hospital patients. *European Journal of Pediatrics* 2018;177(8):1139-48. doi: 10.1007/s00431-018-3187-x
75. Mulvogue K, Roberts JA, Coombes I, et al. The effect of pharmacists on ward rounds measured by the stopp/start tool in a specialized geriatric unit. *Journal of clinical pharmacy and therapeutics* 2017;42(2):178-84. doi: 10.1111/jcpt.12489
76. Gallagher J, McCarthy S, Byrne S. Economic evaluations of clinical pharmacist interventions on hospital inpatients: A systematic review of recent literature. *Int J Clin Pharm* 2014;36(6):1101-14. doi: 10.1007/s11096-014-0008-9 [published Online First: 2014/09/15]
77. Bullock B, Coombes I, Mitchell C, et al. A systematic review of the costs and cost-effectiveness of clinical pharmacists on hospital ward rounds. *Expert Rev Pharmacoecon Outcomes Res* 2019;19(5):551-59. doi: 10.1080/14737167.2019.1643089 [published Online First: 2019/07/16]
78. Ravn-Nielsen LV, Duckert ML, Lund ML, et al. Effect of an in-hospital multifaceted clinical pharmacist intervention on the risk of readmission: A randomized clinical trial. *JAMA Intern Med* 2018;178(3):375-82. doi: 10.1001/jamainternmed.2017.8274
79. Zemaitis CT, Morris G, Cabie M, et al. Reducing readmission at an academic medical center: Results of a pharmacy-facilitated discharge counseling and medication reconciliation program. *Hospital Pharmacy* 2016;51(6):468-73. doi: 10.1310/hpj5106-468
80. Phatak A, Prusi R, Ward B, et al. Impact of pharmacist involvement in the transitional care of high-risk patients through medication reconciliation, medication education, and postdischarge call-backs (ipitch study). *J Hosp Med* 2016;11(1):39-44. doi: 10.1002/jhm.2493
81. Pourrat X, Leyrat C, Allenet B, et al. Effectiveness of a multicomponent pharmacist intervention at hospital discharge for drug-related problems: A cluster randomised cross-over trial. *Brit J Clin Pharmaco* 2020;86(12):2441-54. doi: 10.1111/bcp.14349
82. International Pharmaceutical Federation, World Health Organization. Good pharmacy practice - joint fip/who guidelines on gpp: Standards for quality of pharmacy services. *WHO Technical Report Series* 2011;No. 961
83. Agency for Healthcare Research and Quality. Care transitions from hospital to home: Ideal discharge planning 2017 [Available from: https://www.ahrq.gov/sites/default/files/wysiwyg/professionals/systems/hospital/engagingfamilies/strategy4/Strat4_Implement_Hndbook_508_v2.pdf accessed 17.09.2020.
84. Clyne W, Blenkinsopp A, Seal R. A guide to medication review 2008 - national prescribing centre 2008 [Available from: https://www.cff.org.br/userfiles/52%20-

%20CLYNE%20W%20A%20guide%20to%20medication%20review%202008.pdf accessed 11.03.2021.
85. Vincent C, Staines A. Enhancing the quality and safety of swiss healthcare: Federal Office of Public Health; 2019 [Available from: https://www.bag.admin.ch/bag/en/home/versicherungen/krankenversicherung/krankenversicherung-qualitaetssicherung.html accessed 30.01.2020.
86. Fishman L, Bruhwiler L, Schwappach D. [medication safety in switzerland: Where are we today?] medikationssicherheit: Wo steht die schweiz? *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz* 2018;61(9):1152-58. doi: 10.1007/s00103-018-2794-z
87. Federal Office of Public Health. Short reports - enhancing the quality and safety of swiss healthcare 2019 [Available from: https://www.bag.admin.ch/bag/en/home/versicherungen/krankenversicherung/krankenversicherung-qualitaetssicherung.html accessed 30.01.2020.
88. Stiftung Patientensicherheit Schweiz. Pilotprogramm progress! Sichere medikation schnittstellen - schlussbericht executive summeray 2017 [Available from: https://www.patientensicherheit.ch/fileadmin/user_upload/1_Projekte_und_Programme/progress_sichere_med._schnittstellen/progress_sms_d/Executive_Summary_progress__Sichere_Medikation.pdf accessed 25.03.2021.
89. Ohno T. Toyota production system: Beyond large-scale production: Taylor & Francis 1988.
90. Helmreich RL, Merritt AC, Wilhelm JA. The evolution of crew resource management training in commercial aviation. *The International Journal of Aviation Psychology* 1999;9(1):19-32. doi: 10.1207/s15327108ijap0901_2
91. Green CF, Crawford V, Bresnen G, et al. A waste walk through clinical pharmacy: How do the 'seven wastes' of lean techniques apply to the practice of clinical pharmacists†‡. *Int J Pharm Pract* 2015;23(1):21-26. doi: 10.1111/ijpp.12106
92. Gross B, Rusin L, Kiesewetter J, et al. Crew resource management training in healthcare: A systematic review of intervention design, training conditions and evaluation. *BMJ Open* 2019;9(2):e025247. doi: 10.1136/bmjopen-2018-025247
93. Kohn LT, Corrigan J, Donaldson MS. To err is human: Building a safer health system. Washington, D.C.: National Academy Press 2000.
94. Craig P, Dieppe P, Macintyre S, et al. Developing and evaluating complex interventions: The new medical research council guidance. *BMJ* 2008;337:a1655. doi: 10.1136/bmj.a1655
95. Bundesvereinigung Deutscher Apothekerverbände ABDA. Grundsatzpapier zur medikationsanalyse und zum medikationsmanagement 2014 [Available from: https://www.abda.de/themen/arzneimitteltherapiesicherheit/foerderinitiative-pharmazeutische-betreuung/medikationsmanagement/.
96. Imfeld-Isenegger TL, Studer H, Ceppi MG, et al. Detection and resolution of drug-related problems at hospital discharge focusing on information availability – a retrospective analysis. *ZEFQ* 2021;Online Publication Ahead of Print doi: 10.1016/j.zefq.2021.08.004
97. Pharmaceutical Care Network Europe. Pcne working group on medication review 2016 [Available from: https://www.pcne.org/working-groups/1/medication-review accessed 09.03.2018.
98. American Society of Health-System Pharmacists. Ashp guidelines: Minimum standard for pharmacies in hospitals 2013 [Available from: https://www.ashp.org/-

/media/assets/policy-guidelines/docs/guidelines/minimum-standard-pharmacies-hospitals.ashx accessed 17.09.2020.
99. Canadian Pharmacists Association. Pharmacheck guide - a guide for pharmacists to aid in identifying and resolving medication issues 2012 [Available from: https://www.pharmacists.ca/cpha-ca/assets/File/membership/PharmaCheckGuideforPharmacists2012EN.pdf accessed 11.03.2021.
100. National Institute for Health and Care Exellence. Medication review 2017 [Available from: https://pathways.nice.org.uk/pathways/medicines-optimisation/medication-review#content=view-node%3Anodes-medicines-review accessed 17.01.2018.
101. National Institute for Health and Care Exellence. Medicines optimisation: The safe and effective use of medicines to enable the best possible outcomes 2015 [Available from: https://www.nice.org.uk/guidance/ng5 accessed 17.01.2018.
102. The Society of Hospital Pharmacists of Australia. Compiled quick guides shpa 2013 [Available from: https://www.shpa.org.au/sites/default/files/uploaded-content/website-content/SOP/quick_guides_e-book_2013.pdf accessed 17.09.2020.
103. Stampfli D, Boeni F, Gerber A, et al. Assessing the ability of the drug-associated risk tool (dart) questionnaire to stratify hospitalised older patients according to their risk of drug-related problems: A cross-sectional validation study. *BMJ Open* 2018;8(6):e021284. doi: 10.1136/bmjopen-2017-021284 [published Online First: 2018/06/29]
104. Wilmer CM, Huiskes VJB, Natsch S, et al. Drug-related problems in a clinical setting: A literature review and cross-sectional study evaluating factors to identify patients at risk. *Eur J Hosp Pharm-S P* 2015;22(4):229-35. doi: 10.1136/ejhpharm-2014-000605
105. Taylor MJ, McNicholas C, Nicolay C, et al. Systematic review of the application of the plan–do–study–act method to improve quality in healthcare. *BMJ Quality & Safety* 2014;23(4):290-98. doi: 10.1136/bmjqs-2013-001862
106. Altman M, Huang TTK, Breland JY. Design thinking in health care. *Preventing Chronic Disease* 2018;15 doi: 10.5888/pcd15.180128
107. Marvin V, Kuo S, Poots AJ, et al. Applying quality improvement methods to address gaps in medicines reconciliation at transfers of care from an acute uk hospital. *BMJ Open* 2016;6(6):e010230. doi: 10.1136/bmjopen-2015-010230
108. Kempen TGH, Kalvemark A, Sawires M, et al. Facilitators and barriers for performing comprehensive medication reviews and follow-up by multiprofessional teams in older hospitalised patients. *Eur J Clin Pharmacol* 2020;76(6):775-84. doi: 10.1007/s00228-020-02846-8 [published Online First: 2020/02/23]
109. Karam M, Brault I, Van Durme T, et al. Comparing interprofessional and interorganizational collaboration in healthcare: A systematic review of the qualitative research. *Int J Nurs Stud* 2018;79:70-83. doi: 10.1016/j.ijnurstu.2017.11.002 [published Online First: 2017/12/05]
110. World Health Organization. Framework for action on interprofessional education and collaborative practice 2010 [Available from: https://www.who.int/hrh/resources/framework_action/en/ accessed 26.03.2021.
111. Bruhwiler LD, Hersberger KE, Lutters M. Hospital discharge: What are the problems, information needs and objectives of community pharmacists? A mixed method approach. *Pharm Pract (Granada)* 2017;15(3):1046. doi: 10.18549/PharmPract.2017.03.1046

112. Wuyts J, Vande Ginste M, De Lepeleire J, et al. Discharge report for the community pharmacist: Development and validation of a prototype. *Res Social Adm Pharm* 2020;16(2):168-77. doi: 10.1016/j.sapharm.2019.04.049 [published Online First: 2019/05/13]
113. University of Basel. Cas klinische pharmazie [Available from: https://weiterbildung.pharma.unibas.ch/de/cas-klinische-pharmazie/ accessed 26.03.2021.
114. Mahtani K, Spencer EA, Brassey J, et al. Catalogue of bias: Observer bias. *BMJ Evidence-Based Medicine* 2018;23(1):23-24. doi: 10.1136/ebmed-2017-110884
115. Eidgenössisches Departement für auswärtige Angelegenheiten. Gesundheitssystem 2017 [updated 27.11.2017. Available from: https://www.eda.admin.ch/aboutswitzerland/de/home/wirtschaft/soziale-aspekte/gesundheitssystem.html accessed 28.04.2021.
116. Biller-Andorno N, Zeltner T. Individual responsibility and community solidarity--the swiss health care system. *N Engl J Med* 2015;373(23):2193-7. doi: 10.1056/NEJMp1508256 [published Online First: 2015/12/03]
117. Sackett DL. Bias in analytic research: Elsevier 1979:51-63.
118. Sjöström O, Holst D. Validity of a questionnaire survey: Response patterns in different subgroups and the effect of social desirability. *Acta Odontologica Scandinavica* 2002;60(3):136-40. doi: 10.1080/000163502753740133
119. Stämpfli D, Baumgartner P, Boeni F, et al. Translation and validation of a tool to assess the impact of clinical pharmacists' interventions. *International Journal of Clinical Pharmacy* 2019;41(1):56-64. doi: 10.1007/s11096-018-0755-0

APPENDICES

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Preview only: real form can vary slightly - Nur Vorschau: echtes Formular kann geringfügig anders aussehen

Mapping Klinische Pharmazie 2017

ATTENTION: The introductory text will not show up in paged forms.
For this case use an info field as first form field.

Mapping Klinische Pharmazie 2017

Mit dieser Umfrage soll einerseits die Entwicklung der klinisch-pharmazeutischen Tätigkeiten innerhalb der Schweizer Spitäler seit der letzten Erhebung erfasst werden (Mapping clinical pharmacy practice in Swiss hospitals 2013). Andererseits soll der Ablauf des Spitalaustrittes in Schweizer Spitälern erhoben werden. Wir möchten uns an dieser Stelle herzlich für Ihre Angaben bedanken.

Bitte füllen Sie die Umfrage auch dann aus, wann Sie zum heutigen Zeitpunkt keine klinisch-pharmazeutischen Aktivitäten ausweisen und / oder die Spitalapotheke nicht in den Spitalaustritt involviert ist.

WICHTIG: Wir setzen voraus, dass diese Umfrage von der verantwortlichen Person für den Fachbereich 'Klinische Pharmazie' ausgefüllt wird. Sollte keine entsprechende Person nominiert sein, bitten wir darum, dass die Leitung der Spitalapotheke die Fragen beantwortet. Das Ausfüllen des Fragebogens dauert etwa 25 Minuten.

Für Fragen steht Ihnen Helene Studer gerne zur Verfügung (Office: 061 207 15 19, Email: helene.studer@unibas.ch).

