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The implications of involving pharmacy technicians in obtaining a best possible medication history from the perspectives of pharmaceutical, medical and nursing staff: a qualitative study

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3 **The implications of involving pharmacy technicians in obtaining a best possible medication**
4 **history from the perspectives of pharmaceutical, medical and nursing staff: a qualitative study**
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Abstract

Objectives: Medication reconciliation is an important strategy to increase medication safety at transitions of care. In the last years the involvement of pharmacy technicians in medication reconciliation has increasingly been investigated. The aim of this study was to assess the implications on professional roles and collaboration when a best possible medication history (BPMH) at admission is obtained by pharmacy technicians.

Design: Qualitative study with semi-structured interviews.

Setting: Internal medicine pilot wards in two mid-sized Swiss hospitals.

Participants: A total of twenty-one health care professionals working on the pilot wards.

Results: Pharmacy technicians generally appreciated their new tasks in obtaining a BPMH. However, they also experienced challenges associated with their new role, such as uncertainties in the direct patient interaction or the integration of the new tasks with their regular daily duties. Pharmacists acted as coaches for pharmacy technicians and were generally more involved in the medication process as compared to before, which also resulted in their strengthened collaboration with physicians. Physicians benefitted from the delegation of administrative tasks to pharmacy technicians. Regarding the interprofessional collaboration, we found that pharmacy technicians in the study acted on a preliminary administrative level and did not become part of the larger treatment team. There was no direct interaction between pharmacy technicians and physicians, but rather, the supervising pharmacists acted as intermediaries.

Conclusion: Pharmacy technicians should receive sufficient time and training to obtain a BPMH. The tasks assumed by pharmacy technicians need to be clearly defined and fully integrated into existing processes. Engaging pharmacy technicians may generate new risks and inefficiencies due to process fragmentation. Communication and information flow at the interfaces between professional groups therefore need to be well organised. More research is needed to understand if and under which circumstances such a model can be efficient and contribute to higher medication safety.

Article summary

Strengths and limitations of this study

- The qualitative study design allowed an in-depth exploration of the implications for different health care professionals when introducing a new interprofessional model .
- By interviewing pharmacy technicians, pharmacists, physicians and nurses, we were able to take into account the perceptions of all health care professionals affected by the new model.
- Participants were recruited from two sites only. Findings need to be understood in the local context and are only partly transferable to other settings.

- Interviews were conducted at about six months after implementation of the new model and it was therefore not possible to capture its long term effects.

Introduction

Transitions of patients between the hospital and other healthcare settings are vulnerable moments for medication errors and adverse drug events (ADEs). Discrepancies such as inadvertent omissions and duplications of medications and dosing errors are common at hospital admission and discharge (1-6). Unintentional medication changes and communication failures at these interfaces are associated with potential harm and high utilisation of healthcare resources such as readmissions (7-9). Medication reconciliation is the process of thoroughly and accurately establishing a patient's medication list and using this list to provide correct medications to the patient (10). Over the past decade, medication reconciliation has been advocated in more and more countries as an important patient safety strategy for preventing medication discrepancies at transitions of care (11-17).

While medication reconciliation (or "med rec", as it is often called) has strong face validity and a large body of evidence points to its benefits (18-21), many questions still arise as to how to best conduct the process in routine care. An important implementation barrier is the resource intensity that is associated with med rec interventions which have proved effective (22). Systematic literature reviews have concluded that pharmacists' involvement in medication reconciliation is an important success factor for the intervention (18-20). However, implementing interventions in which pharmacists conduct med rec for a majority of hospitalized patients is expensive (though this may still be cost-effective on a systems-level by reducing drug expenses and costly ADEs (23;24)). In the last years the involvement of pharmacy technicians, supervised by pharmacists, in medication reconciliation has increasingly been investigated, the assumption being that this may offer many of the advantages of pharmacist-based interventions but at a lower cost. Evidence from numerous studies demonstrates that trained pharmacy technicians are able to gather medication histories with similar completeness and accuracy to other health care professionals (25;26). One study found that, compared to non-pharmacy personnel, pharmacy technicians had an absolute risk reduction of 50% in medication history errors (27). A three-arm randomized controlled study found that when adding a best possible medication history by either pharmacy technicians or pharmacists to usual care processes, errors in the admission history were reduced by over 80%. There was no difference in the benefits provided by pharmacy technicians versus pharmacists (28).

For pharmacy technicians, participating in the medication reconciliation process represents a new professional role not included in their initial training. Obtaining a best possible medication history (BPMH), for example, includes a systematic interview with the patient and/or his or her carers in order to capture all medications currently being taken (figure 1). Despite the emerging evidence regarding the involvement of pharmacy technicians in medication reconciliation, to our knowledge no studies have yet investigated the implications of these new patient-centred tasks for pharmacy technicians and their self-perceived role in the process. We are also not aware of studies that have examined the

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3 consequences of the involvement of pharmacy technicians for the interprofessional collaboration
4 within the care team. Knowing more about these aspects may have important implications for
5 successfully implementing this novel interprofessional medication reconciliation model. We thus
6 conceived this study in the context of a larger multi-site quality improvement programme led by the
7 Swiss Foundation for Patient Safety. The aim of the study was to investigate the new role of pharmacy
8 technicians in obtaining a BPMH from the perspectives of pharmaceutical, medical and nursing staff
9 as well as its implications for the interprofessional collaboration.
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12 **Methods**

13 **Study design**

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15 This qualitative sub-study was conducted as part of the Swiss national quality improvement
16 programme *progress! Medication Reconciliation* which aimed to promote medication reconciliation in
17 acute care hospitals in Switzerland. One of the cornerstones of the programme was to test the
18 feasibility of performing the essential first step of medication reconciliation, namely obtaining a BPMH
19 at admission. Eight hospitals participated in a pilot project and implemented a new process for
20 obtaining a BPMH. Each hospital designed and tested its own BPMH process taking into account
21 certain quality standards defined by the programme (figure 1). In two of the eight hospitals, a model
22 involving pharmacy technicians to obtain a BPMH was implemented.
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28 ---- Insert figure 1 ----
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30 **Setting and processes for obtaining a best possible medication history**

31 Both hospitals included in the study are mid-sized acute care hospitals located in Switzerland. In each
32 of the hospitals an interdisciplinary project group defined a process to obtain a BPMH upon admission
33 (figure 2) and piloted it on the internal medicine unit for the duration of one year (November 2015 -
34 November 2016).
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37 ---- Insert figure 2 ----
38

39 **Sample**

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41 Twenty-one semi-structured interviews with six pharmacy technicians, two pharmacists, six nurses,
42 five physician residents and two senior physicians were conducted in the two hospitals during a two-
43 day site visit from the research team at six months after implementation of the new processes.
44 Participants were purposely sampled to represent members of all professional groups involved in the
45 new BPMH process. They were recruited by the local project teams. Of the 21 participants, 17 were
46 female. All pharmacy technicians and pharmacists interviewed were directly involved either in
47 obtaining or controlling the BPMH. Nurses, residents and senior physicians were recruited from the
48 participating pilot wards and had to have experienced the new BPMH process for at least four weeks.
49 Due to rotations, not all of the interviewed residents still worked on the pilot ward at the time of the
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3 interview. One senior physician was not working on the pilot ward, but was responsible for instructing
4 the residents on the new BPMH processes.
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6 **Data collection**

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8 The interview guide was developed and iterated within the research team. The guide contained
9 several thematic sections: Participants were first invited to describe their role, as well as the role of
10 other health care professionals in completing the new processes. They were then asked to evaluate
11 their collaboration with the other health care professionals and whether they had noticed any positive
12 or negative changes or implications for their daily practice since implementation of the new processes.
13 Respondents were also asked to comment on the advantages and disadvantages of involving
14 pharmacy technicians in obtaining a BPMH. In the last section, which was not included in the present
15 analysis, participants were asked about the perceived benefits of a BPMH on medication safety, the
16 impact on patients and general suggestions for improving implementation of the new processes. For
17 each section, various sub-questions and prompts were included. Written informed consent was
18 obtained from all participants prior to the interview. The personal interviews were conducted by two
19 members of the research team face-to-face at the respective hospital and lasted between 30 and 40
20 minutes each. They were audio-taped and transcribed verbatim.
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26 **Data analysis**

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28 All analysis was performed by using the software ATLAS.ti 7. A conventional qualitative content
29 analysis approach was applied (29;30). In a first step, two researchers both read three randomly
30 selected transcripts and classified recurring topics and ideas into a first set of categories. The two
31 code structures were discussed and merged into one. The structure was compared to the interview
32 guide to determine whether additional codes were necessary. In a next step, both researchers
33 independently applied the new code structure to three more transcripts. The code structure was then
34 discussed and revised anew, as new codes were added and some were removed. This iterative
35 process continued until each of the researchers had coded one half of the transcripts. The code
36 structure was reflected and finalized together with a senior researcher and transcripts were recoded
37 accordingly. To increase reliability, the two researchers jointly applied the finalized code structure to
38 the three initial transcripts. After that, each of the researchers independently coded the second half of
39 the transcripts. Through code by code comparison, discrepancies were identified, reviewed together
40 and resolved. Data was organized into major themes relevant to the research question and quotes
41 were analysed accordingly. Results were discussed by the two researchers and in a joint session with
42 the larger research team. Quotes were translated from German to English for this publication by the
43 authors.
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50 **Results**

Two relevant major themes emerged to be pertinent to the research question: the impact of the pharmacy technicians' new role on the daily work of all involved health care professionals and its impact on the interprofessional collaboration.

Impact on the daily work

The pharmacy technicians' new role had impacts on the daily work of each professional group. We report the results from the perspective of each of the groups interviewed.

Perspective of pharmacy technicians

The new BPMH process had positive and negative impacts on the daily work of pharmacy technicians. A majority of them mentioned that their new tasks were interesting or enriching and that they made their day-to-day operations more varied.

"For us there is a lot of variety and I like to interact with people, so in this regard I also find it valorising for myself and for my profession." Pharmacy technician

By conducting structured patient interviews, pharmacy technicians work with patients in a much closer way than they did before. Throughout the interviews it became clear that, unlike nurses or physicians, pharmacy technicians are not much used to, nor specifically trained for direct patient interaction. Most participants reported enjoying the new contact with patients, however, they also mentioned that it had required them to learn new ways on how to interact with patients (e.g. using disinfectant before greeting the patient) and how to handle difficult or unexpected situations (e.g. when patients are unwilling or unable to answer questions). In the hospital where pharmacy technicians obtained the BPMH from elective as well as emergency patients, the elective patients were interviewed in a separate booth in the main lobby after registering in the hospital and before being admitted to the ward, whereas emergency patients were interviewed in their ward rooms. The pharmacy technicians in this hospital enjoyed interviewing patients entering for elective treatments, but did not feel at ease with interviewing patients on the ward. They felt that contact with patients on the ward was "too close" and that they were not sufficiently trained to adequately handle difficult situations. Pharmacy technicians in the other hospital did not mention this issue. However, they only interviewed patients on the ward and therefore did not have a similar opportunity to compare the different situations.

"And yes, sometimes I find it difficult upstairs [on the ward], well, depending on the patient one has, because we weren't trained or prepared for something like that. [...] If one then really has to interview a patient who's in serious pain [...], then I don't feel at ease with him." Pharmacy technician

Lastly, the new tasks of pharmacy technicians had a significant impact on the planning of their day-to-day operations. The time required for obtaining a BPMH had to be fit in within the other daily duties, which was perceived by some as burdensome and stressful.

Perspective of pharmacists

Pharmacists in both hospitals reported an increased workload. As supervisors, pharmacists coach and advise pharmacy technicians before and after the patient interviews, for example on how to interact with patients or how to better understand the individual medication in relation to the diagnoses, as illustrated by the following quote:

„They are experiencing so much through the interaction with the patients that I try to meet them there too, in order to discuss their experiences, to talk about what the patient told them [...]. On the other hand also to give them explanations about why he takes [a medication].”

Pharmacist

In one hospital, interview partners explained that an additional check of the preadmission medication list by pharmacists was introduced directly after the pharmacy technicians had obtained a BPMH and before sending it to the physicians. Pharmacists control the plausibility and accuracy of the recorded information, for example by taking into account patients' diagnoses. This check was not intended in the original design of the BPMH process, but was introduced after pharmacists had received feedback from residents that in some cases pharmacy technicians hadn't recognised the relevance of certain information concerning a patient's medication in relation to his diagnoses. Thus, they hadn't forwarded important information immediately to the resident physician.

Finally, in both hospitals, pharmacists also conduct the final step of medication reconciliation at admission. Once the patient's preadmission medication list is established by pharmacy technicians, pharmacists compare that list with the admission orders and check the medication for potential drug-drug interactions.

“And [the pharmacists] also looked at it again and gave us feedback on interactions, or that they cannot find a correct diagnosis for this and that medication.” Physician resident

Perspective of physicians

The impact of the BPMH obtained by pharmacy technicians on the daily work of physicians was experienced differently by the respondents of the two hospitals. In one hospital, physicians used the preadmission medication list of the pharmacy technicians in order to write their admission orders. Hence, their work built on the BPMH previously obtained by pharmacy technicians. They noted that involving the pharmacy technicians relieved them of certain time-consuming administrative duties.

“The administrative burden [of our work] was clearly reduced.” Physician resident

„And now, everything is already documented and a tedious part of our work is already done.”

Physician resident

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3 In addition, physician residents stated that the multi-staged processes led to a more systematic and
4 thorough assessment of a patient's medication. They also expressed comfort in the thought that there
5 was someone else looking at the patient's medication.
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8 *"I think, what is good about it, is that I know that one of the pharmacists will have a look at it,*
9 *that there certainly is a better control of the medication in general. If there are things that need*
10 *to be changed. This is certainly something that helps."* Physician resident
11

12 In the other hospital, at the start of the project, physician residents were trained to obtain a more
13 complete medication history compared to the previous status quo, and to document it in a new, more
14 structured electronic form. In this hospital, the BPMH obtained by pharmacy technicians and
15 pharmacists was implemented in complement, rather than in substitution of the medication history
16 obtained by physicians. The physician residents interviewed did not report any noticeable change to
17 their daily work since pharmacy technicians were involved in obtaining a BPMH. Rather, one of them
18 stated that:
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22 *„We don't rely on the work of pharmacists or pharmacy technicians. We're trying to obtain a*
23 *best possible medication history ourselves."* Physician resident
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25 *Perspective of nurses*

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27 In both hospitals, nursing staff was only peripherally involved in obtaining a BPMH. However, all
28 nurses reported experiencing positive impacts on their daily work since implementation of the new
29 BPMH process. Since both hospitals implemented various elements at once (e.g. new electronic form,
30 new process for hospital discharge), for nursing staff it was not possible to clearly discern whether it
31 was the work of pharmacy technicians or other elements that contributed to this impact.
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33 Notwithstanding, they all stated that medication orders had improved in clarity and completeness.
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36 *"Prior to this, we often experienced that we came in the morning, distributed the pills and then*
37 *it was said [by the patients] "this one is missing and that one is missing". Then we went to ask*
38 *[the doctors]: 'Yes, that's not important.' Or: 'Oh, I didn't know that.' Only those from the*
39 *general practitioner [were recorded], but something that [the patient] took himself wasn't*
40 *recorded."* Nurse
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43 With preadmission medication recorded more thoroughly, the nurses found that they spent less time
44 asking physicians about incomplete or imprecise orders as well as discussing missing medication with
45 patients. Furthermore, one nurse pointed out that knowing that someone else would record all
46 preadmission medication relieved nursing staff from the perceived responsibility of ensuring that the
47 patient received all his necessary medication.
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50 **Impact on interprofessional collaboration**

We were particularly interested in analysing how the involvement of pharmacy technicians would affect the existing structures and team dynamics between the professional groups. The following central themes emerged from the interviews.

Pharmacy technicians act outside of the care team

With the new BPMH process, pharmacy technicians became an additional professional group that requires access to the patient. In spite of this, the interviews suggest that the pharmacy technicians did not become part of the larger care team, but rather assume an outside role. Pharmacy technicians reported having to work their way around other health care professionals' schedules and spending a lot of time coordinating with nursing staff to find a good time to conduct the interview. Other health care workers didn't pay a lot of attention to them. This is also illustrated by the fact that some physicians were not able to clearly distinguish between pharmacy technicians and pharmacists in the interviews. Some nurses reported that the presence of pharmacy technicians was hardly noticed on the wards.

„Well, we don't actually see them that much. They sneak upstairs quickly [...] and then they do it, actually calmly and quietly, well, they rarely come to ask us anything and then they leave again". Nurse

Some pharmacy technicians also described themselves as "someone from the outside". They attributed positive characteristics to this role, stating that this way they could act as a link between the patients and the physicians and gather more information from a patient.

I see myself as an intermediary, somehow. I'm not anyone's competitor, but I'm coming from the outside. I can also see this with the patients. They notice 'aha, someone is coming, he's not part of the nursing staff, he's coming from a different place in the hospital.' I notice that sometimes they tell me almost more [...]. Pharmacy technician

No direct interaction between pharmacy technicians and physicians

Pharmacy technicians and physicians reported that there is almost no direct interaction between them. In each hospital, one of the pharmacy technicians said that she considers herself a "link" or an "intermediary" between the physician and the patient. However, the interviews suggest that the way the BPMH processes were defined in both hospitals does not allow pharmacy technicians to fulfil such a role. Rather, information flows in one direction only and passes the pharmacists as another checkpoint before reaching the physician. Pharmacy technicians do not know what happens to the information collected from the patient after it has been transmitted from the pharmacists to the physicians and they receive little feedback from the physicians on how their work is perceived.

"I: How would you describe the role of the physicians in all of this?