Bitte speichern Sie sämtliche Bereiche nach dem Ausfüllen der Fragen ab, am Ende wird der Fragebogen durch das Klicken von 'Fertig stellen' zur Auswertung übermittelt.

Teil 1 - Erhebung der Stammdaten des Spitals

1. Name der Institution

2. Ort

3. Postleitzahl (1000 ... 9999)

4. Art der Einrichtung

- ○ Universitätsspital
- ○ Kantonsspital
- ○ Regionalspital mit Notfallstation
- ○ Regionalspital ohne Notfallstation
- ○ Privatspital
- ○ Rehabilitationsklinik/-zentrum
- ○ Psychiatrische Klinik
- ○ Spitalverbund / -netzwerk*
- ○ Andere Klinikform:

*** falls als Spitalnetzwerk/ -verbund organisiert...**

... beschreiben Sie bitte unter Nr. 5 dessen Struktur und Umfang. Verwenden Sie dazu wenn immer möglich die Kategorien aus Frage 4. Beziehen Sie sich bitte im weiteren Verlauf des Fragebogens auf die Einrichtung(en), welche von Ihrer Apothekeneinheit betreut wird.

5. Struktur und Umfang des Spitalnetzwerk/-verbund:

6. Anzahl Betten, welche durch die Apotheke mit Medikamenten versorgt werden (= Spitalgrösse unter Berücksichtigung von Netzwerken und Verbund-Lösungen)

7. Anzahl Stellenprozente Apotheker/innen:

Zum Beispiel:
1 Apothekerin 100% + 1 Apotheker 80% + 1 Apotheker 40% = 220% Stellenprozente

8. Auf wie viele Apotheker/innen verteilen sich die Stellenprozente?

9. Wie viele der beschäftigten Apotheker/innen führen ausschliesslich den Fachtitel 'FPH Spitalpharmazie'?

10. Wie viele der beschäftigten Apotheker/innen führen ausschliesslich das Zertifikat 'FPH Klinische Pharmazie'?

11. Wie viele der beschäftigten Apotheker/innen führen sowohl den Fachtitel 'FPH Spitalpharmazie', als auch das Zertifikat 'Klinische Pharmazie'?

12. Werden Ausbildungsplätze für den Fachtitel 'FPH Spitalpharmazie' angeboten? ○ Ja ○ Nein

13. Falls 'JA': Wie viele?

14. Werden Ausbildungsplätze für das Zertifikat 'FPH Klinische Pharmazie' angeboten? ○ Ja ○ Nein

15. Falls 'JA': Wie viele?

16. Bildet Ihre Institution Assistenzärzte aus (=Ausbildungskrankenhaus)? ○ Ja ○ Nein

17. Haben Sie Bemerkungen zu Teil 1?

Seitenumbruch --- **Teil 2 - Dienstleistungen der Klinischen Pharmazie**

Die Befragung basiert auf der von GSASA formulierten Definition für 'Klinische Pharmazie':

‚Die klinische Pharmazie ist jener Teilbereich der Pharmazie, der die Entwicklung und Förderung einer angemessenen, sicheren und ökonomischen Anwendung von Arzneimitteln zum Ziel hat.

Im Spital versteht man unter „klinischer Pharmazie" die **patientenorientierten** pharmazeutischen Tätigkeiten **auf den Pflegeabteilungen in interdisziplinärer** Zusammenarbeit mit den anderen Fachpersonen.' (V.1, 11/2011)

18. Werden von Ihrem Betrieb klinisch-pharmazeutische Dienstleistungen angeboten? *

○ Ja ○ Nein, aber in Planung ○ Nein

Falls JA -> Bitte ALLE der folgenden Fragen beantworten. Danke!

Falls NEIN -> Bitte diese Seite unten speichern und mit Teil 3 'Spitalaustritt' fortfahren. Danke!

19. Wie viele der Apothekan-Stellenprozente stehen für den Bereich 'Klinische Pharmazie' zur Verfügung?

20. Wie viele Betten werden regelmässig durch klinische Pharmazeuten betreut (mind. alle zwei Wochen ein Visitenbesuch)

21. Wie sind die Dienstleistungangebote des Bereichs 'Klinische Pharmazie' organisiert?

○ Ohne Präsenz zur Patientenstation

○ Teilweise mit Präsenz zur Patientenstation

○ >50% der Arbeitszeit* erfolgt auf der Patientenstation (*rmind. eines Apothekers)

Wie häufig erbringen Sie folgende Leistungen (bezogen auf die letzten 12 Monate)?

Die Dienstleistungsbereiche sind der Übersicht halber in drei Kategorien mit jeweils unterschiedlichem Fokus aufgeteilt (Patientenorientierte, Behandlungsorientierte und Prozessorientierte Dienstleistungen).

Bei Anfragen für Empfehlungen, sind sowohl Anfragen auf Visite, als auch Anfragen per Email, Telefon, usw. zu berücksichtigen.

22. Patientenorientierte Dienstleistungen

	täglich	wöchentlich	monatlich	3-4x pro Jahr	1-2x pro Jahr	nie
Visite auf Station mit Mappex	○	○	○	○	○	○
Visite auf Station mit Arzt & Mappex (ohne Patientenkontakt)	○	○	○	○	○	○
Visite auf Station mit Arzt am Patientenbett	○	○	○	○	○	○
Patientenschulung während dem Spitalaufenthalt	○	○	○	○	○	○
Anamnese der Eintrittsmedikation	○	○	○	○	○	○
Bereitstellen der Medikamente mit Dosette [stationär]	○	○	○	○	○	○
Bereitstellen der Medikamente mit Dosette [ambulant]	○	○	○	○	○	○
Bereitstellen der Medikamente mit Dosette [Patientenurlaub / Wochenende zuhause]	○	○	○	○	○	○

23. Behandlungsorientierte Dienstleistungen

	täglich	wöchentlich	monatlich	3-4x pro Jahr	1-2x pro Jahr	nie
Empfehlungen zu TDM-Verordnungen	○	○	○	○	○	○
Empfehlungen zu TPN-Verordnungen	○	○	○	○	○	○
Empfehlungen zu Verordnungen von Risikomedikamenten*	○	○	○	○	○	○

Empfehlungen zu Verordnungen von Antibiotika	○	○	○	○	○	○
Empfehlungen zur Austrittsverordnung	○	○	○	○	○	○

*hier liegt der Fokus auf Wirkstoffen mit enger therapeutischer Breite und/oder kritischem Interaktionspotential. Ein Risikomedikament ist demnach zum Beispiel Methotrexat.

24. Prozessorientierte Dienstleistungen

	täglich	wöchentlich	monatlich	3-4x pro Jahr	1-2x pro Jahr	nie
Beantworten von internen Anfragen	○	○	○	○	○	○
Beantworten von externen Anfragen	○	○	○	○	○	○
UAW-Meldung an Pharmacovigilanz-Zentrum	○	○	○	○	○	○
Erstellung von einem Therapieplan für Austrittsverordnung z.H. des Patienten	○	○	○	○	○	○

25. Bieten Sie weitere klinisch-pharmazeutische Dienstleistungen an, welche nicht aufgeführt sind? (Falls 'Ja': Bitte beschreiben Sie diese in einigen Stichworten)

26. Haben Sie Bemerkungen zu den patientenorientierten, behandlungsorientierten oder prozessorientierten Dienstleistungen?

27. Bieten Sie eine offizielle Hotline für externe klinisch-pharmazeutische Anfragen von MEDIZINALPERSONEN an?

○ Ja ○ Nein

28. Bieten Sie eine offizielle Hotline für externe klinisch-pharmazeutische Anfragen von PATIENTEN an?

○ Ja ○ Nein

EAHP Statements

EAHP = european association of hospital pharmacists

Die nachfolgenden Fragen basieren auf den EAHP Statements (http://statements.eahp.eu/statements/european-statements-hospital-pharmacy). Mit diesen Fragen soll der nationale Implementierungsgrad erfasst werden.

29. Wie häufig ist die Klinische Pharmazie / Spitalapotheke in folgende Tätigkeiten involviert?

	Täglich	Mehrmals wöchentlich	Mehrmals monatlich	1 Mal monatlich oder weniger	Nie
Therapeutische Entscheidungen wie Beratung, Implementierung und Überwachung von Medikationsänderungen	○	○	○	○	○
Prüfung und Validierung der Verordnungen	○	○	○	○	○
Medikationsabgleich bei Spitaleintritt	○	○	○	○	○
Beurteilung, ob die Medikation (inkl. pflanzliche Präparate und Nahrungsergänzungsmittel) angemessen ist	○	○	○	○	○
Weiterleitung von Informationen zur Medikation der Patienten bei Schnittstellen (z.B. Spitaleintritt / -austritt, Abteilungswechsel)	○	○	○	○	○
Sicherstellen, dass Patienten leicht verständliche Informationen zur Medikation erhalten	○	○	○	○	○

Information, Aufklärung und Beratung der Patienten über Medikamente bei 'Off-label' Gebrauch	○	○	○	○	○
Dokumentation pharmazeutischer Interventionen	○	○	○	○	○

30. Falls 'pharmazeutische Interventionen dokumentiert werden': Wie werden diese dokumentiert? (Mehrfachauswahl)

☐ GSASA Klassifikationssystem
☐ Patientendossier
☐ Anders:

31. Falls 'pharmazeutische Interventionen dokumentiert werden': Werden diese zur Qualitätssteigerung analysiert?

○ Ja
○ Nein

32. Haben Sie Bemerkungen zu den obengegenannten Tätigkeiten (EAHP Statements)?

Akzeptanz und Rahmenbedingungen in der klinischen Pharmazie

33. Bitte nehmen Sie zu folgenden Aussagen Stellung:

	Stimme überhaupt nicht zu	Stimme eher nicht zu	Stimme eher zu	Stimme voll und ganz zu	Keine Äusserung
Bezogen auf die letzten fünf Jahre hat die Akzeptanz innerhalb der Ärzteschaft für den Fachbereich 'Klinische Pharmazie' zugenommen.	○	○	○	○	○
Ärzte schätzen unsere Empfehlungen und setzen diese um.	○	○	○	○	○
Ich werde über die Umsetzung unserer Empfehlungen informiert.	○	○	○	○	○
Mein Betrieb stellt genügend personelle Ressourcen für den Fachbereich 'Klinische Pharmazie' zur Verfügung.	○	○	○	○	○
Wir würden in unserem Betrieb gerne mehr klinische Pharmazie anbieten	○	○	○	○	○

34. Werden in Ihrem Betrieb Forschungsprojekte mit klinisch-pharmazeutischen Hintergrund bearbeitet? ○ Ja ○ Nein

35. Falls 'JA': Können Sie in Stichworten umschreiben, worin der Fokus liegt?

36. Haben Sie Bemerkungen zu Teil 2 – 'Dienstleistungen der Klinischen Pharmazie'?

Seitenumbruch --- **Teil 3 – Spitalaustritt**

Teil 3.1 – Vor Spitalaustritt

In diesem Teil geht es um patientenbezogene Tätigkeiten vor dem Spitalaustritt und die darin involvierten Personen.

37. Gibt es in Ihrem Spital Richtlinien zu den Abläufen des Spitalaustrittes?

○ Ja
○ Nein
○ Ich weiss es nicht

38. Gibt es Bemühungen, Patienten zu identifizieren, die eine intensivere Betreuung hinsichtlich des Spitalaustritts benötigen?

○ Ja
○ Nein
○ Ich weiss es nicht

39. Falls 'JA': Wie werden diese Patienten identifiziert?

40. Falls 'JA': Was beinhaltet die intensivere Betreuung zusätzlich zur Standard Betreuung? (Bitte beschreiben Sie in einigen Stichworten)

41. Welche der untenstehenden Personen sind bei Spitalaustritt in folgende Tätigkeiten involviert (unabhängig von der Häufigkeit)? (Mehrfachauswahl)

	Klinische Pharmazie / Spitalapotheke	Offizin Apotheke im Spital (falls vorhanden)	Arzt	Pflege	Andere	Wird nicht gemacht	Ich weiss es nicht
Validierung des Austrittsrezeptes	☐	☐	☐	☐	☐	☐	☐
Festhalten von zusätzlichen Informationen auf dem Austrittsrezept (z.B. gestoppte Medikamente)	☐	☐	☐	☐	☐	☐	☐
Rücksubstitutionen (vom Medikament der Spitalliste auf Medikament des Patienten vor Spitaleintritt, z.B. Generikum)	☐	☐	☐	☐	☐	☐	☐
Dokumentation von durchgeführten Interventionen zum Spitalaustrittsrezept	☐	☐	☐	☐	☐	☐	☐

Information der Patienten über ihre Medikation (z.B. Behandlungsdauer / Dosierung)	☐	☐	☐	☐	☐	☐	☐
Vertiefte Information der Patienten über ihre Medikation (z.B. Wirkung / Nutzen bzw. Therapieziel / Nebenwirkungen)	☐	☐	☐	☐	☐	☐	☐
Patienteninstruktion (z.B. für Inhalationsgerät / Fertigspritze)	☐	☐	☐	☐	☐	☐	☐
Information der Patienten über «Red Flags» (Symptome, die auf eine Verschlechterung der Krankheit / Medikamentenunverträglichkeit hindeuten)	☐	☐	☐	☐	☐	☐	☐
Information der Patienten, was sie mit den Medikamenten machen sollen, die sie noch von vor dem Spitaleintritt besitzen	☐	☐	☐	☐	☐	☐	☐
Abgabe der Medikamente zur Erstversorgung	☐	☐	☐	☐	☐	☐	☐
Erstellen eines Medikationsplans	☐	☐	☐	☐	☐	☐	☐

42. Falls 'Andere': Bitte beschreiben Sie in Stichworten welche 'Anderen' Personen in die obengenannten Tätigkeiten involviert sind

43. Haben Sie Bemerkungen zu den obengenannten Tätigkeiten bzw. den involvierten Personen?

44. Falls 'die Klinische Pharmazie / Spitalapotheke involviert ist': Wie häufig ist die klinische Pharmazie / Spitalapotheke bei Spitalaustritt in folgende Tätigkeiten involviert?

	Täglich	Mehrmals wöchentlich	Mehrmals monatlich	1 Mal monatlich oder weniger
Validierung des Austrittsrezeptes	○	○	○	○
Festhalten von zusätzlichen Informationen auf dem Austrittsrezept (z.B. gestoppte Medikamente)	○	○	○	○
Rücksubstitutionen (vom Medikament der Spitalliste auf Medikament des Patienten vor Spitaleintritt, z.B. Generikum)	○	○	○	○
Dokumentation von durchgeführten Interventionen zum Spitalaustrittsrezept	○	○	○	○
Information der Patienten über ihre Medikation (z.B. Behandlungsdauer / Dosierung)	○	○	○	○
Vertiefte Information der Patienten über ihre Medikation (z.B. Wirkung / Nutzen bzw. Therapieziel / Nebenwirkungen)	○	○	○	○
Patienteninstruktion (z.B. für Inhalationsgerät / Fertigspritze)	○	○	○	○
Information der Patienten über «Red Flags» (Symptome, die auf eine Verschlechterung der Krankheit / Medikamentenunverträglichkeit hindeuten)	○	○	○	○
Information der Patienten, was sie mit den Medikamenten machen sollen, die sie noch von vor dem Spitaleintritt besitzen	○	○	○	○
Abgabe der Medikamente zur Erstversorgung	○	○	○	○
Erstellen eines Medikationsplans	○	○	○	○

45. Haben Sie Bemerkungen zu Teil 3.1 - 'Vor dem Spitalaustritt'?

Teil 3.2 – Nach Spitalaustritt

Im nachfolgenden Teil geht es um die Kommunikation der Medikationsänderungen zwischen den involvierten Personen / Institutionen nach dem Spitalaustritt.

46. An welche der folgenden Personen / Institutionen werden Medikationsänderungen kommuniziert? (Mehrfachauswahl)

- ☐ Niedergelassener Arzt
- ☐ Stammapotheke der Patienten
- ☐ Spitex
- ☐ Patienten / Angehörige
- ☐ Alters- und Pflegeheim
- ☐ Medikationsänderungen werden nicht kommuniziert
- ☐ Ich weiss es nicht
- ☐ An andere Personen / Institutionen:

47. Falls 'Medikationsänderungen kommuniziert werden': Wie werden Medikationsänderungen an folgende Personen / Institutionen kommuniziert? (Mehrfachauswahl)

	Austrittsrezept	Austrittsbericht	Medikationsplan	Andere Art	Ich weiss es nicht
Niedergelassener Arzt	☐	☐	☐	☐	☐
Stammapotheke der Patienten	☐	☐	☐	☐	☐
Spitex	☐	☐	☐	☐	☐
Patienten / Angehörige	☐	☐	☐	☐	☐
Alters- und Pflegeheim	☐	☐	☐	☐	☐

48. Falls 'Medikationsänderungen auf eine 'Andere Art' kommuniziert werden': Bitte beschreiben Sie diese in Stichworten

49. Falls 'Medikationsänderungen an 'Andere Personen / Institutionen' kommuniziert werden': Wie werden Medikationsänderungen an diese kommuniziert? Bitte beantworten Sie die Frage mit den selben Kategorien wie in der vorhergehenden Frage ('Austrittsrezept', 'Austrittsbericht', 'Medikationsplan', 'Andere Art', 'Ich weiss es nicht' -> Beispiel nach Textfeld)

Zum Beispiel:

1. Andere Person / Institution: Austrittsrezept, Austrittsbericht und Medikationsplan

2. Andere Person / Institution: Medikationsplan

50. Falls 'Medikationsänderungen kommuniziert werden': Werden auch Gründe für die Medikationsänderungen kommuniziert?

	Ja, regelmässig	Ja, gelegentlich	Nein	Ich weiss es nicht
Niedergelassener Arzt	○	○	○	○
Stammapotheke der Patienten	○	○	○	○
Spitex	○	○	○	○
Patienten / Angehörige	○	○	○	○
Alters- und Pflegeheim	○	○	○	○

51. Falls 'Medikationsänderungen an 'Andere Personen / Institutionen' kommuniziert werden': Werden auch Gründe für Medikationsänderungen an diese kommuniziert? Bitte beantworten Sie die Frage mit den selben Kategorien wie in der vorhergehenden Frage ('Ja, regelmässig', 'Ja, gelegentlich', 'Nein', 'Ich weiss es nicht' -> Beispiel nach Textfeld)

Zum Beispiel:

1. Andere Person / Institution: Ja, regelmässig

2. Andere Person / Institution: Nein

52. Falls 'Medikationsänderungen kommuniziert werden': Wie häufig ist die Klinische Pharmazie / Spitalapotheke in die Kommunikation von Medikationsänderungen in den ambulanten Bereich involviert?

- ○ Täglich
- ○ Mehrmals wöchentlich
- ○ Mehrmals monatlich
- ○ 1 Mal monatlich oder weniger
- ○ Nie

53. Findet ein Follow-up Telefonanruf mit den Austrittspatienten statt (z.B. um die richtige Anwendung der Spitalaustrittsmedikation sicherzustellen)?

- ○ Ja, regelmässig
- ○ Ja, gelegentlich
- ○ Nein
- ○ Ich weiss es nicht

54. Falls 'JA': Mit welchen Austrittspatienten findet ein Follow-up Telefonanruf statt?

55. Falls 'JA': Wer führt diese Telefonanrufe durch? (Mehrfachauswahl)

- ☐ Klinische Pharmazeuten / Spitalapotheker
- ☐ Arzt
- ☐ Pflege
- ☐ Andere:

56. Falls 'JA': Wie lange nach Spitalaustritt findet dieser Telefonanruf in der Regel statt?

- ○ Innerhalb der ersten 48 Stunden
- ○ Innerhalb der ersten 4 Tage
- ○ Innerhalb der ersten Woche
- ○ Nach der ersten Woche
- ○ Unterschiedlich

- ○ Ich weiss es nicht

57. Haben Sie Bemerkungen zu Teil 3.2 - 'Nach Spitalaustritt'?

Teil 3.3 – Modelle zur Unterstützung des Medikamentenmanagements bei Spitalaustritt

In einigen Spitälern wurden Modelle implementiert, um die Patienten bei Spitalaustritt zu unterstützen. In diesem Teil des Fragebogens sollen solche Modelle erfasst werden, insbesondere das Konzept einer Offizin Apotheke im Spital und Personen, welche die Patienten bei Spitalaustritt unterstützen.

58. Welche der folgenden Patientendaten werden elektronisch erfasst? (Mehrfachauswahl)

- ☐ Eintrittsanamnese
- ☐ Diagnose
- ☐ Vitalparameter
- ☐ Verordnung der Medikamente während dem Spitalaufenthalt
- ☐ Verlaufsbericht
- ☐ Laborresultate
- ☐ Allergien
- ☐ Austrittsverordnung / Austrittsbericht
- ☐ Keine

59. Falls 'elektronisch erfasst': Wie ist der Zugriff für die Spitalapotheke / Offizin Apotheke (falls in Ihrem Spital eine vorhanden) auf die elektronischen Patientendaten geregelt? (Mehrfachauswahl)

	Die Spitalapotheke hat Leseberechtigung	Die Spitalapotheke hat Schreibberechtigung	Die Offizin Apotheke hat Leseberechtigung	Die Offizin Apotheke hat Schreibberechtigung	Die Offizin Apotheke hat Leseberechtigung, aber nur mit Zustimmung der Patienten	Die Offizin Apotheke hat Schreibberechtigung, aber nur mit Zustimmung der Patienten
Eintrittsanamnese	☐	☐	☐	☐	☐	☐
Diagnose	☐	☐	☐	☐	☐	☐
Vitalparameter	☐	☐	☐	☐	☐	☐
Verordnung der Medikamente während Spitalaufenthalt	☐	☐	☐	☐	☐	☐
Verlaufsbericht	☐	☐	☐	☐	☐	☐
Laborresultate	☐	☐	☐	☐	☐	☐
Allergien	☐	☐	☐	☐	☐	☐
Austrittsverordnung / Austrittsbericht	☐	☐	☐	☐	☐	☐

Offizin Apotheke im / beim Spital

60. Gibt es eine für die Patienten zugängliche Apotheke im / beim Spital?

- ○ Eine Offizin Apotheke, die dem Spital gehört
- ○ Eine Offizin Apotheke, die nicht dem Spital gehört
- ○ Die Spitalapotheke hat einen öffentlichen Schalter für Austrittspatienten
- ○ Nichts der obengenannten

Falls **'Nichts der obengenannten'** -> Überspringen Sie die folgenden Fragen und fahren Sie bei 'Transition Coach' weiter. Danke!

Alle anderen -> Beantworten Sie folgende Fragen. Danke!

51. Bitte beschreiben Sie die Zusammenarbeit mit dieser Apotheke in einigen Stichworten

52. Welche Funktion hat diese Offizin Apotheke / dieser Schalter der Spitalapotheke für die Austrittspatienten? (Mehrfachauswahl)

- ☐ Sicherstellung Erstversorgung des Patienten (z.B. Abgabe Kleinpackung)
- ☐ Spezielle Austrittsplanung
- ☐ Abgleich der Medikation mit Spitaldaten
- ☐ Überleitung und Kommunikation von Änderungen an die Stammapotheke
- ☐ Andere:

53. Wird diese Offizin Apotheke / dieser Schalter der Spitalapotheke vor dem Spitalaustritt des Patienten über den Austritt informiert? (Mehrfachauswahl)

- ☐ Ja, in Form eines schriftlichen Berichtes (Austrittsbericht)
- ☐ Ja, das Rezept wird im Voraus gesendet
- ☐ Ja, durch einen Telefonanruf
- ☐ Nein
- ☐ Ja, anders:

54. Falls 'JA': Durch wen wird diese Offizin Apotheke / dieser Schalter im Spital informiert? (Mehrfachauswahl)

- ☐ Spitalapotheke
- ☐ Arzt
- ☐ Pflege
- ☐ Andere:

55. Falls der Patient eine Stammapotheke ausserhalb des Spitals hat, wird diese vor dem Spitalaustritt des Patienten über den Austritt informiert? (Mehrfachauswahl)

- ☐ Ja, in Form eines schriftlichen Berichtes (Austrittsbericht)
- ☐ Ja, das Rezept wird im Voraus gesendet
- ☐ Ja, durch einen Telefonanruf
- ☐ Nein
- ☐ Ich weiss es nicht
- ☐ Ja, anders:

56. Falls 'JA': Durch wen wird die Stammapotheke informiert? (Mehrfachauswahl)

- ☐ Spitalapotheke
- ☐ Offizin Apotheke im Spital (falls vorhanden)
- ☐ Arzt
- ☐ Pflege
- ☐ Andere:

57. Bitte nennen Sie uns eine Kontaktperson mit Email-Adresse und Telefonnummer dieser Offizin

Apotheke, für weitere Fragen:

58. Haben Sie Bemerkungen zum Model 'Offizin Apotheke im / beim Spital'?

Transition Coach

In einigen Spitälern werden «Patient Manager» / «Transition Coach» / «Case Manager» eingesetzt, die die Patienten während des Spitalaustrittes unterstützten. Sie übernehmen verschiedene Aufgaben, wie zum Beispiel: Medikamentenmanagement, organisatorische Aufgaben oder Besprechung von «Red Flags» (Symptome, die auf eine Verschlechterung der Krankheit / Medikamentenunverträglichkeit hindeuten).