R: I can't say much about it, because it's all done by our pharmacists. I just hand them over

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3 *the sheet. I tell the pharmacist: "[...] 'here and here you will probably have to take a closer*
4 *look' or 'here I'm not quite sure', but I hardly ever see a physician."* Pharmacy technician
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8 *Strengthened collaboration between pharmacists and physicians*

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10 Pharmacists and physicians both reported that their collaboration has intensified since the new
11 medication reconciliation processes were introduced. Because they control the work of pharmacy
12 technicians and reconcile preadmission lists with admission orders, pharmacists were also provided
13 with an opportunity to analyse patients' individual medication and provide feedback on interactions.
14 Physicians in both hospitals found this feedback to be helpful for their work. Pharmacists in turn
15 considered it of high value to be more involved in the medication process and to better know and
16 interact with physicians.
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19 *"[...] it sometimes happens that the residents approach me about something in the hallway or*
20 *that they ask questions or call me. It is not just because it's interesting for me, but I also think*
21 *that it's better for medication safety when one is less inhibited to ask someone, because ... If*
22 *one asks everything and doesn't hesitate to ask because one doesn't want to disturb."*
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25 Pharmacist
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27 **Discussion**

28 Our study found that pharmacy technicians who obtain a BPMH generally enjoy and benefit from their
29 new tasks. Their daily work becomes more varied and interviewing elective patients in particular
30 seems to be a welcoming change. However, these tasks also come with challenges for pharmacy
31 technicians. Being responsible for conducting the BPMH makes their planning of day-to-day duties
32 more difficult, since the daily number of admissions is not predictable and the pharmacy technicians
33 have to work their way around the schedules of other health care professionals. Direct patient
34 interaction can be another challenge for pharmacy technicians, since they are usually not used to, nor
35 trained to be in direct contact with seriously ill patients. Simple questions such as whether or not to
36 shake a patient's hand illustrate the dimension of uncertainty for pharmacy technicians. This finding
37 underlines the importance of a dedicated training programme for pharmacy technicians on how to
38 obtain a BPMH which includes practical elements such as role-playing exercises, as stated in other
39 studies (25;31). Our findings suggest that for some pharmacy technicians, direct patient interaction
40 may be too close and that not all pharmacy technicians may be equally willing and apt to deal with
41 these challenges. This is an aspect that should be considered when recruiting pharmacy technicians
42 for these tasks. Choosing pharmacy technicians who demonstrate good interpersonal, communication
43 and problem-solving skills has been identified as one of the best practices when engaging pharmacy
44 technicians in medication reconciliation efforts (25). The situation for pharmacy technicians in our
45 study is different when they are interviewing elective patients at admission, who are generally
46 adequate and not in urgent need for medical care. In this case, the neutral space of the admission
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3 booth may convey a sense of distance and better control of the situation. As for their place within the
4 team, we found that pharmacy technicians did not become members of the treatment team. They have
5 no proper position awarded in the pre-existing spatial and social structures on the ward, but rather act
6 on a preliminary administrative level.
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8 Our findings indicate a benefit for the daily work of nurses as well as for the integration of pharmacists
9 in the medication process. However, due to the complexity of the processes it is not clear to what
10 extent these implications are linked to the work of the pharmacy technicians in obtaining a BPMH, and
11 to what extent they are a result of the other elements introduced within the programme.
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14 The findings suggest that involving pharmacy technicians in obtaining a BPMH can also have positive
15 effects on the daily work of physicians. In particular, physician residents benefit from the delegation of
16 administrative tasks to pharmacy technicians (such as collecting additional sources for the medication
17 history). However, we also found that certain tasks were still performed by pharmacy technicians as
18 well as physicians. In line with other research (32), our analysis indicates that physicians may be
19 reluctant to hand off tasks to other professional groups, because they consider obtaining a medication
20 history a cornerstone for deciding on the treatment regime. Boockvar et al. found that medication
21 reconciliation is challenging for physicians because it competes for their time with other tasks and that
22 they prioritize more urgent care responsibilities; the authors thus suggest that efficacy and perceived
23 capability regarding the completion of medication reconciliation might be improved by dividing the task
24 into parts more easily manageable by individual team members (33). Our findings however also
25 suggest that the efficiency gained by delegating administrative tasks from physicians to pharmacy
26 technicians may be lost if pharmacists assume a similarly important role in the new process. We found
27 that in both hospitals, engaging pharmacy technicians in obtaining a BPMH was, at the time of the
28 interviews, not possible without the substantial involvement of pharmacists. Pharmacists coached and
29 supported pharmacy technicians and, in one hospital, controlled their work before it was transmitted to
30 the physicians, thus becoming important intermediaries. As other studies have pointed out, once it is
31 established that a pharmacy technician has enough practice to collect an accurate preadmission
32 medication list, removing routine pharmacist verification could improve efficiency in the process (27). It
33 is also important to note that the need for the additional check by pharmacists may be due to different
34 expectations as to what is included in the process of obtaining a "best possible medication history".
35 Obtaining a BPMH means to compile an accurate and complete list of all preadmission medication of a
36 patient. It does not include any sort of analysis of the preadmission medication. If pharmacy
37 technicians are to be involved in obtaining a BMPH, this distinction needs to be clear to all health care
38 professionals involved, because it clearly delimits which tasks pharmacy technicians can take over
39 and which tasks need to be performed by other health care professionals. Lastly, transferring the task
40 of obtaining a best possible medication history to another profession such as pharmacy technicians
41 adds to the fragmentation of the process. This may be problematic for patient safety, because it
42 creates new interfaces where information can get lost, even more so, since there is no direct
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3 communication between the pharmacy technician and the physician and this multi-staged process
4 may be more prone to errors.

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6 In summary, we found that engaging pharmacy technicians in obtaining a BPMH can have positive
7 effects on all involved health care professionals. However, their engagement may also generate new
8 risks and inefficiencies, especially if tasks are not clearly delimited or if a pharmacist's active
9 involvement is required to transmit relevant information from the pharmacy technicians to the
10 physicians. These issues need to be addressed in order for this model to be a safe and cost-effective
11 alternative to more traditional ways for obtaining a BPMH.
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14 **Strengths and limitations**

15
16 With this study we aimed to shed light on the implications of a specific interprofessional model for
17 obtaining a best possible medication history. The sampling of medical, pharmaceutical and nursing
18 staff allowed an in-depth exploration of the perception of all health care professionals directly affected
19 by such a new model. Since all participants were recruited from two hospitals only, the findings cannot
20 be generalised. However, since the main themes emerged across both hospitals and align with the
21 results from other studies, findings can still be relevant to other hospitals that consider implementing
22 such a model. Each hospital designed its own process adapted to its local structures and culture and
23 the understanding of the new BPMH process varied among the interviewed staff. Furthermore, in each
24 hospital the implementation of the BPMH was accompanied by the introduction of other tools and
25 processes that had a possible impact on the perceptions and answers of the participants. Results
26 therefore need to be interpreted in the local context. The interviews took place at a single time point at
27 six months after implementation of the new BPMH process. It is possible that such a new
28 interprofessional model requires a longer time in order to become established and efficient in the daily
29 routine. Follow-up interviews could have shed more light upon the long-term effects of the new model.
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32 **Conclusion**

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34 To our knowledge this is the first qualitative study that specifically explored the implications on
35 professional roles and collaboration by transferring certain tasks of obtaining a BPMH to pharmacy
36 technicians. There are some important implications for practice. First, it is crucial that pharmacy
37 technicians receive sufficient time and training to perform their new tasks. Furthermore, the scope of
38 the tasks assumed by pharmacy technicians needs to be clearly defined and fully integrated into
39 existing processes, so that work is not duplicated. Pharmacy technicians can be involved in
40 establishing a complete list of preadmission medication, however, the expertise of pharmacists or
41 physicians is required to analyse potential clinical problems regarding the patient's medication.
42 Ultimately, it is still the physician's responsibility to assess whether treatment is appropriate. Due to a
43 fragmentation of the process it is essential that communication and information flow at the interfaces
44 between professional groups is well organised. Institutions considering this model need to account for
45 sufficient resources for training and task completion and be attentive to the implications which the
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3 involvement of a further professional group has on teamwork dynamics and workflow design. More
4 research is needed to understand if and under which circumstances such a model can be efficient and
5 contribute to higher medication safety.
6

7 **Acknowledgement:** The authors would like to thank all participating pharmacy technicians,
8 pharmacists, nurses, physician residents and senior physicians for their willingness to share their
9 thoughts in these interviews. We greatly appreciate the support of the local project teams in organising
10 the interviews in the two hospitals.
11
12

13 **Author statement:** AN, ChZ, LF and DS participated in the conception and design of this study. AN
14 and LF conducted the interviews. AN, ChZ and DS analysed the data and interpreted the results. AN,
15 ChZ and LF drafted the article. DS performed critical review of the article. All authors approved the
16 submission of this article.
17
18

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20
21

22 **Competing interests:** None declared.
23

24 **Ethics approval:** This study was conducted as part of a quality improvement program. The quality
25 improvement program and all data collected obtained a Declaration of no objection from the Ethics
26 Committee of the Canton of Zurich.
27
28

29 **Data sharing statement:** No additional data are available.
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31

32 **Figure legend:**

33 **Figure 1:** Quality standards for obtaining a best possible medication history (BPMH)
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35 **Figure 2:** Processes defined to obtain the best possible medication history
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Figure 1: Quality standards for obtaining a best possible medication history (BPMH) (16)

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- 1 • Use at least two reliable sources for obtaining a BPMH (e.g. medication list from the general
2 practitioner, patients' medication list, drug packages). Whenever possible, one of the sources
3 should be a systematic patient interview conducted with a structured guide.
- 4 • Record all current medications (incl. OTC, vitamins, herbals, "as needed" etc.)
- 5 • Make preadmission medication list accessible to the whole healthcare team by filing in a central
6 place
- 7 • Obtain BPMH within 24h after admission
- 8 • Define roles and responsibilities for obtaining BPMH and train accordingly

For peer review only - <http://bmjopen.bmj.com/site/about/guidelines.xhtml>

Hospital A:

BPMH is obtained for all elective patients admitted to the general internal medicine department and for patients admitted between 12 midnight and 5 am from the emergency department to the general internal medicine department (approx. 30 admissions / month). Pharmacy technicians conduct systematic patient interviews using available information sources and record the preadmission medication list on a special form in the electronic patient chart. Physicians receive the list and document further action for each medication (e.g. stop, continue, modify). They then order the admission medications. Subsequently, clinical pharmacists check the admission orders and provide feedback to the physicians on any discrepancies identified.