69. Gibt es in Ihrem Spital Personen, welche die Patienten beim Spitalaustritt unterstützen?

- ○ Ja
- ○ Nein
- ○ Ich weiss es nicht

70. Falls 'JA': Welche Personen übernehmen diese Aufgabe? (Mehrfachauswahl)

- ☐ Apotheker
- ☐ Arzt
- ☐ Pflege
- ☐ Sozialarbeiter
- ☐ Physio- / Ergotherapeuten
- ☐ Ich weiss es nicht
- ☐ Andere:

71. Falls 'JA': Was sind die Aufgaben dieser Personen? (Mehrfachauswahl)

- ☐ Besprechung der Medikamente (z.B. Dosis, Wirkung, Nebenwirkung, ...)
- ☐ Organisation der Medikamente (z.B. Kontakt mit Stammapotheke / Dosett® / Kostenübernahme)
- ☐ Besprechung von «Red Flags» (Symptome, die auf eine Verschlechterung der Krankheit / Medikamentenunverträglichkeit hindeuten)
- ☐ Organisation Reha / Spitex
- ☐ Sicherstellung einer Nachsorge (z.B. Termin zur Nachkontrolle bei behandelndem Arzt)
- ☐ Nachbetreuung nach Austritt (z.B. Telefonkontakt)
- ☐ Ich weiss es nicht

72. Sind in Ihrem Spital weitere Modelle zur Erleichterung des Spitalaustrittes implementiert?

- ○ Ja
- ○ Nein
- ○ Ich weiss es nicht

73. Falls 'JA': Bitte erläuren Sie diese Modelle in einigen Stichworten

74. Haben Sie Bemerkungen zu Teil 3.3 - 'Modelle zur Unterstützung des Medikamentenmanagements bei Spitalaustrittes'?

Seitenumbruch --- **Teil 4 - Kontaktdaten**

Kontaktdaten

Bitte geben Sie Ihre Kontaktdaten an. Diese werden vertraulich behandelt und dienen nur zu Rückfragen bei allfälligen Unklarheiten. Vielen Dank!

75. Kontaktperson für Rückfragen:

76. E-Mail:

Formular abschicken

Vielen Dank, dass Sie sich die Zeit genommen haben bei dieser Umfrage mitzumachen!

Beenden Sie die Umfrage, in dem Sie den Button oben links 'Fertig stellen' wählen.

Abschicken Zurücksetzen

Vorschau schliessen

Preview only: real form can vary slightly - Nur Vorschau: echtes Formular kann geringfügig anders aussehen

Mapping pharmacie clinique 2017

ATTENTION: The introductory text will not show up in paged forms.
For this case use an info field as first form field.

Mapping pharmacie clinique 2017

Le but de ce sondage est de répertorier d'une part le développement des activités en pharmacie clinique pratiquées dans les hôpitaux suisses depuis la dernière enquête (Mapping clinical pharmacy practice in Swiss hospitals 2013). D'autre part, on cherche également à répertorier le déroulement de la sortie d'hôpital en Suisse. Nous tenons à vous remercier chaleureusement pour votre collaboration.

Veuillez, s'il vous plaît (s.v.p.), répondre au questionnaire, même si vous ne proposez actuellement pas de prestations en pharmacie clinique dans votre établissement et / ou si la pharmacie hospitalière n'est pas impliquée dans les sorties d'hôpital.

IMPORTANT : le questionnaire est à remplir par la personne responsable de la section 'pharmacie clinique' de l'établissement. Si personne n'est désignée ainsi, la personne responsable de la pharmacie hospitalière est priée de répondre aux questions. Le temps nécessaire pour remplir le questionnaire est d'environ 25 minutes.

Pour d'éventuelles questions, Helene Studer reste volontiers à votre disposition (bureau: 061 207 15 19, email: helene.studer@unibas.ch).

Veuillez, s.v.p., sauvegarder chaque partie du questionnaire après avoir répondu aux questions. Une fois le questionnaire rempli, cliquez sur le bouton «terminer» pour garantir l'évaluation de vos réponses.

(Dans le but d'alléger le texte, le genre masculin désigne ici à la fois le masculin et le féminin)

Partie 1- Saisie des données de base de l'hôpital

1. Nom de l'établissement:

2. Lieu

3. Code postal (1000 ... 9999)

4. Type d'établissement

- ○ Hôpital universitaire
- ○ Hôpital régional sans service d'urgences
- ○ Clinique psychiatrique
- ○ Hôpital cantonal
- ○ Hôpital privé
- ○ Réseau hospitalier*
- ○ Hôpital régional avec service d'urgences
- ○ Centre de réhabilitation
- ○ Autre type:

*** Si votre établissement est organisé en réseau hospitalier...**

... veuillez, s.v.p., décrire la structure et la taille de celui-ci dans la question 5. Utilisez, si possible, les catégories de la question 4. Référez-vous, pour la suite du questionnaire, à l'établissement / aux établissements qui profite/nt des prestations de votre pharmacie.

5. Structure et taille du réseau hospitalier:

6. Nombre de lits approvisionnés en médicaments par la pharmacie (= taille de l'hôpital en tenant compte des réseaux hospitaliers)

7. Pourcentage de postes de pharmaciens

Par exemple:

1 pharmacienne 100% + 1 pharmacien 80% + 1 pharmacien 40% = 220% (pourcentage de postes)

8. Sur combien de pharmaciens se distribue ce pourcentage?

9. Combien de pharmaciens employés sont exclusivement porteurs du titre de spécialiste 'FPH en pharmacie hospitalière'?

10. Combien de pharmaciens employés sont exclusivement porteurs du certificat 'FPH en pharmacie clinique'?

11. Combien de pharmaciens employés sont porteurs tant du titre de spécialiste 'FPH en pharmacie hospitalière' que du certificat 'FPH en pharmacie clinique'?

12. Offrez-vous des places de formation pour le titre de spécialiste 'FPH en pharmacie hospitalière'? ○ Oui ○ Non

13. Si 'Oui': combien?

14. Offrez-vous des places de formation pour le certificat 'FPH en pharmacie clinique'? ○ Oui ○ Non

15. Si 'Oui': combien?

16. Votre établissement forme-t-il des médecins assistants (= hôpital formateur)? ○ Oui ○ Non

17. Avez-vous des remarques additionnelles sur la partie 1?

Seitenumbruch --- **Partie 2 – Prestations en pharmacie clinique**

Le sondage se base sur la définition de la 'pharmacie clinique' selon la GSASA :

'La pharmacie clinique est un domaine de la pharmacie visant le développement et la promotion d'une utilisation appropriée, sûre et économique des produits thérapeutiques.

A l'hôpital, elle comprend des activités pharmaceutiques orientées directement vers le **patient**, développées dans les **unités de soins** en collaboration avec les **autres professionnels de santé**.' (V.1, 11/2011)

18. Votre pharmacie propose-t-elle des prestations en pharmacie clinique? (*)

○ Oui ○ Non, mais c'est prévu ○ Non

Si 'Oui' -> Veuillez, s.v.p., répondre à TOUTES les questions suivantes. Merci!

Si 'Non' -> Veuillez, s.v.p., sauvegarder cette page en bas et continuer avec la partie 3 'sortie d'hôpital'. Merci!

19. Quel pourcentage de postes est à disposition pour le domaine de la 'pharmacie clinique'?

20. Combien de lits sont régulièrement visités par la pharmacie clinique (au moins une visite toutes les deux semaines)?

21. Comment les prestations en pharmacie clinique sont-elles organisées?

○ Pas de présence dans les unités de soins
○ Présence partielle dans les unités de soins
○ Plus de 50% du temps de travail* se passe dans les unités de soins (*présence d'au moins un pharmacien)

A quelle fréquence pratiquez-vous les activités cliniques suivantes (relatif aux 12 derniers mois)?

Par souci de clarté, les secteurs de service sont répartis dans trois catégories traitant un accent différent (prestations liées au patient, au traitement et au processus).

Toutes les demandes de recommandations sont à prendre en compte, qu'elles soient demandées lors de la visite, par e-mail, par téléphone, etc.

22. Prestations liées au patient

	journalier	hebdomadaire	mensuel	3-4 x par an	1-2 x par an	jamais
Visite dans les unités de soins avec le dossier médical	○	○	○	○	○	○
Visite dans les unités de soins avec le médecin et le dossier médical (sans contact avec le patient)	○	○	○	○	○	○
Visite dans les unités de soins avec le médecin au chevet du patient	○	○	○	○	○	○
Education du patient lors de son séjour à l'hôpital	○	○	○	○	○	○
Anamnèse du traitement lors de l'entrée à l'hôpital	○	○	○	○	○	○
Préparer un pilulier journalier [stationnaire]	○	○	○	○	○	○
Préparer un pilulier journalier [ambulatoire]	○	○	○	○	○	○
Préparer un pilulier journalier [vacances du patient / week-end à la maison]	○	○	○	○	○	○

23. Prestations liées au traitement

	journalier	hebdomadaire	mensuel	3-4 x par an	1-2 x par an	jamais
Recommandations de prescriptions TDM (suivi thérapeutique pharmacologique)	○	○	○	○	○	○
Recommandations de prescriptions d'alimentation parentérale	○	○	○	○	○	○
Recommandations de prescriptions de médicaments à risques*	○	○	○	○	○	○
Recommandations concernant les prescriptions d'antibiotiques	○	○	○	○	○	○
Recommandations concernant les prescriptions à la sortie d'hôpital	○	○	○	○	○	○

*Ici, l'accent est mis sur les principes actifs à index thérapeutique faible et / ou avec un important potentiel d'interactions. Un médicament à risque est p. ex. le méthotrexate.

24. Prestations liées au processus

	journalier	hebdomadaire	mensuel	3-4 x par an	1-2 x par an	jamais
Répondre aux demandes internes (assistance pharmaceutique)	○	○	○	○	○	○
Répondre aux demandes externes	○	○	○	○	○	○
Annoncer des effets indésirables au centre de pharmacovigilance	○	○	○	○	○	○
Elaborer un plan thérapeutique à la décharge du patient	○	○	○	○	○	○

25. Offrez-vous d'autres prestations pharmaceutiques, qui ne sont pas répertoriées ci-dessus? (Si 'Oui': veuillez, s.v.p., les décrire en quelques mots)

26. Avez-vous des remarques additionnelles sur les prestations liées au patient, au traitement ou au processus?

27. Offrez-vous une hotline officielle pour des demandes pharmaceutiques externes posées par des PERSONNES MÉDICALES?

○ Oui ○ Non

28. Offrez-vous une hotline officielle pour des demandes pharmaceutiques externes posées par des PATIENTS?

○ Oui ○ Non

EAHP statements

EAHP = European association of hospital pharmacists

Les questions suivantes se basent sur les déclarations de l'EAHP (http://statements.eahp.eu/statements/european-statements-hospital-pharmacy). Avec ces questions, nous cherchons à répertorier le degré d'implémentation nationale.

29. A quelle fréquence la pharmacie clinique / hospitalière est-elle impliquée dans les activités suivantes?

	Quotidiennement	plusieurs fois par semaine	Plusieurs fois par mois	1 fois par mois ou moins	Jamais
La prise de décisions thérapeutiques telles que le conseil, la mise en œuvre et le contrôle des modifications de la médication	○	○	○	○	○

Analyse et validation de prescriptions	○	○	○	○	○
Réconciliation médicamenteuse lors de l'entrée à l'hôpital	○	○	○	○	○
Evaluation du caractère approprié de la médication (y compris les suppléments à base de plantes et les compléments alimentaires)	○	○	○	○	○
Circulation de l'information sur les médicaments aux interfaces (p.ex. entrée / sortie de l'hôpital, transfert)	○	○	○	○	○
Assurer que les patients bénéficient d'informations concernant la médication, dans des termes compréhensibles pour eux	○	○	○	○	○
Information, éducation et conseil des patients, en cas d'utilisation de médicaments hors autorisation de mise sur le marché	○	○	○	○	○
Documentation d'interventions pharmaceutiques	○	○	○	○	○

30. Si 'les interventions pharmaceutiques sont documentées': comment-sont-elles documentées? (Sélection multiple)

☐ Système de classification de la GSASA
☐ Dossiers des patients
☐ Autre:

31. Si 'les interventions pharmaceutiques sont documentées': sont-elles analysées pour garantir l'amélioration de qualité?

○ Oui
○ Non

32. Avez-vous des remarques sur les activités ci-dessus (EAHP statements)?

Acceptation et conditions cadres de la pharmacie clinique

33. Veuillez, s.v.p., évaluer les énoncés suivants:

	Pas du tout d'accord	Plutôt pas d'accord	Plutôt d'accord	Tout à fait d'accord	Pas de réponse
Relatif aux 5 dernières années, l'acceptation de la 'pharmacie clinique' au sein du personnel médical s'est améliorée.	○	○	○	○	○
Les médecins apprécient nos recommandations et les appliquent.	○	○	○	○	○
Je suis informé du devenir de l'intervention.	○	○	○	○	○
L'établissement met assez de personnel à disposition pour la pratique de la 'pharmacie clinique'.	○	○	○	○	○
Nous aimerions proposer plus d'activités en 'pharmacie clinique' dans notre établissement.	○	○	○	○	○

34. Avez-vous des projets de recherche concernant la pharmacie clinique dans votre établissement? ○ Oui ○ Non

35. Si 'Oui': pouvez-vous décrire, en quelques mots, où vous placez l'accent dans vos projets?

36. Avez-vous des remarques additionnelles concernant la partie 2 – 'Prestations en pharmacie cliniques'?

Seitenumbruch --- **Partie 3 – Sortie d'hôpital**

Partie 3.1 – Avant la sortie d'hôpital

Cette partie se concentre sur les activités liées au patient avant sa sortie d'hôpital en tenant compte des personnes qui y sont impliquées.

37. Est-ce qu'il y a dans votre établissement des directives sur les procédures lors de la sortie d'hôpital?

○ Oui
○ Non
○ Je ne sais pas

38. Y at-il des efforts faits pour identifier les patients qui ont besoin d'une prise en charge plus intensive en vue de leur sortie d'hôpital?

○ Oui
○ Non
○ Je ne sais pas

39. Si 'Oui': comment ces patients sont-ils identifiés?

40. Si 'Oui': qu'est-ce qui différencie une prise en charge plus intensive d'une prise en charge standard? (Veuillez, s.v.p., décrire en quelques mots)

41. Quelles personnes décrites ci-dessous sont impliquées dans les activités suivantes lors de la sortie d'hôpital (indépendamment de la fréquence)? (Sélection multiple)

	Pharmacie clinique / hospitalière	Pharmacie d'officine dans l'hôpital (si existant)	Médecin	Soins	Autre	N'est pas fait	Je ne sais pas
Valider la prescription de sortie	☐	☐	☐	☐	☐	☐	☐

Annoter les informations supplémentaires sur la prescription de sortie (p.ex. médicaments arrêtés)	☐	☐	☐	☐	☐	☐	☐
Substituer en retour (du médicament de la liste de l'hôpital au médicament des patients avant l'admission, p.ex. générique)	☐	☐	☐	☐	☐	☐	☐
Documenter les interventions effectuées sur la prescription de sortie	☐	☐	☐	☐	☐	☐	☐
Donner aux patients des informations sur leurs médicaments (p.ex. durée du traitement / posologie)	☐	☐	☐	☐	☐	☐	☐
Donner aux patients des informations approfondies sur leurs médicaments (p.ex. effet / bénéfice resp. objectif thérapeutique / effets secondaires)	☐	☐	☐	☐	☐	☐	☐
Instruire les patients (p.ex. pour un appareil d'inhalation / une seringue pré-remplie)	☐	☐	☐	☐	☐	☐	☐
Informer les patients à propos des drapeaux rouges (symptômes indiquant une détérioration de la maladie / intolérance médicamenteuse)	☐	☐	☐	☐	☐	☐	☐
Informer les patients de quoi faire de leurs médicaments possédés d'avant leur entrée à l'hôpital	☐	☐	☐	☐	☐	☐	☐
Premier approvisionnement en médicaments	☐	☐	☐	☐	☐	☐	☐
Elaborer un plan de médication	☐	☐	☐	☐	☐	☐	☐

42. Si vous avez coché 'Autre', veuillez décrire en quelques mots, quelles 'autres' personnes sont impliquées dans les activités ci-dessus

43. Avez-vous des remarques sur les activités ci-dessus resp. les personnes impliquées?

44. Si 'la pharmacie clinique / hospitalière est impliquée': à quelle fréquence est-ce que la pharmacie clinique / hospitalière est impliquée dans les activités suivantes?

	Quotidiennement	Plusieurs fois par semaine	Plusieurs fois par mois	1 fois par mois ou moins
Valider la prescription de sortie	○	○	○	○
Annoter les informations supplémentaires sur la prescription de sortie (p.ex. médicaments arrêtés)	○	○	○	○
Substituer en retour (du médicament de la liste de l'hôpital au médicament des patients avant l'admission, p.ex. générique)	○	○	○	○
Documenter les interventions effectuées sur la prescription de sortie	○	○	○	○

Donner aux patients des informations sur leurs médicaments (p.ex. durée du traitement / posologie)	○	○	○	○
Donner aux patients des informations approfondies sur leurs médicaments (p.ex. effet / bénéfice resp. objectif thérapeutique / effets secondaires)	○	○	○	○
Instruire les patients (p.ex. pour un appareil d'inhalation / une seringue pré-remplie)	○	○	○	○
Informer les patients à propos des drapeaux rouges (symptômes indiquant une détérioration de la maladie / intolérance médicamenteuse)	○	○	○	○
Informer les patients de quoi faire de leurs médicaments possédés d'avant leur entrée à l'hôpital	○	○	○	○
Premier approvisionnement en médicaments	○	○	○	○
Elaborer un plan de médication	○	○	○	○

45. Avez-vous des remarques additionnelles sur la partie 3.1 – 'Avant la sortie d'hôpital'?

Partie 3.2 – Après la sortie d'hôpital

La prochaine partie traite de la communication de modifications de traitements médicamenteux entre les personnes / institutions impliquées après la sortie d'hôpital.

46. Parmi les personnes / institutions suivantes, à qui sont communiquées des modifications médicamenteuses? (Sélection multiple)

- ☐ Médecin installé
- ☐ Pharmacie de référence du patient
- ☐ Soins à domicile
- ☐ Patient / proches
- ☐ Maison de retraite / (EMS) établissements médico-sociaux
- ☐ Les modifications médicamenteuses ne sont pas communiquées
- ☐ Je ne sais pas
- ☐ À d'autres personnes / institutions:

47. Si 'les modifications médicamenteuses sont communiquées': comment est-ce que les modifications médicamenteuses sont communiquées aux personnes / institutions suivantes? (Sélection multiple)

	Prescription de sortie d'hôpital	Rapport de sortie d'hôpital	Plan de médication	Autre manière	Je ne sais pas
Médecin installé	☐	☐	☐	☐	☐
Pharmacie de référence du patient	☐	☐	☐	☐	☐
Soins à domicile	☐	☐	☐	☐	☐
Patient / proches	☐	☐	☐	☐	☐
Maison de retraite / EMS	☐	☐	☐	☐	☐

48. Si 'les modifications médicamenteuses sont communiquées d'une autre manière': veuillez, s.v.p., les décrire en quelques mots

49. Si 'les modifications médicamenteuses sont communiquées à d'autres personnes / institutions': comment les modifications médicamenteuses sont-elles communiquées? Veuillez, s.v.p., répondre à la question en utilisant les mêmes catégories que dans la question précédente ('prescription de sortie d'hôpital', 'rapport de sortie d'hôpital', 'plan de médication', 'autre manière', 'je ne sais pas' -> exemple après le champ de texte)

Par exemple:

1. Autre personne / institution : prescription de sortie d'hôpital, rapport de sortie d'hôpital et plan de médication

2. Autre personne / institution : plan de médication

50. Si 'les modifications médicamenteuses sont communiquées': les raisons des modifications médicamentauses sont-elles également communiquées?

	Oui, régulièrement	Oui, parfois	Non	Je ne sais pas
Médecin installé	○	○	○	○
Pharmacie de référence du patient	○	○	○	○
Soins à domicile	○	○	○	○
Patient / proches	○	○	○	○
Maison de retraite / EMS	○	○	○	○

51. Si 'les modifications médicamenteuses sont communiquées à d'autres personnes / institutions': les raisons des modifications médicamenteuses leur sont-elles également communiquées? Veuillez, s.v.p., répondre à la question en utilisant les mêmes catégories que dans la question précédente ('oui, régulièrement', 'oui, parfois', 'non', 'je ne sais pas' -> exemple après le champ de texte)

Par exemple:

1. Autre personne / institution : oui, régulièrement

2. Autre personne / institution : non

52. Si 'les modifications médicamenteuses sont communiquées': à quelle fréquence la pharmacie clinique / hospitalière est-elle impliquée dans la communication des modifications médicamenteuses dans le domaine ambulatoire?

- ○ Quotidiennement
- ○ Plusieurs fois par semaine
- ○ Plusieurs fois par mois
- ○ 1 fois par mois ou moins
- ○ Jamais

53. Est-ce qu'il y a un suivi par téléphone avec les patients après leur sortie de l'hôpital (p. ex. pour assurer l'utilisation correcte de la médication)? ⓘ

- ○ Oui, régulièrement
- ○ Oui, parfois
- ○ Non
- ○ Je ne sais pas

54. Si 'Oui': avec quels patients sortant de l'hôpital ce suivi téléphonique a-t-il lieu?

55. Si 'Oui': qui s'occupe de ces appels téléphoniques? (Sélection multiple)

- ☐ Pharmacie clinique / hospitalière
- ☐ Médecin
- ☐ Soins
- ☐ Autre:

56. Si 'Oui': combien de temps après la sortie d'hôpital cet appel téléphonique a-t-il normalement lieu?

- ○ Dans les premières 48 heures
- ○ Dans les 4 premiers jours
- ○ Dans la première semaine
- ○ Après la première semaine
- ○ Différent
- ○ Je ne sais pas

57. Avez-vous des remarques sur la partie 3.2 – 'Après la sortie d'hôpital'?

Partie 3.3 – Modèles pour soutenir la gestion des médicaments à la sortie d'hôpital

Dans quelques hôpitaux, des modèles sont mis en oeuvre pour soutenir les patients lors de leur sortie d'hôpital. Dans cette partie du questionnaire, de tels modèles sont répertoriés, en particulier le concept d'une pharmacie d'officine au sein de l'hôpital ainsi que les personnes soutenant les patients lors de la sortie d'hôpital.

58. Quelles données concernant les patients sont enregistrées par voie électronique? (Sélection multiple) ⓘ

- ☐ Anamnèse à l'entrée
- ☐ Diagnostics
- ☐ Paramètres vitaux
- ☐ Prescription des médicaments pendant le séjour hospitalier
- ☐ Rapports intermédiaires
- ☐ Résultats des analyses médicales
- ☐ Allergies
- ☐ Prescription de sortie / rapport de sortie
- ☐ Aucune

59. Si 'enregistrée par voie électronique': comment l'accès aux données électroniques des patients est-il réglé pour la pharmacie hospitalière / officine (si existante dans votre hôpital)? (Sélection multiple)

	La pharmacie hospitalière a une autorisation de lecture	La pharmacie hospitalière a une autorisation d'écriture	La pharmacie d'officine a une autorisation de lecture	La pharmacie d'officine a une autorisation d'écriture	La pharmacie d'officine a une autorisation de lecture, mais seulement avec l'accord du patient	La pharmacie d'officine a une autorisation d'écriture, mais seulement avec l'accord du patient
Anamnèse à l'entrée	☐	☐	☐	☐	☐	☐
Diagnostics	☐	☐	☐	☐	☐	☐
Paramètres vitaux	☐	☐	☐	☐	☐	☐
Prescription des médicaments pendant le séjour hospitalier	☐	☐	☐	☐	☐	☐

Rapports intermédiaires	☐	☐	☐	☐	☐	☐
Résultats des analyses médicales	☐	☐	☐	☐	☐	☐
Allergies	☐	☐	☐	☐	☐	☐
Prescription de sortie / rapport de sortie	☐	☐	☐	☐	☐	☐

Pharmacie d'officine dans / près de l'hôpital

60. Existe-t-il une pharmacie accessible aux patients dans / près de l'hôpital? ①

- ○ Une pharmacie d'officine, appartenant à l'hôpital
- ○ Une pharmacie d'officine, n'appartenant pas à l'hôpital
- ○ La pharmacie hospitalière possède un guichet public pour les patients sortant de l'hôpital
- ○ Pas de pharmacie accessible aux patients dans / près de l'hôpital

Si 'Pas de pharmacie accessible aux patients dans / près de l'hôpital' -> Veuillez, s.v.p., faire l'impasse sur les prochaines questions et continuer avec 'Transition Coach'. Merci!

Tous les autres -> Veuillez, s.v.p., répondre aux questions suivantes. Merci!

61. Veuillez, s.v.p., décrire la collaboration avec cette pharmacie en quelques mots

62. Quelle fonction a cette pharmacie d'officine / ce guichet de la pharmacie hospitalière pour les patients sortant de l'hôpital? (Sélection multiple)

- ☐ Premier approvisionnement en médicaments des patients (p.ex. remise de petits emballages)
- ☐ Planification spéciale de la sortie
- ☐ Comparaison de la médication avec les données hospitalières
- ☐ Transmission et communication de changements à la pharmacie de référence du patient
- ☐ Autre:

63. Est-ce que cette pharmacie d'officine / ce guichet de la pharmacie hospitalière est informé/e à l'avance de la sortie d'hôpital d'un patient? (Sélection multiple)

- ☐ Oui, sous la forme d'un rapport écrit (rapport de sortie)
- ☐ Oui, l'ordonnance est envoyée à l'avance
- ☐ Oui, par un appel téléphonique
- ☐ Non
- ☐ Oui, autre:

64. Si 'Oui': qui se charge d'informer la pharmacie d'officine / le guichet de la pharmacie hospitalière? (Sélection multiple)

- ☐ Pharmacie hospitalière
- ☐ Médecin
- ☐ Soins
- ☐ Autre:

65. Si le patient a une pharmacie de référence en dehors de l'hôpital, celle-ci est-elle informée de la sortie du patient? (Sélection multiple)

- ☐ Oui, sous forme d'un rapport écrit (rapport de sortie)

- ☐ Oui, l'ordonnance est envoyée à l'avance
- ☐ Oui, par un appel téléphonique
- ☐ Non
- ☐ Je ne sais pas
- ☐ Oui, autre:

66. Si 'Oui': qui se charge d'informer la pharmacie de référence du patient? (Sélection multiple)

- ☐ Pharmacie hospitalière
- ☐ Pharmacie d'officine dans l'hôpital (si existant)
- ☐ Médecin
- ☐ Soins
- ☐ Autre:

67. Veuillez, s.v.p., nommer une personne de contact de cette pharmacie d'officine, en indiquant l'adresse e-mail ainsi que le numéro de téléphone, pour des questions supplémentaires:

68. Avez-vous des remarques additionnelles sur le modèle 'Pharmacie d'officine dans / près de l'hôpital'?

Transition Coach

Dans quelques hôpitaux, des « Patient Manager » / « Transition Coach » / « Case Manager » sont intégrés pour soutenir les patients lors de leur sortie d'hôpital. Ils assument diverses tâches, comme par exemple: la gestion des médicaments, des tâches organisationnelles ou la discussion des drapeaux rouges (symptômes indiquant une détérioration de la maladie / intolérance médicamenteuse).