Hospital B:

BPMH is obtained for all patients aged 40 to 85 years admitted through the emergency department to the general internal medicine ward (approx. 40-60 admissions/month). At admission, a medication history is obtained by physician residents. To this end, a new electronic form was introduced where information on preadmission medication is recorded. Physician residents then write the admission orders. Once patients are transferred to the ward, pharmacy technicians conduct a structured patient interview to systematically capture all preadmission medications and record this information on a paper form. If necessary, other sources are consulted for additional information. Pharmacists then compare the preadmission medication to the medication orders, check for potential drug-drug interactions and control doses and provide feedback to the physicians. The paper form is filed in the patient record.

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1 **The implications of involving pharmacy technicians in obtaining a best possible medication**
2 **history from the perspectives of pharmaceutical, medical and nursing staff: a qualitative study**

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21 Key Words: medication reconciliation, pharmacy technician, medication history, medication safety

22 Word count: 6044 (including quotes)

1 Abstract

2 Objectives: In the last years the involvement of pharmacy technicians in medication reconciliation has
3 increasingly been investigated. The aim of this study was to assess the implications on professional
4 roles and collaboration when a best possible medication history (BPMH) at admission is obtained by
5 pharmacy technicians.

6 Design: Qualitative study with semi-structured interviews. Data was analysed using a qualitative
7 content analysis approach.

8 Setting: Internal medicine units in two mid-sized Swiss hospitals.

9 Participants: 21 staff members working at the two sites (6 pharmacy technicians, 2 pharmacists, 6
10 nurses, 5 physician residents and 2 senior physicians).

11 Results: Pharmacy technicians generally appreciated their new tasks in obtaining a BPMH. However,
12 they also experienced challenges associated with their new role. Interviewees reported unease with
13 direct patient interaction and challenges with integrating the new BPMH tasks into their regular daily
14 duties. We found that pharmacists played a key role in the BPMH process, since they act as coaches
15 for pharmacy technicians, transmit information to the physicians and reconcile preadmission
16 medication lists with admission orders. Physicians stated that they benefitted from the delegation of
17 administrative tasks to pharmacy technicians. Regarding the interprofessional collaboration, we found
18 that pharmacy technicians in the study acted on a preliminary administrative level and did not become
19 part of the larger treatment team. There was no direct interaction between pharmacy technicians and
20 physicians, but rather, the supervising pharmacists acted as intermediaries.

21 Conclusion: The tasks assumed by pharmacy technicians need to be clearly defined and fully
22 integrated into existing processes. Engaging pharmacy technicians may generate new patient safety
23 risks and inefficiencies due to process fragmentation. Communication and information flow at the
24 interfaces between professional groups therefore need to be well organised. More research is needed
25 to understand if and under which circumstances such a model can be efficient and contribute to
26 improving medication safety.

27 Article summary

28 Strengths and limitations of this study

- 29 • The qualitative study design allowed an in-depth exploration of the implications for different health
30 care professionals when introducing a new interprofessional model.
- 31 • By interviewing pharmacy technicians, pharmacists, physicians and nurses, we were able to take
32 into account the perceptions of all health care professionals affected by the new model.
- 33 • Participants were recruited from two sites only. Findings need to be understood in the local
34 context and are only partly transferable to other settings.

- Participants were recruited by local study coordinators, sampling bias cannot be excluded.

Introduction

Transitions of patients between the hospital and other healthcare settings are vulnerable times for medication errors and adverse drug events (ADEs). Discrepancies such as inadvertent omissions and duplications of medications and dosing errors are common at hospital admission and discharge (1-6). Unintentional medication changes and communication failures at these interfaces are associated with potential harm and high utilisation of healthcare resources such as readmissions (7-9). Medication reconciliation is the process of thoroughly and accurately establishing a patient's medication list and using this list to provide correct medications to the patient (10). Over the past decade, medication reconciliation has been advocated in more and more countries as an important patient safety strategy for preventing medication discrepancies at transitions of care (11-17).

While medication reconciliation (or "med rec", as it is often called) has strong face validity and a large body of evidence points to its benefits (18-21), many questions still arise as to how to best conduct the process in routine care. An important implementation barrier is the resource intensity that is associated with med rec interventions (22). Systematic literature reviews have concluded that many successful interventions in medication reconciliation involved pharmacists (18-20). However, implementing interventions in which pharmacists conduct med rec for a majority of hospitalized patients is expensive (though this may still be cost-effective on a systems-level by reducing drug expenses and costly adverse drug events (23;24)). In the last years the involvement of pharmacy technicians, supervised by pharmacists, in medication reconciliation has increasingly been investigated, the assumption being that this may offer many of the advantages of pharmacist-based interventions but at a lower cost. Evidence from numerous studies demonstrates that trained pharmacy technicians are able to gather medication histories with similar completeness and accuracy to other health care professionals (25;26). One study found that, compared to non-pharmacy personnel, pharmacy technicians had an absolute risk reduction of 50% in medication history errors (27). A three-arm randomized controlled study found that when adding a best possible medication history by either pharmacy technicians or pharmacists to usual care processes, errors in the admission history were reduced by over 80%. There was no difference in the benefits provided by pharmacy technicians versus pharmacists (28).

For pharmacy technicians, participating in the medication reconciliation process represents a new professional role not included in their initial training. Obtaining a BPMH, for example, includes a systematic interview with the patient and/or his or her carers in order to capture all medications currently being taken (figure 1). To our knowledge, only few studies have explored the views of pharmacy technicians regarding new patient-centred tasks. The studies concluded that pharmacy technicians indicate a desire to take on more clinical or managerial tasks; however, their current training and education may not sufficiently equip them for these new roles (29;30). With a growing interest to involve pharmacy technicians in medication reconciliation, it is important to understand how pharmacy technicians perceive their role in the process and to understand the consequences for the

1 interprofessional collaboration within the care team. Knowing more about these aspects may have
2 important implications for successfully implementing this novel interprofessional medication
3 reconciliation model. We thus conceived this study in the context of a larger multi-site quality
4 improvement programme led by the Swiss Foundation for Patient Safety (SPS). The aim of the study
5 was to investigate the new role of pharmacy technicians in obtaining a BPMH from the perspectives of
6 pharmaceutical, medical and nursing staff as well as its implications for the interprofessional
7 collaboration.

8 **Methods**

9 **Study design**

10 This qualitative sub-study was conducted as part of the Swiss national quality improvement
11 programme *progress! Medication Reconciliation* which aimed to promote medication reconciliation in
12 acute care hospitals in Switzerland. The *progress!* programme was designed and led by the Swiss
13 Patient Safety Foundation. One of the cornerstones of the programme was to test the feasibility of
14 performing the essential first step of medication reconciliation, namely obtaining a BPMH at admission.
15 Eight hospitals participated in the programme. Each hospital committed itself to defining and testing a
16 new process for obtaining a BPMH on a designated internal medicine “pilot unit”. The new process
17 had to be based on the quality standards as defined by the programme (figure 1).

18 ---- Insert figure 1 ----

19 The hospitals were otherwise free to design workflows, tools and responsibilities adapted to their local
20 conditions. As a result, the roles and responsibilities for obtaining a BPMH varied among the hospitals.
21 In some hospitals, the BPMH was obtained by physician residents, in others, pharmaceutical staff was
22 involved in the process. In two hospitals, pharmacy technicians (supervised by pharmacists) were
23 responsible for obtaining a BPMH. The sub-study focuses on the experiences with this novel model in
24 these two hospitals.

25 **Setting and processes for obtaining a best possible medication history**

26 Both hospitals included in the study are mid-sized acute care hospitals located in Switzerland. In each
27 of the hospitals an interdisciplinary project group defined a process to obtain a BPMH upon admission
28 (figure 2). The new process was tested on an internal medicine pilot unit for the duration of one year
29 (November 2015 - November 2016). In both hospitals, no pharmaceutical personnel was involved in
30 obtaining a medication history prior to the project. Physician residents and sometimes nursing staff as
31 well, obtained the medication history. Pharmacy technicians already working in the hospital pharmacy
32 were trained for the new role. The SPS project team supplied a training guide, training resources (e.g.
33 role-playing exercises and presentations) as well as a patient interview guide. The training sessions
34 were organised and conducted by the local study teams.