69. Y a-t-il dans votre hôpital des personnes qui soutiennent les patients lors de leur sortie d'hôpital? ①

- ○ Oui
- ○ Non
- ○ Je ne sais pas

70. Si 'Oui': quelles personnes assument cette fonction? (Sélection multiple)

- ☐ Pharmacien
- ☐ Médecin
- ☐ Soins
- ☐ Assistant social
- ☐ Physio- / ergothérapeute
- ☐ Je ne sais pas
- ☐ Autre:

71. Si 'Oui': quelles sont les tâches de ces personnes? (Sélection multiple)

- ☐ Discussion des médicaments (p.ex. posologie, effet, effet secondaire, ...)
- ☐ Organisation des médicaments (p.ex. contact avec la pharmacie de référence / semainier / prise en charge)
- ☐ Discussion des drapeaux rouges (symptômes indiquant une détérioration de la maladie / intolérance médicamenteuse)
- ☐ Organisation de réhabilitation / soins à domicile
- ☐ Assurer un suivi médical (p.ex. rendez-vous pour un contrôle de suivi chez le médecin traitant)
- ☐ Suivi après la sortie d'hôpital (p.ex. contact téléphonique)

☐ Je ne sais pas

72. Y at-il d'autres modèles implémentés dans votre hôpital afin de faciliter la sortie d'hôpital?

○ Oui
○ Non
○ Je ne sais pas

73. Si 'Oui': veuillez, s.v.p., décrire ces modèles en quelques mots

74. Avez-vous des remarques additionnelles sur la partie 3.3 – 'Modèles pour soutenir la gestion des médicaments à la sortie d'hôpital'

Seitenumbruch --- **Partie 4 – données de contact**

Données de contact

Veuillez, s.v.p., indiquer vos données de contact. Ces données seront traitées de manière anonyme et serviront uniquement à vous contacter pour d'éventuelles questions. Merci beaucoup!

75. Personne de contact pour d'éventuelles informations complémentaires:

76. E-mail:

Envoyer le formulaire

Nous vous remercions chaleureusement d'avoir pris le temps de participer à ce sondage!

Veuillez, s.v.p., sauvegarder également cette page (en bas du document) et terminer le sondage en cliquant sur le bouton « terminer » se trouvant en haut à gauche.

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Appendix III Interview Guide

Interview guide

Spitaleintritt

- Grundsätzlich: gibt es allgemein Guidelines (j/n)?
- Wie kommt der Patient ins Spital? Überweisung? Selbsteinweisung? Verschiedene Prozesse?
- Notfall vs. geplanter Eintritt?
- Bei elektivem Eintritt: wie sieht Aufgebot des Patienten aus?
- Der erste „Schritt" des Patienten ins Spital, was passiert? Wer ist involviert?
- Arzneimittelanamnese: wer führt diese durch? Wie? Validierung?

Spitalaufenthalt

- Bei welchem Anlass / welcher Gelegenheit kommt der Patient mit einem Pharmazeuten in Kontakt?
- Visiten: Art der Visite?
- Medikationsanalyse: wird Dienstleistung durchgeführt? Wer übernimmt diese Aufgabe?
- Wie wird Analyse vorbereitet? Standardisiertes Protokoll? Häufigkeit?
- Welche Patientengruppe profitiert von einer Medikationsanalyse?
- „Patient education": gibt es Schulungen für den Patienten? Wird der Apotheker in medikamentöse Schulungen (z.B. über Inhalatoren oder andere Devices) involviert?
- Verlegungen von Station zu Station: Prozess? Miteinbezug Apotheke?
- Medikamenten-Management bei Verlegungen: Medikamentenabgleich vor und nach Verlegung durch geeignete Person?

Spitalaustritt

- Grundsätzlich: gibt es allgemein Guidelines (j/n)? Wie sehen Richtlinien aus (Frage 37)?
- Wann beginnt die Vorbereitung des Spitalaustritts?
- Auf welche Art und Weise wird die Spitalentlassung koordiniert?
- Was wird vorbereitet? Wer bereitet was vor?
- Welche Informationen / Dokumente werden weitergeleitet und in welchem Zeitrahmen (Bsp.: 24 h nach Spitalentlassung)? Auf welche Art (Mail/Fax/Brief etc.)? Vollständigkeit der Dokumente?
- Reha / Spitex, Sicherstellung einer Nachsorge (Termin zur Nachkontrolle bei behandelndem Arzt): wer übernimmt Organisation?
- Wie und von wem wird der Patient auf seine Spitalentlassung vorbereitet?
- Schnittstellenmanagement? Wie wird der nahtlose Übergang der Betreuung gewährleistet?

1

- Bei Spitalaustritt anstehende Testresultate: wie wird damit umgegangen?

Transition Coach

- Einsatz eines Transition Coaches = Standard? Oder nur bei Bedarf?
- Wann findet der erste Kontakt zwischen Patient und Transition Coach statt? Wie sieht der aus? Themen (weitere als in Frage 71.: Besprechung der Medikamente, deren Organisation und Besprechung von Red flags)?
- Wann wird der jeweilige Coach eingesetzt? Laut Umfrage teilen sich Arzt, Pflege und Sozialarbeiter diese Funktion.
- Zusammenarbeit unter den Coaches? Wer übernimmt welche Aufgaben (Umfrage Frage 71. Evtl. noch mehr Aufgaben bezgl. Austrittsmanagement?)?
- Wird Familie aktiv miteingebunden (j/n)?
- Wie lange begleitet der Transition Coach den Patienten? Nur im Spital oder auch nach Spitalaustritt?

Apotheke

- Genauere Beschreibung der Zusammenarbeit Spitalapotheke <-> öffentliche Apotheke
- Wer übernimmt welche Aufgaben: öffentlicher Apotheker vs. klinischer Pharmazeut?
- Apotheke <-> Spitalarzt-Kommunikation (Bsp. bei entdeckten Diskrepanzen)?
- Besteht eine direkte Apotheke <-> Hausarzt-Kommunikation (ja/nein)?
- Datenschutz (wegen Frage 62.: Abgleich der Medikation mit Spitaldaten)? Zugang zu welchen Spitaldaten (Diagnoseliste bis zu Laborwerte?)?
- Was erwartet den Patienten in der öffentlichen Apotheke, die dem Spital gehört: ausführliche Aufklärung über Änderungen / neue Medikamente? Evtl. Medikationsanaylse bei bestimmten Patienten? Aufgaben Pharmaassistentinnen?
- Wird die Patienten-Entlassung auf die Öffnungszeiten der Apotheke abgestimmt?
- Wie kommt der Patient zu seinen Medikamenten ausserhalb der Öffnungszeiten?
- Falls der Patient das Rezept in einer anderen öffentlichen Apotheke einlösen will: wird mit dieser öffentlichen Apotheke kommuniziert (ja/nein)? Werden wichtige Informationen weitergeleitet?
- Mit was für Problemen nach Spitalaustritt wird die Apotheke konfrontiert (Frage 62)? Häufigkeit?
- Wird mit öffentlichen Apotheken zusammengearbeitet?
- Kommunikation bzw. weiterleiten von Information?

2

Nachbetreuung

- Follow-up *appointment* (ja/nein): was wird bei diesem Termin angesprochen (Arzt)? Wer organisiert (Pflege)?
- Aktives follow-up durch Apotheke / Transition coach (ja/nein)?

3

Appendix IV Ethics proposal

Universität Basel

Departement
Pharmazeutische Wissenschaften

Vorlage von swissethics für die Einreichung eines Projekts „Weiterverwendung ohne Einwilligung" gemäss HFG Art.34/HFV.

Die gesetzlichen Anforderungen an Forschungsprojekte, die mit Weiterverwendung verbunden sind, findet man im HFG Kap. 4 (Art. 32-35) und HFV Kap. 3 (Art. 24-40).
Sind die Anforderungen an Einwilligung und Information nach den Artikeln 32 und 33 HFG nicht erfüllt, so dürfen biologisches Material oder gesundheitsbezogene Personendaten nach Art. 34 HFG ausnahmsweise zu Forschungszwecken weiterverwendet werden.

Change history

Version Nr	Version date	Modified without version change	Description, comments	Control
1.0	2018		Initial version	ML/HS/TI
2.0	20.08.2018		Änderungen gemäss Auflagen	ML/HS/TI
3.0	20.06.2019		Amendment betreffend der Studienperiode	ML/HS/TI

Universität Basel

Departement
Pharmazeutische Wissenschaften

Testing plan/protocol HFV: Further use of biological material and/or health-related patient data for research without consent and information according to article 34 HFG:

Title of the research project:
Medicines management Optimisation by Structured Assessment in Integrated Care (MOSAIC) - Drug-related problems during hospital stay and at discharge

Name and address of the project lead:
Dr. phil. II Markus L. Lampert
Pharmaceutical Care Research Group
FPH Spitalapotheker, FPH klinische Pharmazie

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Universität Basel

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If applicable: Name and address of the sponsor
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Universität Basel

Departement Pharmazeutische Wissenschaften

Confirmation of the project lead and (if applicable) the sponsor:

With my signature I attest that all information in this action plan is correct, and that I adhere to the provided information and to the national law, namely the data protection.

Project leader:

Basel, 21.06.19
Place, date

Signature

If applicable and not identical to project lead: Sponsor:

Basel, 20.6.19
Place, date

Signature

Abbreviation:

CSV	Comma Separated Value, plaintext format
DRP	drug related problem
GSASA	Swiss association of public health administration and hospital pharmacists
SPSS	Statistical Package for the Social Sciences
ZGKS	cantonal hospital of Zug

Universität Basel
Departement Pharmazeutische Wissenschaften

1. Background

During transitions of care, such as the hospital admission or discharge, patient safety is vulnerable with a risk for medication errors. A prolonged hospital stay, an increased number of hospital readmissions and post-discharge emergency department visits are just some examples for the result of such medication errors.[1] At hospital admission, discrepancies between the patients' medication regimen at home and the medication prescribed at admission occur, because some of the patients' chronic medication will be paused, some medications are added and some are changed at hospital admission.[2] Poor communication of medication changes at hospital transitions contribute to medication discrepancies and consequently to potential or actual ADE.[3] At hospital discharge, discrepancies occur more frequently than at hospital admission[4]

Pharmacist-led medication reconciliation services at hospital transitions were reported to have a positive effect on the hospital readmission rate, the number of emergency department visits and associated costs.[5-7] Moreover, a significant difference in the number of interventions related to drug related problems (DRPs) on discharge prescriptions was reported in patients receiving a set of different pharmaceutical interventions before discharge (medication reconciliation at admission, medication review, and discharge planning).[8]

At the cantonal hospital of Zug (ZGKS), patients with elective admission to the internal medicine ward receive a systematic medication anamnesis conducted by pharmacy staff at admission. For all other patients, the physician conducts a traditional anamnesis. Furthermore, during hospital stay, interprofessional ward rounds including a clinical pharmacist take place on a regular basis on the medical, intensive care and surgical ward. Pharmaceutical interventions (e.g., recommendations on dose adjustment, interactions, etc.) are classified and documented in the validated GSASA-classification database (GSASA: Swiss association of public health administration and hospital pharmacists). This database will further be named pharmacist ward intervention database. This classification and documentation has been initiated by the hospital for quality assurance. Clinical pharmacists continuously fill in their interventions during regularly conducted ward rounds. At hospital discharge, all patients have the possibility to pick up their medication at the publicly accessible pharmacy of the hospital. If they choose to do so, a pharmacist conducts a medication review; she/he then classifies and documents all DRPs in the discharge pharmacy database.

Overall, from admission to discharge, some patients of the cantonal hospital Zug receive pharmaceutical care that is well documented. These data together with the clinical data from the patients' hospital files constitute a valuable opportunity for research. Understanding the type and frequency of the interventions and the DRPs could help to improve processes and ultimately patient safety.

We hypothesise that clinical pharmaceutical interventions at earlier stages during the hospital stay reduce DRPs at hospital discharge, and that DRPs at hospital discharge can only partially be discovered and solved by community pharmacists according to their nature and lack of information.

2. Aim

To analyse the contribution of different clinical pharmacists interventions during a patients path through the hospital (from admission to discharge) on the pattern of DRPs at discharge.

3. Design and target figure

This study is a retrospective data analysis using information routinely collected by the ZGKS. Different patient groups will be analysed:

A. Patient with comprehensive pharmaceutical care (pharmacist-led anamnesis at admission and pharmacist-assisted ward rounds and pharmacist-led discharge counselling)
B. Pharmacist-led anamnesis, pharmacist-led discharge counselling and standard care
C. Pharmacist-assisted ward round, pharmacist-led discharge counselling and standard care
D. Pharmacist-led discharge counselling and standard care

Universität Basel
Departement Pharmazeutische Wissenschaften

The analysis will consist of a comparison of the four patient groups and an in-depth evaluation of the pattern of all DRPs at discharge. Demographic and specific health related data of the patients will be extracted from the electronic patients' hospital files (incl. age, sex, diagnosis, medication etc.). Using the patients' hospital case number these data will be linked to the two databases (Pharmacists ward intervention database & discharge pharmacy database) with documented DRPs.
Retrospective analysis of the data, starting two months after the beginning of the documentation of DRPs at discharge will be conducted at the research site (University of Basel). The first two months are excluded from the analysis to allow for an adaption phase.

4. Origin of the data/material
Data will be extracted from the electronic patients' hospital file and from the routinely documented DRPs at the cantonal hospital of Zug during the study period. Obtaining informed consent for the study retrospectively is difficult due to the large number of patients.

5. Inclusion criteria
Patients will be included, if the following criteria are met:
- Hospitalized as an inpatient on the internal medical ward at the cantonal hospital of Zug during study period
- Discharged through the publicly accessible pharmacy of the hospital
- Aged 18 years or older on the day they were discharged from the hospital

6. Exclusion criteria
- Documented refusal available

7. For which health-related patient data / biological material an authorisation should be issued?
Personal and health related data out of the electronic patients' hospital files and the databases of the documented DRPs during the study period 01.06.2016-31.05.2019.

8. A reason for the request for a representative consent by the responsible ethics committee
We expect the number of patients to be high (approx. 4500). Obtaining informed consent for the study retrospectively is difficult due to the large number of patients and some patients may have passed away since their hospitalisation. In addition, the data was collected up to two years ago and the hospital may not have current contact details of all patients. The time expenditure and effort would therefore be disproportionally high to obtain informed consent from all still living patients and relatives of deceased patients.
With the knowledge from the data analysis we aim to gain insight on how to improve the quality of the pharmaceutical care during the discharge process at the ZGKS. With this improvement, transitions of care of future patients may increase patient safety by reducing medication discrepancies and DRPs. The knowledge could also help to understand the discharge process in general and be used to improve efficiency. It could help to develop a specialised pharmaceutical discharge service implementable in Swiss hospitals.

9. Confirmation that no documented refusal is available.
The study director confirms that no health related person data and no biological material will be used, if a written or documented oral refusal of a person concerned exist.

10. Which group of persons is allowed to transfer the biological material and health-related data?

Christoph Rosen (head of the hospital pharmacy at the ZGKS) and the clinical pharmacists of the ZGKS will organize the electronic data extraction from the hospital databases. All data will be coded. For the analysis by the research team, only coded data are put at disposal.

11. Who takes the responsibility for receiving this data/this material?
The data is extracted from the electronic patients' hospital files and the two databases, it is then received by Christoph Rosen (head of the hospital pharmacy at the ZGKS). He is responsible for the electronic data extraction and is the only person with access to the encryption code of the coded data.
The coded data is then given to the study team, where Markus Lampert (project leader) is responsible for receiving the data.

12. Which group of person has authorized access to the health-related person data as part of the research project?
Christoph Rosen (head of the hospital pharmacy at the ZGKS)
Marco Ceppi
Christoph Rosen can authorise additional persons to have access (e.g. student / trainee)

13. Who is responsible for the protection of the disclosed data?
Christoph Rosen

14. Scientific methodology
For descriptive analysis metric data like age, time, and length of stay are expressed as means ± standard deviation and / or median with interquartile ranges.
Most data will be expressed as frequencies. Group comparison (e.g. correlation between DRP and medication) will be analysed using Chi^2-test, comparison of group variables with continuous variables (e.g. DRP and age) will be analysed with regression or correlation statistics. For the analysis of variances, ANOVA will be used.
Statistical significance will be calculated with $1-\beta=0.8$ and $\alpha=0.05$ with a two-sided hypothesis. SPSS Version 24 (Statistical Package for the Social Sciences, IMB® Corporation) and R (RStudio) will be used for statistical analysis.

15. Reporting obligation
A change of the project lead as well as changes in the information mentioned in the authorisation have to be reported to the responsible ethics committee in advance. The completion or discontinuation of the research project is reported to the ethics committee within 90 days.

16. Data protection: encryption and storage:
Not applicable

17. Procedure for unencrypted data
The demographic and specific health related data will be extracted from the hospital patient file. Using the hospital case number, they will be linked to the documented DRPs. The hospital case number will then be replaced by a neutral study number (e.g. ZGKS-00001; ZGKS = Zuger Kantonsspital, continuous numbering).
Only Christoph Rosen and Marco Ceppi will have access to the code list linking the hospital case number with the neutral study number. The code list will be password protected.
The generated databases will then be analysed according to the protocol considering data protection.

18. Information about the storage

The electronic files will be kept on a network resource with password protected access at the study centre. Hard copies will be archived in a locked storage room at the study site.
After every change to the database, the contents of the database are exported to a CSV (Comma Separated Value, plaintext format) file. The state of this CSV file is tracked using a local Git repository (Git version 2.16.1+, Free Software Foundation Inc., Massachusetts, USA). The Git repository is managed by the user with the GitHub Desktop application version 1.1.0+ (GitHub Inc., California, USA). Note that the repository is never uploaded to the GitHub platform.

19. Duration of the storage
All data will be archived at the study site for 10 years after the end of the study.

20. Ethical and regulatory requirements
This project complies with the regulatory requirements of the HFG und the HFV. The condition for the execution of the research project is the authorisation of the cantonal ethics committee.

21. Financing / publication / conflict of interests
The University of Basel provides the material and personnel used at the study site, including Kurt Hersberger, Markus Lampert, Fabienne Böni, Tamara Imfeld-Isenegger and Helene Studer. The study is conducted within the PhDs of Tamara Imfeld-Isenegger and Helene Studer. The hospital pharmacists (incl. Christoph Rosen and Marco Ceppi) are employed by the cantonal hospital of Zug. The project is assured by existing third party funding of Prof. Kurt Hersberger and a grant for this project from GSASA (Swiss association of public health administration and hospital pharmacists).

22. Literature

1. Mueller SK, Sponsler KC, Kripalani S, et al. Hospital-based medication reconciliation practices: a systematic review. *Arch Intern Med* 2012;172(14):1057-69. doi: 10.1001/archinternmed.2012.2246
2. Unroe KT, Pfeiffenberger T, Riegelhaupt S, et al. Inpatient medication reconciliation at admission and discharge: A retrospective cohort study of age and other risk factors for medication discrepancies. *The American journal of geriatric pharmacotherapy* 2010;8(2):115-26.
3. Ensing HT, Koster ES, van Berkel PI, et al. Problems with continuity of care identified by community pharmacists post-discharge. *Journal of clinical pharmacy and therapeutics* 2016 doi: 10.1111/jcpt.12488 [published Online First: 2016/12/13]
4. Varkey P, Cunningham J, Bisping DS. Improving medication reconciliation in the outpatient setting. *Jt Comm J Qual Patient Saf* 2007;33(5):286-92.
5. Mekonnen AB, McLachlan AJ, Brien JA. Effectiveness of pharmacist-led medication reconciliation programmes on clinical outcomes at hospital transitions: a systematic review and meta-analysis. *BMJ Open* 2016;6(2):e010003. doi: 10.1136/bmjopen-2015-010003
6. Polinski JM, Moore JM, Kyrychenko P, et al. An Insurer's Care Transition Program Emphasizes Medication Reconciliation, Reduces Readmissions And Costs. *Health Aff (Millwood)* 2016;35(7):1222-9. doi: 10.1377/hlthaff.2015.0648
7. Ravn-Nielsen LV, Duckert ML, Lund ML, et al. Effect of an In-Hospital Multifaceted Clinical Pharmacist Intervention on the Risk of Readmission: A Randomized Clinical Trial. *JAMA Intern Med* 2018;178(3):375-82. doi: 10.1001/jamainternmed.2017.8274
8. Neeman M, Dobrinas M, Maurer S, et al. Transition of care: A set of pharmaceutical interventions improves hospital discharge prescriptions from an internal medicine ward. *Eur J Intern Med* 2017;38:30-37. doi: 10.1016/j.ejim.2016.11.004

Appendix V Ethics approval

EKNZ

Ethikkommission
Nordwest- und
Zentralschweiz

Präsident
Prof. Christoph Beglinger
Vizepräsidenten
Dr. Angela Frotzler
Dr. Marco Schärer

Dr. phil. II Markus L. Lampert
Pharmaceutical Care
Research Group
Universität Basel
Klingelbergstrasse 50
4056 Basel

Basel, 30. August 2018 / FR

Verfügung der Ethikkommission Nordwest- und Zentralschweiz (EKNZ)

Project-ID	2018-01462
Projekttitel	Medicines management Optimisation by Structured Assessment in Integrated Care (MOSAIC) - Drug-related problems during hospital stay and at discharge
Master-/Doktorarbeit von	Studer, Helene
Haupt-Prüfer / Koordinierender Prüfer	Dr. Markus L. Lampert
Sponsor	Pharmaceutical Care Research Group, Universität Basel, Prof. Kurt E. Hersberger
Zentren	Dr. Markus L. Lampert, Pharmaceutical Care Research Group, University of Basel, Basel

Entscheidverfahren

☐ ordentliches Verfahren ☐ vereinfachtes Verfahren ☒ Präsidialverfahren

Entscheid

Dr. Markus L. Lampert, Pharmaceutical Care Research Group, University of Basel, Basel

☒ Die Bewilligung wird erteilt → Die Auflagen der EKNZ vom 20. August 2018 wurden erfüllt.
☐ Die Bewilligung wird mit Auflagen erteilt
☐ Die Bewilligung kann noch nicht erteilt werden
☐ Die Bewilligung wird nicht erteilt
☐ Auf das Gesuch wird nicht eingetreten

Klassifizierung

☒ Forschungsprojekt gemäss HFV Kategorie: --
- ☐ Forschung mit Personen
- ☒ Weiterverwendung des biologischen Materials oder der gesundheitsbezogenen Personendaten
- ☐ mit Verstorbenen
- ☐ mit Embryonen / Föten
- ☐ mit ionisierender Strahlung

Geschäftsführerin Irene Oberli | Hebelstrasse 53 | 4056 Basel | Tel 061 268 13 50 | Fax 061 268 13 51 | eknz@bs.ch | www.eknz.ch

☐ Umkategorisierung gemäss Art. 48, Abs. 2, HFV

☒ Das Forschungsprojekt ist eine Weiterverwendung biologischen Materials und gesundheitsbezogener Personendaten bei fehlender Einwilligung (Art. 34 HFG, Art. 37-40 HFV)

a. Zweck der Weiterverwendung:

Der Einfluss verschiedener klinisch-pharmazeutischer Interventionen (Eintrittsanamnese durch die Apotheke, interprofessionelle Stationsvisite) auf die Art und Häufigkeit der arzneimittelbezogenen Probleme bei Spitalaustritt soll analysiert werden.

b. Bezeichnung des biologischen Materials/der gesundheitsbezogenen Personendaten:

Klassifizierte und dokumentierte arzneimittelbezogenen Probleme, welche während der Eintrittsanamnese durch die Apotheke, der klinisch-pharmazeutischen Visite und in der spitaleigenen Apotheke bei Spitalaustritt dokumentiert wurden, sowie gesundheitsbezogene Daten der Patienten (Alter, Geschlecht, Medikamente, Diagnosen).

c. Personen, die berechtigt sind biologisches Material und gesundheitsbezogenen Personendaten weiterzugeben:

Christoph Rosen (Leitender Spitalapotheker des ZGKS) und die klinischen Pharmazeuten des ZGKS sind berechtigt die Studiendaten weiterzugeben

d. Personen, die berechtigt sind biologisches Material und gesundheitsbezogene Personendaten entgegenzunehmen:

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+41 61 207 14 26
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Gebühren

Tarifcode: **Betrag:** **CHF**

Gemäss der geltenden Gebührenordnung von swissethics.

Rekursmöglichkeiten

Gegen diesen Entscheid kann an den Regierungsrat des Kantons Basel-Stadt (Rathaus, Marktplatz 9, 4051 Basel) rekurriert werden. Der Rekurs ist innert 10 Tagen seit Eröffnung des Entscheides bei der Rekursinstanz anzumelden; innert 30 Tagen, vom gleichen Zeitpunkt an gerechnet, ist die Rekursbegründung einzureichen, welche die Anträge und deren Begründung mit Angabe der Beweismittel zu enthalten hat. Bei völliger oder teilweiser Abweisung des Rekurses können die Kosten der Rekurrentin respektive dem Rekurrenten ganz oder teilweise auferlegt werden.

Kopie an

☐ BAG	
☒ Sponsor	Pharmaceutical Care Research Group, Universität Basel, kurt.hersberger@unibas.ch
☒ Andere	Helene Studer, helene.studer@unibas.ch

Unterschriften

i.V.