35 ---- Insert figure 2 ----

1 Sample

2 Twenty-one semi-structured interviews with six pharmacy technicians, two pharmacists, six members
3 of the nursing staff, five physician residents and two senior physicians were conducted in the two
4 hospitals (table 1). The interviews took place during a two-day site visit from the SPS project team at
5 six months after implementation of the new processes.

6 --- Insert table 1 ---

7 Participants were purposely sampled to represent members of all professional groups who are
8 affected by the new BPMH process, i.e. pharmacy technicians, pharmacists, physicians and nurses.
9 To be eligible for an interview, pharmacy technicians had to be directly involved in obtaining the
10 BPMH. Pharmacists had to have an active part in supervising the pharmacy technicians in the BPMH.
11 Nurses, residents and senior physicians were recruited from the participating pilot units and had to
12 have experienced the new BPMH process for at least four weeks. Due to rotations, not all of the
13 interviewed residents in hospital A still worked on the pilot unit at the time of the interview. One senior
14 physician was not working on the pilot unit, but was responsible for instructing the residents on the
15 new BPMH processes and was therefore selected to be interviewed. Participants were recruited by
16 the local study coordinator. Written informed consent was obtained from all participants prior to the
17 interview.

18 Data collection

19 The interview guide (see appendix 1) was developed and iterated by the SPS project team. The guide
20 contained several thematic sections. Participants were first invited to describe their own role, as well
21 as the role of other health care professionals in completing the new processes. They were then asked
22 to evaluate their collaboration with the other health care professionals and whether they had noticed
23 any positive or negative changes or implications for their daily practice since implementation of the
24 new processes. Respondents were also asked to comment on the advantages and disadvantages of
25 involving pharmacy technicians in obtaining a BPMH. In the last section, which was not included in the
26 present analysis, participants were asked about the perceived benefits of a BPMH on medication
27 safety, the impact on patients and general suggestions for improving implementation of the new
28 processes. For each section, various sub-questions and prompts were included.

29 The personal interviews were conducted by LF (physician, project lead for the *progress!* programme)
30 and AN (social scientist). ChZ (nurse and social scientist) was present in three of the interviews to take
31 notes. Both interviewers trained in interviewing techniques beforehand. The interviews were
32 conducted face-to-face at the respective hospital and lasted between 30 and 40 minutes each. With
33 the exception of the participant and the researchers, no one else was present during the interview.
34 The interviewers introduced themselves and reiterated the background and aims of the study before
35 the interview. Handwritten notes were taken during the interview. The interviews were audio-taped and

1 transcribed verbatim by a professional transcriptionist. No repeat interviews were conducted.

2 Transcripts were not returned to participants for comment.

3 **Data analysis**

4 All analysis was performed by using the software ATLAS.ti 7. A conventional qualitative content
5 analysis approach was applied (31;32). The data was analysed by AN and ChZ. In a first step, both
6 researchers each read three randomly selected transcripts. They first applied an inductive approach of
7 data coding, taking notes on recurring topics or concepts that emerged from the interviews. Based on
8 this, both researchers developed a first set of codes. These two sets were then compared and merged
9 into one coding structure. The code structure was then completed by comparing it to the interview
10 guide. In a next step, both researchers independently applied the new code structure to three more
11 transcripts. The code structure was then discussed and revised anew, as new codes were added and
12 some were removed. This iterative process continued until each of the researchers had coded one half
13 of the transcripts. The code structure was reflected, discussed and finalized together with DS (senior
14 researcher) and transcripts were recoded accordingly. To increase reliability, AN and ChZ jointly
15 applied the finalized code structure to the three initial transcripts. Following this, each of the
16 researchers independently coded the second half of the transcripts. The final coding tree consisted of
17 the following main categories: "tasks" (in BPMH process), "impact on own work", "interprofessional
18 collaboration", "evaluation of the pharmacy technician's involvement", and "evaluation of current
19 processes". Subcategories were developed for a more differentiated organisation of the data content.
20 Through code by code comparison, discrepancies were identified, reviewed together and resolved.
21 These intensive discussions also allowed the two coders to reflect upon the personal assumptions and
22 preconceptions that they may have applied to the interviews. Data was organized into major themes
23 relevant to the research question and quotes were analysed accordingly. Final results were discussed
24 in a joint session with all four authors. Findings were not discussed with participants. Quotations were
25 translated from German to English for this publication by the authors.

26 **Results**

27 Two relevant major themes emerged to be pertinent to the research question: the impact of the
28 pharmacy technicians' new role on the daily work of all involved health care professionals and its
29 impact on the interprofessional collaboration.

30 **Impact on the daily work**

31 The pharmacy technicians' new role had impacts on the daily work of each professional group. We
32 report the results from the perspective of each of the groups interviewed.

33 *Perspective of pharmacy technicians*

1 The new BPMH process had positive and negative impacts on the daily work of pharmacy technicians.
2 A majority of them mentioned that their new tasks were interesting or enriching and that they made
3 their day-to-day operations more varied.

4 *“For us there is a lot of variety and I like to interact with people, so in this regard I also find it*
5 *adds value to me and to my profession.”* Pharmacy technician 4

6 By conducting structured patient interviews, pharmacy technicians work with patients in a much closer
7 way than they did before. Throughout the interviews it became clear that, unlike nurses or physicians,
8 pharmacy technicians are not much used to, nor specifically trained for direct patient interaction. Most
9 participants reported enjoying the new contact with patients, however, they also mentioned that it had
10 required them to learn new ways on how to interact with patients (e.g. using disinfectant before
11 greeting the patient) and how to handle difficult or unexpected situations (e.g. when patients are
12 unwilling or unable to answer questions).

13 *“You always have to be very careful. Some try to tell you their entire life. How do you interrupt,*
14 *without insulting the patient, but so that you know enough? This is difficult at times.”* Pharmacy
15 technician 4

16 In hospital A, where pharmacy technicians obtained the BPMH from elective as well as emergency
17 patients, the elective patients were interviewed in a separate booth in the main lobby after registering
18 in the hospital and before being admitted to the ward, whereas emergency patients were interviewed
19 in their ward rooms. The pharmacy technicians in this hospital enjoyed interviewing patients entering
20 for elective treatments, but did not feel at ease interviewing patients on the ward.

21 *“I don’t find it interesting to go to the ward and into the room. I don’t like that too much.”*
22 Pharmacy technician 3

23 One pharmacy technician explained that she chose her profession in order to keep a certain distance
24 to the clients. She didn’t consider herself to be sufficiently trained to adequately handle difficult
25 situations.

26 *“And I feel, for me, as a pharmacy technician you enjoy the contact with clients, but not if it’s*
27 *too close. And in the patient room it is different, compared to when the patient is here [in the*
28 *admission booth]. Here you still have a certain distance. And yes, sometimes I find it difficult*
29 *upstairs [on the ward], well, depending on the patient you have, because we weren’t trained or*
30 *prepared for something like that. [...] If you then really have to interview a patient who’s in*
31 *serious pain [...], then I don’t feel at ease with him.”* Pharmacy technician 2

32 Pharmacy technicians in hospital B did not mention this issue of being too close to the patients.
33 However, they only interviewed patients on the ward and therefore did not have a similar opportunity
34 to compare the different situations. Lastly, the new tasks of pharmacy technicians had a significant

1 impact on the planning of their day-to-day operations. The time required for obtaining a BPMH had to
2 be fit in within the other daily duties. In hospital A, this was perceived as burdensome and stressful by
3 some.

4 *“It extremely influences and impairs the daily operations. (...) I manage the medicine stock on
5 the intensive care unit. I’m there and then I’m called, ‘someone is here’, then I have to leave
6 [the ICU] and come here. I cannot plan my daily operations anymore. They are interrupted or
7 are falling short. The medication history requires a lot of time.”* Pharmacy technician 3

8 *“It is just difficult in our current situation. You have too little resources, you notice, you have to,
9 or you can, or you should do this as well, and as precisely as possible. (...) and then you
10 make some further inquiries and sometimes it really takes a lot of time. Sometimes not,
11 sometimes it does. And I notice, sometimes this becomes a burden.”* Pharmacy technician 1

12 In hospital B, pharmacy technicians also mentioned challenges with integrating the BPMH into their
13 daily routine. However, they also mentioned that there’s the option of not obtaining a BPMH, if there is
14 too much conflict with their other tasks.

15 *“When it gets really bad, you have to say, today we can’t do it. But otherwise, I don’t feel that
16 stressed because of it. It already happened that I had three or four patients to interview. I
17 arrive [on the ward], but then one is being seen by the doctor, the second is having
18 physiotherapy, the third is in an examination. In the end I have four patients and I would have
19 had the time but could not interview anyone. This has happened before.”* Pharmacy
20 technician 4

21 *Perspective of pharmacists*

22 Pharmacists in both hospitals reported an increased workload.

23 *“It certainly has gotten more laborious. You have to think about it more, that you have to do it
24 (...) and then the next day we have to check everything, this takes a lot of time.”* Pharmacist 1

25 *“Yes, it is additional, something you do as well.”* Pharmacist 2

26 As supervisors, pharmacists coach and advise pharmacy technicians before and after the patient
27 interviews, for example on how to interact with patients or how to better understand the individual
28 medication in relation to the diagnoses, as illustrated by the following quote:

29 *„They are experiencing so much through the interaction with the patients that I try to meet
30 them there too, in order to discuss their experiences, to talk about what the patient told them
31 [...]. On the other hand also to give them explanations about why he takes [a medication].”*
32 Pharmacist 2

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3 1 In hospital A, interview partners explained that an additional check of the preadmission medication list
4 2 by pharmacists was introduced directly after the pharmacy technicians had obtained a BPMH and
5 3 before sending it to the physicians. Pharmacists control the plausibility and accuracy of the recorded
6 4 information, for example by taking into account patients' diagnoses. This check was not intended in
7 5 the original design of the BPMH process, but was introduced after pharmacists had received feedback
8 6 from residents that in some cases pharmacy technicians hadn't recognised the relevance of certain
9 7 information concerning a patient's medication in relation to his diagnoses. Thus, they hadn't forwarded
10 8 important information immediately to the resident physician.