Dr. pharm. Marco Schärer
Vizepräsident

Anhang: 1. Pflichten des Gesuchstellers / Bedeutung der möglichen Entscheide
2. Eingereichte Dokumente (Stand 24. August 2018)

Anhang 1

Pflichten des Gesuchstellers (Sponsor oder Prüfer):

Einreichung Dokumente: revidierte Dokumente und neue Dokumente zur Studie/zum Projekt sollen ausschliesslich über das Web-Portal BASEC eingereicht werden, auf der entsprechenden Formularseite des betreffenden Gesuches. Obsolete Dokumente sind dabei zu entfernen und Datums- und Versionsangaben entsprechend zu ergänzen. Die erfolgten Änderungen müssen im Korrekturmodus abgefasst werden und zusätzlich als ‚clean'-Version eingereicht werden. Die Studieninformationen und -einwilligungen, das Protokoll und die Amendments müssen in durchsuchbaren PDF-Dateien eingereicht werden, insbesondere müssen gescannte Dokumente eine Texterkennung durchlaufen haben (OCR). Das unterschriebene und datierte Begleitschreiben muss die Antworten auf eventuell von der EK gestellte Fragen enthalten. Revidierte Dokumente sind auch den weiteren Zulassungsbehörden zuzustellen, sofern diese involviert sind.

Anmerkung: Die zuständige Ethikkommission überprüft im Rahmen des Bewilligungsverfahrens Aufklärungsbogen und Einwilligungserklärung in einer der Amtssprachen Deutsch, Französisch oder Italienisch. Aufklärungsbogen und Einwilligungserklärung in einer anderen Sprache werden von der Ethikkommission lediglich zur Kenntnis genommen. Für die korrekte Übersetzung ist der Sponsor oder die Projektleitung verantwortlich.

Meldepflichten: Die rechtlich bindenden Melde- resp. Bewilligungspflichten an die Ethikkommission für wesentliche Änderungen, einen vorzeitigen Studienabbruch, unerwünschte Ereignisse u.a. sind einzuhalten (Verordnungen des Bundes). Der Abschlussbericht ist spätesten ein Jahr nach Studienende der Ethikkommission einzureichen.

Registrierungspflicht: Der Sponsor muss – falls es sich um einen klinischen Versuch handelt – diesen in einem WHO-Primärregister oder im Register der Nationalen Medizinbibliothek der USA (clinicaltrials.gov) erfassen und anschliessend diese Nummer im BASEC-Portal eingeben. Die Übertragung der erforderlichen Daten in das Swiss National Clinical Trials Portal (SNCTP) kann nach Bewilligung der Ethikkommission und Zustimmung des Gesuchstellers automatisch erfolgen. Die Informationen über den klinischen Versuch sind in beiden Registern öffentlich zugänglich. Zusätzlich veröffentlicht swissethics wenige Informationen wie Titel, Projekttyp oder Leit-Ethikkommission aller durch die kantonalen Ethikkommissionen bewilligten Gesuche auf swissethics.ch (ausser Phase-I-Studien).

Die Ethikkommission bestätigt, dass sie nach ICH-GCP arbeitet.
Anmerkung: detaillierte Anleitungen zur Einreichung auf BASEC befinden sich im Portal selbst.

Bedeutung der möglichen Entscheide

Die Bewilligung wird erteilt: Das Vorhaben gemäss bewilligtem Forschungsplan kann gestartet und im Rahmen der anwendbaren rechtlichen Bestimmungen durchgeführt werden.
Bewilligungen für klinische Versuche mit Heilmitteln der Kategorie B und C stehen unter dem Vorbehalt, dass

1. allfällig durch die zuständige eidgenössische Zulassungbehörde (Swissmedic/BAG) festgestellte Mangel keine Änderungen der von der Ethikkommission evaluierten Unterlagen erfordern, und dass
2. die Bewilligung der eidgenössischen Zulassungsbehörde (Swissmedic/BAG) vorliegt.

Die Bewilligung wird mit Auflagen erteilt: Das Vorhaben gemäss bewilligtem Forschungsplan kann gestartet und im Rahmen der anwendbaren rechtlichen Bestimmungen durchgeführt werden. Die Auflagen sind innert 30 Tagen zu erfüllen und in jedem Fall vor der Rekrutierung des ersten Patienten. Die revidierten Dokumente werden nach Einreichung im präsidentialen Verfahren geprüft.

Die Bewilligung kann noch nicht erteilt werden: Das Vorhaben kann noch nicht gestartet werden. Die nachfolgenden Bedingungen sind zu erfüllen. Die revidierten Dokumente werden nach Einreichung von der Ethikkommission geprüft.

Die Bewilligung wird nicht erteilt: Das Vorhaben kann in der vorliegenden Form nicht durchgeführt werden. Eine Neueinreichung ist möglich.

Auf das Gesuch wird nicht eingetreten: Die Ethikkommission ist für die Beurteilung rechtlich nicht zuständig. Entweder ist eine andere Stelle für die Bewilligung zuständig, oder das Vorhaben kann ohne Bewilligung durchgeführt werden.

Anhang 2

Eingereichte Dokumente für das Hauptzentrum

Dr. Markus L. Lampert, Pharmaceutical Care Research Group, University of Basel, Basel

Dokument	Dok.Datum	Version
20180824_Protokoll_DRP hospital stay and discharge_korr.pdf	24.08.2018	2.0
20180824_Protokoll_DRP hospital stay and discharge_clean.pdf	24.08.2018	2.0

Helene Marlene Studer

Von: swissethics <messaging@basec.swissethics.ch>
Gesendet: Dienstag, 25. Juni 2019 09:03
An: Helene Marlene Studer
Betreff: 2018-01462 - Studienverlängerung

Please do not reply below this line

Please note that when replying to this message, all other recipients mentioned below will receive your message.

Other recipients: Rothman Felix (EKNZ), kurt.hersberger@unibas.ch, markus.lampert@unibas.ch

Project: Medicines management Optimisation by Structured Assessment in Integrated Care (MOSAIC) - Drug-related problems during hospital stay and at discharge (2018-01462)
Form: Research Project Application Form
Consult the whole conversation

Message:

Sehr geehrte Damen

Sehr geehrte Herren

Wir nehmen Bezug auf Ihre Einreichung vom 24.06.2019 zu Studie 2018-01462. Die EKNZ genehmigt den Verlängerungsantrag.

Freundliche Grüsse

Felix Rothmann

Felix Rothmann | Sekretär | Ethikkommission Nordwest- und Zentralschweiz (EKNZ) I Hebelstrasse 53 |

4056 Basel | Tel. +41 (0)61 268 13 50 | Fax. +41 (0)61 268 13 51 | Erreichbar von Mo-Fr von 08.00 - 12.00 Uhr

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CURRICULUM VITAE

Personal information

Name	Helene Marlene Studer
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Professional activity

Since 12/2016	**PhD at the Department of Pharmaceutical Sciences**, University of Basel, Switzerland Title of the PhD thesis: "Medication management throughout hospitalization with a focus on discharge – the pharmacist's contribution"
Since 12/2016	**Assistant, tutor and workshop moderator** Department of Pharmaceutical Sciences, University of Basel, Switzerland
Since 11/2017	**Postgraduate training in clinical pharmacy FPH**, Solothurner Spitäler AG, Olten, Switzerland
Since 12/2016	**Author of im@il-Offizin** (www.imail-offizin.ch) – a drug information service for pharmacy practice
Since 09/2018	**Examiner of federal exams (OSCE)**, Department of Pharmaceutical Sciences, University of Basel, Switzerland
09/2015 – 07/2016	**Pharmacist in residency**, Neubad Apotheke & Drogerie AG, Basel, Switzerland

Education

Since 12/2016	**PhD at the Department of Pharmaceutical Sciences**, University of Basel, Switzerland
08/2017-11/2018	**Certificate of Advanced Studies CAS Clinical Pharmacy**, University of Basel, Switzerland
10/2016	**Federal Diploma as a Pharmacist**
09/2014-06/2016	**Master of Science in Pharmacy**, University of Basel, Switzerland

	Title of the master thesis: "The Pharm-DISC System – Documentation and classification of drug-related problems and pharmaceutical interventions in community pharmacies"
09/2013-06/2014	**Erasmus exchange**, University of Valencia, Spain
09/2012-06/2013	**Bachelor of Science in Pharmacy**, University of Basel, Switzerland
09/2009-06/2012	**Propaedeutic in Pharmacy**, University of Fribourg, Switzerland

Scientific contributions

Peer-reviewed publications

Imfeld-Isenegger TL, Studer H, Ceppi MG, Rosen C, Bodmer M, Beeler PE, Boeni F, Häring AP, Hersberger KE, Lampert ML. Detection and resolution of drug-related problems at hospital discharge focusing on information availability – a retrospective analysis. *ZEFQ 2021; DOI: 10.1016/j.zefq.2021.08.004*

Studer H, Boeni F, Hersberger KE, Lampert ML. Pharmaceutical Discharge Management: Implementation in Swiss Hospitals Compared to International Guidelines. *Pharmacy 2021; DOI: 10.3390/pharmacy9010033*

Studer H, Boeni F, Messerli M, Hersberger KE, Lampert ML. Clinical Pharmacy Activities in Swiss Hospitals: How Have They Evolved from 2013 to 2017? *Pharmacy 2020; DOI: 10.3390/pharmacy8010019*

Maes KA, Studer H, Berger J, Hersberger KE, Lampert ML. Documentation of pharmaceutical care: Validation of an intervention oriented classification system. *J Eval Clin Pract. 2017;1–13; DOI: 10.1111/ jep.12817*

Oral and poster presentations

Studer H, Imfeld-Isenegger TL, Ceppi MG, Cerone RC, Hersberger KE, Lampert ML. Drug-related problems on hospital discharge prescriptions – a retrospective data analysis. *Poster presented at the 7th Pharmaceutical Care Network Europe (PCNE) Working Symposium in Egmond aan Zee (the Netherlands), 07.-08. February 2020*

H. Studer, R. C. Cerone, E. Hufschmid Thurnherr, B. Portner, F. Boeni, K. E. Hersberger, M. L. Lampert. Patterns of drug-related problems at hospital discharge with a focus on drug-drug interactions. *Poster presented at the 48th European Society of Clinical Pharmacy (ESCP) Symposium on Clinical Pharmacy in Ljubljana (Slovenia), 23.-25. October 2019*

Studer H, Imfeld-Isenegger TL, Ceppi MG, Hersberger KE, Böni F, Lampert ML. Effect of clinical pharmacist's interventions during a patient's path through the hospital on the pattern of drug-related problems at discharge – a study design. *Poster presented at the 11th Pharmaceutical Care Network Europe (PCNE) Working Conference in Egmond aan Zee (the Netherlands), 6.-9. February 2019*

Studer H, Felder N, Hersberger KE, Lampert ML. Medication reviews in hospitals: an overview of published guidelines. *Oral presentation presented at the 47th European Society of Clinical Pharmacy (ESCP) Symposium on Clinical Pharmacy in Belfast (Northern Ireland), 24.-26. October 2018*

Imfeld-Isenegger TL, Studer H, Lampert ML, Hersberger KE. Development of a Checklist for community pharmacies to facilitate the identification of DRPs and improve patient counselling at hospital discharge – a study design. *Poster presented at 1st International Conference FIP Pharmacy Practice Research, Lisbon (Portugal), June 2018*

Studer H, Boeni F, Hersberger KE, Lampert ML. The hospital pharmacist's role in the discharge procedures. *Poster presented at the 6th Pharmaceutical Care Network Europe (PCNE) Working Symposium in Fuengirola (Spain), 1.-3. February 2018*

Studer H, Böni F, Messerli M, Hersberger KE, Lampert ML. Are Swiss hospital pharmacies ready for medication management support for patients at discharge? A survey on clinical pharmacy services. *Poster presented at the 46th European Society of Clinical Pharmacy (ESCP) Symposium on Clinical Pharmacy in Heidelberg (Germany), 9.-11. October 2017*

Maes KA, Studer H, Berger J, Hersberger KE, Lampert ML. Improving patient safety through documentation of pharmaceutical interventions: the PharmDISC system. *Poster presented at the convention of the Swiss Association of Public Health Administration and Hospital Pharmacists (GSASA) in Zürich (Switzerland), 26.-27. November 2015*

Maes KA, Studer H, Berger J, Hersberger KE, Lampert ML. An instrument to document pharmacists' interventions: the PharmDISC system. *Poster presented at the 44th European Society of Clinical Pharmacy (ESCP) Symposium on Clinical Pharmacy in Lisbon (Portugal), 28.-30. October 2015*

Article in drug information service for pharmacy practice

Studer H. Windpocken (Varizellen) [Chickenpox (Varicella)]. *Article published in iMail Offizin 2020;12*

Studer H. Update GINA 2019: Therapie bei mildem Asthma [Update GINA 2019: Therapy for mild asthma]. *Article published in iMail Offizin 2019;17*

Studer H. HWI Update: Welche Rolle hat Fosfomycin heute? [UTI Update: What is the role of fosfomycin today?]. *Article published in iMail Offizin 2019;8*

Studer H. Notfallsituation: Herz-Kreislauf-Stillstand [Emergency situation: cardiac arrest]. *Article published in iMail Offizin 2018;5*

Studer H. Antibiotikaresistenzen [Antibiotic resistances]. *Article published in iMail Offizin 2017;14*