14 9 *"We received one or two feedbacks that the pharmacy technicians didn't record something*
15 10 *that was important. Somehow, marcumar®, an anticoagulant, had been discontinued some*
16 11 *days before and she had written it down in the comments. And for the physician it is essential*
17 12 *to know that [the patient] had it. (...) A physician would have noted it at the very top. But a*
18 13 *pharmacy technician has her list and her interview guide that she goes through, and she may*
19 14 *not be aware for all the medications how important they are and how they match with a*
20 15 *diagnosis. (...) We should have noticed it. From there on, we looked over it before it is sent to*
21 16 *the physician."* Pharmacist 1

26 17 Finally, in both hospitals, pharmacists also conduct the final step of medication reconciliation at
27 18 admission. Once the patient's preadmission medication list is established by pharmacy technicians,
28 19 pharmacists compare that list with the admission orders and review the medication orders for potential
29 20 drug-drug interactions.

32 21 *"And [the pharmacists] also looked at it again and gave us feedback on interactions, or that*
33 22 *they cannot find a correct diagnosis for this and that medication."* Physician resident 1

36 24 *Perspective of physicians*

38 25 The impact of the BPMH obtained by pharmacy technicians on the daily work of physicians was
39 26 experienced differently by the respondents of the two hospitals. In hospital A, physicians used the
40 27 preadmission medication list of the pharmacy technicians in order to write their admission orders.
41 28 Hence, their work built on the BPMH previously obtained by pharmacy technicians. They noted that
42 29 involving the pharmacy technicians relieved them of certain time-consuming administrative duties.

45 30 *"The administrative burden [of our work] was clearly reduced."* Physician resident 1

47 31 *„And now, everything is already documented and a tedious part of our work is already done.“*
48 32 Physician resident 2

50 33 In addition, physician residents in hospital A stated that the multi-staged processes led to a more
51 34 systematic and thorough assessment of a patient's medication. They also expressed comfort in the
52 35 thought that there was someone else looking at the patient's medication.

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3 1 *“I think, what is good about it, is that I know that one of the pharmacists will have a look at it,*
4 2 *that there certainly is a better control of the medication in general. If there are things that need*
5 3 *to be changed. This is certainly something that helps.” Physician resident 3*

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7 4 In hospital B, at the start of the project, physician residents were trained to obtain a more complete
8 5 medication history compared to the previous status quo, and to document it in a new, more structured
9 6 electronic form. In this hospital, the BPMH obtained by pharmacy technicians and pharmacists was
10 7 implemented in complement, rather than in substitution of the medication history obtained by
11 8 physicians. The physician residents interviewed did not report any noticeable change to their daily
12 9 work since pharmacy technicians were involved in obtaining a BPMH. Rather, one of them stated that:

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16 10 *„We don't rely on the work of pharmacists or pharmacy technicians. We're trying to obtain a*
17 11 *best possible medication history ourselves.” Physician resident 4*

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20 12 *Perspective of nurses*

21 13 In both hospitals, nursing staff was only peripherally involved in obtaining a BPMH. However, all
22 14 nurses reported experiencing positive impacts on their daily work since implementation of the new
23 15 BPMH process. Since both hospitals implemented various elements at once (e.g. new electronic form,
24 16 new process for hospital discharge), for nursing staff it was not possible to clearly discern whether it
25 17 was the work of pharmacy technicians or other elements that contributed to this impact.
26 18 Notwithstanding, they all stated that medication orders had improved in clarity and completeness.

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30 19 *“Prior to this, we often experienced that we came in the morning, distributed the pills and then*
31 20 *it was said [by the patients] “this one is missing and that one is missing”. Then we went to ask*
32 21 *[the doctors]: ‘Yes, that’s not important.’ Or: ‘Oh, I didn’t know that.’ Only those from the*
33 22 *general practitioner [were recorded], but something that [the patient] took himself wasn’t*
34 23 *recorded.” Nurse 5*

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37 24 With preadmission medication recorded more thoroughly, the nurses found that they spent less time
38 25 asking physicians about incomplete or imprecise orders as well as discussing missing medication with
39 26 patients. Furthermore, one nurse pointed out that knowing that someone else would record all
40 27 preadmission medication relieved nursing staff from the perceived responsibility of ensuring that the
41 28 patient received all his necessary medication.

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44 29 *“I think it is really a relief for us. Even when patients come in late in the evening or during the night,*
45 30 *you don't have to think too much about their medications, rather you know someone will come who*
46 31 *conducts an interview with them and records everything.” Nurse 4*

1 **Impact on interprofessional collaboration**

2 We were particularly interested in analysing how the involvement of pharmacy technicians would affect
3 the existing structures and team dynamics between the professional groups. The following central
4 themes emerged from the interviews.

5 *Pharmacy technicians act outside of the care team*

6 With the new BPMH process, pharmacy technicians became an additional professional group that
7 requires access to the patient. In spite of this, the interviews suggest that the pharmacy technicians
8 did not become part of the larger care team, but rather assume an outside role. Pharmacy technicians
9 reported having to work their way around other health care professionals' schedules and spending a
10 lot of time coordinating with nursing staff to find a good time to conduct the interview.

11 *“What can often be a little bit of a problem, maybe there’s the nutritionist with the patient, then
12 the physiotherapist comes in, and then we come in as well. Then the patient gets annoyed at
13 some point. So you have to watch this a little bit, then I’ll go interview the other two [patients]
14 first and maybe only in the afternoon I’ll go see this patient. They are less cooperative, when
15 the physiotherapist is there, she doesn’t show consideration for me. They certainly also have
16 their schedule.”* Pharmacy technician 4

17 Other health care workers don’t pay a lot of attention to the pharmacy technicians. This is also
18 illustrated by the fact that some physicians were not able to clearly distinguish between pharmacy
19 technicians and pharmacists in the interviews. Some nurses reported that the presence of pharmacy
20 technicians was hardly noticed on the wards.

21 *„Well, we don’t actually see them that much. They sneak upstairs quickly [...] and then they do
22 it, actually calmly and quietly, well, they rarely come to ask us anything and then they leave
23 again”.* Nurse 2

24 *“The pharmacy technicians are not really part of our team. They come as if they are guests.”*
25 Senior physician 2

26 Some pharmacy technicians also described themselves as “someone from the outside”. They
27 attributed positive characteristics to this role, stating that this way they could act as a link between the
28 patients and the physicians and gather more information from a patient.

29 *“I see myself as an intermediary, somehow. I’m not anyone’s competitor, but I’m coming from
30 the outside. I can also see this with the patients. They notice ‘aha, someone is coming, she’s
31 not part of the nursing staff, she’s coming from a different place in the hospital.’ I notice that
32 sometimes they tell me almost more [...]”* Pharmacy technician 4

33 *No direct interaction between pharmacy technicians and physicians*

1 Pharmacy technicians and physicians reported that there is almost no direct interaction between them.
 2 In each hospital, one of the pharmacy technicians said that she considers herself a “link” or an
 3 “intermediary” between the physician and the patient. However, the interviews suggest that the way
 4 the BPMH processes were defined in both hospitals does not allow pharmacy technicians to fulfil such
 5 a role. Rather, information flows in one direction only and passes the pharmacists as another
 6 checkpoint before reaching the physician. Pharmacy technicians do not know what happens to the
 7 information collected from the patient after it has been transmitted from the pharmacists to the
 8 physicians and they receive little feedback from the physicians on how their work is perceived.

9 *“I can’t say much about [the role of the physicians], because it’s all done by our pharmacists. I
 10 just hand them over the sheet. I tell the pharmacist: “[...] ‘here and here you will probably have
 11 to take a closer look’ or ‘here I’m not quite sure’, but I hardly ever see a physician.” Pharmacy
 12 technician 4*

13 *“On the ward, I do not have any contact with the physicians.” Pharmacy technician 3*

14 *Strengthened collaboration between pharmacists and physicians*

15 Pharmacists and physicians both reported that their collaboration had intensified since the new
 16 medication reconciliation processes were introduced. Because they control the work of pharmacy
 17 technicians and reconcile preadmission lists with admission orders, pharmacists were also provided
 18 with an opportunity to analyse patients’ individual medication and provide feedback on interactions.
 19 Physicians in both hospitals found this feedback to be helpful for their work. Pharmacists in turn
 20 considered it of high value to be more involved in the medication process and to better know and
 21 interact with physicians.

22 *“[...] it sometimes happens that the residents approach me about something in the hallway or
 23 that they ask questions or call me. It is not just because it’s interesting for me, but I also think
 24 that it’s better for medication safety when one is less inhibited to ask someone, because ... If
 25 one asks everything and doesn’t hesitate to ask because one doesn’t want to disturb.”*

26 Pharmacist 1

27 **Discussion**

28 Our study found that pharmacy technicians who obtain a BPMH generally enjoy and benefit from their
 29 new tasks. Their daily work becomes more varied and interviewing elective patients in particular
 30 seems to be a welcoming change. However, these tasks also come with challenges for pharmacy
 31 technicians. Being responsible for conducting the BPMH makes their planning of day-to-day duties
 32 more difficult, since the daily number of admissions is not predictable and the pharmacy technicians
 33 have to work their way around the schedules of other health care professionals. Direct patient
 34 interaction can be another challenge for pharmacy technicians, since they are usually not used to, nor
 35 trained to be in direct contact with seriously ill patients. Simple questions such as whether or not to
 36 shake a patient’s hand illustrate the dimension of uncertainty for pharmacy technicians. This finding

1 underlines the importance of a dedicated training programme for pharmacy technicians on how to
2 obtain a BPMH which includes practical elements such as role-playing exercises, as stated in other
3 studies (25;33). Our findings suggest that for some pharmacy technicians, direct patient interaction
4 may be too close and that not all pharmacy technicians may be equally willing and apt to deal with
5 these challenges. This is an aspect that should be considered when recruiting pharmacy technicians
6 for these tasks. Choosing pharmacy technicians who demonstrate good interpersonal, communication
7 and problem-solving skills has been identified as one of the best practices when engaging pharmacy
8 technicians in medication reconciliation efforts (25). The situation for pharmacy technicians in our
9 study is different when they are interviewing elective patients at admission, who are generally stable
10 and not in urgent need for medical care. In this case, the neutral space of the admission booth may
11 convey a sense of distance and better control of the situation. As for their place within the team, we
12 found that pharmacy technicians did not become members of the treatment team. They have no
13 proper position awarded in the pre-existing spatial and social structures on the ward, but rather act on
14 a preliminary administrative level.

15 Our findings indicate a benefit for the daily work of nurses as well as for the integration of pharmacists
16 in the medication process. However, due to the complexity of the processes it is not clear to what
17 extent these implications are linked to the work of the pharmacy technicians in obtaining a BPMH, and
18 to what extent they are a result of the other elements introduced within the programme.

19 The findings suggest that involving pharmacy technicians in obtaining a BPMH can also have positive
20 effects on the daily work of physicians. In particular, physician residents benefit from the delegation of
21 administrative tasks to pharmacy technicians (such as collecting additional sources for the medication
22 history). However, we also found that certain tasks were still performed by pharmacy technicians as
23 well as physicians. In line with other research (34), our analysis indicates that physicians may be
24 reluctant to hand off tasks to other professional groups, because they consider obtaining a medication
25 history a cornerstone for deciding on the treatment regime. Boockvar et al. found that medication
26 reconciliation is challenging for physicians because it competes for their time with other tasks and that
27 they prioritize more urgent care responsibilities; the authors thus suggest that efficacy and perceived
28 capability regarding the completion of medication reconciliation might be improved by dividing the task
29 into parts more easily manageable by individual team members (35).

30 The results also demonstrate that there was a shift of workload from physician residents and nurses to
31 pharmacy technicians and pharmacists. In both hospitals, pharmacy technicians and pharmacists
32 performed the BPMH tasks in addition to their other daily duties. As a consequence, they had to
33 interrupt other tasks or at times chose not to obtain a BPMH (hospital B). This raises safety concerns,
34 since shifting the attention away from an original task and returning back to it later can increase the
35 likelihood of errors (36). In hospital A, more pharmaceutical staff was eventually hired to better
36 redistribute some of the workload. This underlines the fact that without adding additional human
37 resources, such a model can hardly be sustainable.

1 We also found that in both hospitals, engaging pharmacy technicians in obtaining a BPMH was, at the
2 time of the interviews, not possible without the substantial involvement of pharmacists. Pharmacists
3 coached and supported pharmacy technicians and, in one hospital, controlled their work before it was
4 transmitted to the physicians, thus becoming important intermediaries. This implies that the efficiency
5 gained by delegating administrative tasks from physicians to pharmacy technicians may be lost if
6 pharmacists assume a similarly important role in the new process. As other studies have pointed out,
7 once it is established that a pharmacy technician has enough practice to collect an accurate
8 preadmission medication list, removing routine pharmacist verification could improve efficiency in the
9 process (27).

10 It is also important to note that the need for the additional check by pharmacists may be due to
11 different expectations as to what is included in the process of obtaining a “best possible medication
12 history”. Obtaining a BPMH means to compile an accurate and complete list of all preadmission
13 medications of a patient. It does not include any sort of clinical analysis of the preadmission
14 medication. If pharmacy technicians are to be involved in obtaining a BMPH, this distinction needs to
15 be clear to all health care professionals involved, because it clearly delimits which tasks pharmacy
16 technicians can take over and which tasks need to be performed by other health care professionals.

17 Lastly, transferring the task of obtaining a best possible medication history from physicians to another
18 professional group adds to the fragmentation of the process. In our study, pharmacy technicians did
19 not become part of the wider care there, there was no direct communication between the pharmacy
20 technician and the physician and pharmacists were added to the process as a third group. This raises
21 patient safety concerns, because it creates new interfaces prone to errors and information loss.

22 In summary, we found that pharmacy technicians are willing and able to take over responsibilities in
23 obtaining a BPMH. However, their engagement can also generate new risks and inefficiencies,
24 especially if new responsibilities are added on top of their other daily duties, if tasks are not clearly
25 delimited or if a pharmacist’s active involvement is required to transmit relevant information from the
26 pharmacy technicians to the physicians. These issues need to be addressed in order for this model to
27 really be a safe and cost-effective alternative to more traditional ways for obtaining a BPMH.

28 **Strengths and limitations**

29 With this study we shed light on the implications of a specific interprofessional model for obtaining a
30 best possible medication history. The sampling of medical, pharmaceutical and nursing staff allowed
31 an in-depth exploration of the perception of all health care professionals directly affected by such a
32 new model. However, participants were recruited from two hospitals only. Each hospital designed its
33 own process adapted to its local structures and culture. The understanding of the new BPMH process
34 may have varied among the interviewed staff. Furthermore, in each hospital the implementation of the
35 BPMH was accompanied by the introduction of other tools and processes that had a possible impact
36 on the perceptions and answers of the participants. Results therefore need to be interpreted in the
37 local context and findings may not be generalizable to other institutions. Nevertheless, because the

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3 1 main themes emerged across both hospitals and align with the results from other studies, we believe
4 2 that our findings can be relevant to other hospitals that consider implementing such a model. Since the
5 3 new process was tested in two hospitals only, the number of staff members eligible to participate was
6 4 very limited. Hence, it is possible that more themes would have emerged if more staff members could
7 5 have been interviewed. Staff members were selected for interviews by local study coordinators. We
8 6 have no knowledge of how many staff members declined to participate. Due to the small number of
9 7 staff eligible for interview, it is unlikely that many refused. Yet, we cannot exclude the possibility that
10 8 highly motivated individuals were more likely to be selected for the interviews than colleagues with
11 9 less interest in the new process. In this case, the interviewees in our sample may have conveyed a
12 10 more positive view about the effects of the new BPMH process on their roles and daily work. Finally, it
13 11 is likely that such a new interprofessional model requires some time in order to become established
14 12 and efficient in the daily routine. Follow-up interviews could have shed more light upon the long-term
15 13 effects of the new model.

14 **Conclusion**

15 To our knowledge this is the first qualitative study that specifically explored the implications on
16 16 professional roles and collaboration by transferring certain tasks of obtaining a BPMH to pharmacy
17 17 technicians. There are some important implications for practice. First, it is crucial that pharmacy
18 18 technicians receive sufficient time and training to perform their new tasks. Furthermore, the scope of
19 19 the tasks assumed by pharmacy technicians needs to be clearly defined and fully integrated into
20 20 existing processes, so that work is not duplicated. Pharmacy technicians can be involved in
21 21 establishing a complete list of preadmission medication, however, the expertise of pharmacists or
22 22 physicians is required to analyse potential clinical problems regarding the patient's medication.
23 23 Ultimately, it is still the physician's responsibility to assess whether treatment is appropriate. Due to a
24 24 fragmentation of the process it is essential that communication and information flow at the interfaces
25 25 between professional groups is well organised. Institutions considering this model need to account for
26 26 sufficient resources for training and task completion and be attentive to the implications which the
27 27 involvement of a further professional group has on teamwork dynamics and workflow design. More
28 28 research is needed to understand if and under which circumstances such a model can be efficient and
29 29 contribute to higher medication safety.

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33 33 the interviews in the two hospitals.

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1 ChZ and LF drafted the article. DS performed critical review of the article. All authors approved the
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5 **Ethics approval:** This study was conducted as part of a quality improvement programme. The quality
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7 Committee of the Canton of Zurich.

8 **Data sharing statement:** No additional data are available.

9 10 **Figure legend:**

11 **Figure 1:** Quality standards for obtaining a best possible medication history (BPMH)

12 **Figure 2:** Processes defined to obtain the best possible medication history

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1 Table 1

Table 1: Interviewees

Profession	Hospital A	Hospital B	Total
Pharmacy technician	3	3	6
(Clinical) pharmacist	1	1	2
Resident physician	3	2	5
Senior physician	1	1	2
Nurse	3	3	6
Gender			
Male	1	3	4
Female	10	7	17

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For peer review only

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7 **Figure 1: Quality standards for obtaining a best possible medication history (BPMH) (16)**

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- Use at least two reliable sources for obtaining a BPMH (e.g. medication list from the general practitioner, patients' medication list, drug packages). Whenever possible, one of the sources should be a systematic patient interview conducted with a structured guide.
 - Record all current medications (incl. OTC, vitamins, herbals, "as needed" etc.)
 - Make preadmission medication list accessible to the whole healthcare team by filing in a central place
 - Obtain BPMH within 24h after admission
 - Define roles and responsibilities for obtaining BPMH and train accordingly

121x29mm (300 x 300 DPI)

Figure 2: Processes defined to obtain the best possible medication history**Hospital A:**

BPMH is obtained for all elective patients admitted to the general internal medicine department and for patients admitted between 12 midnight and 5 am from the emergency department to the general internal medicine department (approx. 30 admissions / month). Pharmacy technicians conduct systematic patient interviews using available information sources and record the preadmission medication list on a special form in the electronic patient chart. Physicians receive the list and document further action for each medication (e.g. stop, continue, modify). They then order the admission medications. Subsequently, clinical pharmacists check the admission orders and provide feedback to the physicians on any discrepancies identified.

Hospital B:

BPMH is obtained for all patients aged 40 to 85 years admitted through the emergency department to one general internal medicine ward (approx. 40-60 admissions/month). At admission, a medication history is obtained by physician residents. To this end, a new electronic form was introduced where information on preadmission medication is recorded. Physician residents then write the admission orders. Once patients are transferred to the ward, pharmacy technicians conduct a structured patient interview to systematically capture all preadmission medications and record this information on a paper form. If necessary, other sources are consulted for additional information. Pharmacists then compare the preadmission medication to the medication orders, check for potential drug-drug interactions and control doses and provide feedback to the physicians. The paper form is filed in the patient record.

122x64mm (300 x 300 DPI)

Appendix 1: Interview Guide

1. Please introduce yourself: what is your function and how long have you been working in this unit?
2. Were you informed about the new process to obtain a BPMH? How and by whom?
3. Could you please describe in your own words what a best possible or systematic medication history is?
4. *Nursing staff only*: Do you know where the preadmission medications are documented? If yes, do you work with this list? How useful is it for your work?
5. What is your role (tasks, responsibility, competency) in obtaining a best possible medication history?
6. What is, in your view, the role of the other professional groups (physicians, nurses, pharmaceutical staff)?
7. On a scale from 1 (very bad) to 6 (very good), how would you rate the current collaboration with the other professional groups in regard to obtaining a BPMH? Please explain.
8. Do you notice a difference compared to before? Has the collaboration changed since the introduction of the new processes (positively or negatively)? If yes, what exactly is different? How do you see this change?
9. In your opinion, has it proved to be of value that pharmacy technicians obtain a BPMH? Please explain. What advantages or disadvantages do you see with this model?
10. Has your own daily work changed since the introduction of a best possible medication history? If yes, what is different? Can you give an example?
11. *Physicians only*: In order for you to write a good admission order - do you think the additional effort required for a BPMH is worth the additional benefit? Please explain.
12. On a scale from 1 (not important at all) to 6 (very important), in your opinion how important is the best possible medication history to reduce medication errors in your hospital? Please explain.
13. What kind of medication errors can be avoided with obtaining a best possible medication history? Can you give an example of an error that was avoided?
14. In your experience, how do patients react when they are being interviewed about their preadmission medication?
15. Did you experience a change in their behavior since the introduction of the structured patient interview?
16. If you had to narrow it down, for which patient group would you consider the BPMH to be especially beneficial?
17. On a scale from 1 (not smooth at all) to 6 (very smooth), how smoothly is the new BPMH process running in your hospital?
18. Where do you see room for improvement?
19. Would you recommend extending the new processes to other units? Why / why not?
20. Do you have any additional comments?

Translated from German original. Questions analyzed for this study are highlighted.

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Page numbers refer to the revised MS copy without track changes.

Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

Developed from:

Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

No. Item	Guide questions/description	Reported on page #
Domain 1: Research team and reflexivity		
<i>Personal Characteristics</i>		
1. Interviewer/facilitator	Which author/s conducted the interview or focus group?	p. 5 (data collection) p.15 (authors statement)
2. Credentials	What were the researcher's credentials? <i>E.g. PhD, MD</i>	p.1
3. Occupation	What was their occupation at the time of the study?	p.1
4. Gender	Was the researcher male or female?	p. 5 (data collection)
5. Experience and training	What experience or training did the researcher have?	p. 5 (data collection)
<i>Relationship with participants</i>		
6. Relationship established	Was a relationship established prior to study commencement?	p. 5 (sample) p. 5 (data collection)
7. Participant knowledge of the interviewer	What did the participants know about the researcher? <i>e.g. personal goals, reasons for doing the research</i>	p. 5 (data collection)
8. Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? <i>e.g. Bias, assumptions, reasons and interests in the research topic</i>	p. 5 (data collection)
Domain 2: study design		
<i>Theoretical framework</i>		
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? <i>e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis</i>	p. 6 (data analysis)
<i>Participant selection</i>		
10. Sampling	How were participants selected? <i>e.g. purposive, convenience, consecutive, snowball</i>	p. 5 (sample) p. 15 (limitations)
11. Method of approach	How were participants approached? <i>e.g. face-to-face, telephone, mail, email</i>	p. 5 (sample) p. 15 (limitations)
12. Sample size	How many participants were in the study?	p. 5 (sample) table 1
13. Non-participation	How many people refused to participate or dropped out? Reasons?	p. 15 (limitations)
<i>Setting</i>		
14. Setting of data collection	Where was the data collected? <i>e.g. home, clinic, workplace</i>	p. 5 (data collection)
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	p. 5 (data collection)
16. Description of sample	What are the important characteristics of the	p. 5 (sample)

	sample? <i>e.g. demographic data, date</i>	table 1
<i>Data collection</i>		
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	p. 5 (data collection) appendix 1
18. Repeat interviews	Were repeat interviews carried out? If yes, how many?	p. 6 (data collection)
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	p. 5 (data collection)
20. Field notes	Were field notes made during and/or after the interview or focus group?	p. 5 (data collection)
21. Duration	What was the duration of the interviews or focus group?	p. 5 (data collection)
22. Data saturation	Was data saturation discussed?	p. 15 (limitations)
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	p. 6 (data collection)
Domain 3: analysis and findings		
<i>Data analysis</i>		
24. Number of data coders	How many data coders coded the data?	p. 6 (data analysis)
25. Description of the coding tree	Did authors provide a description of the coding tree?	p. 6 (data analysis)
26. Derivation of themes	Were themes identified in advance or derived from the data?	p. 6 (data analysis)
27. Software	What software, if applicable, was used to manage the data?	p. 6 (data analysis)
28. Participant checking	Did participants provide feedback on the findings?	p. 6 (data analysis)
<i>Reporting</i>		
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? <i>e.g. participant number</i>	p. 6-12 (results)
30. Data and findings consistent	Was there consistency between the data presented and the findings?	p.12-14 (discussion)
31. Clarity of major themes	Were major themes clearly presented in the findings?	p.6 (results) p.6-12 (interview quotes) p 12-14 (discussion)
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	p.6-12 (results)

BMJ Open

The implications of involving pharmacy technicians in obtaining a best possible medication history from the perspectives of pharmaceutical, medical and nursing staff: a qualitative study

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1 **The implications of involving pharmacy technicians in obtaining a best possible medication**
2 **history from the perspectives of pharmaceutical, medical and nursing staff: a qualitative study**

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21 Key Words: medication reconciliation, pharmacy technician, medication history, medication safety

22 Word count: 6113 (including quotes)

1 Abstract

2 Objectives: In recent years, the involvement of pharmacy technicians in medication reconciliation has
3 increasingly been investigated. The aim of this study was to assess the implications on professional
4 roles and collaboration when a best possible medication history (BPMH) at admission is obtained by
5 pharmacy technicians.

6 Design: Qualitative study with semi-structured interviews. Data was analysed using a qualitative
7 content analysis approach.

8 Setting: Internal medicine units in two mid-sized Swiss hospitals.

9 Participants: 21 staff members working at the two sites (6 pharmacy technicians, 2 pharmacists, 6
10 nurses, 5 physician residents and 2 senior physicians).

11 Results: Pharmacy technicians generally appreciated their new tasks in obtaining a BPMH. However,
12 they also experienced challenges associated with their new role. Interviewees reported unease with
13 direct patient interaction and challenges with integrating the new BPMH tasks into their regular daily
14 duties. We found that pharmacists played a key role in the BPMH process, since they act as coaches
15 for pharmacy technicians, transmit information to the physicians and reconcile preadmission
16 medication lists with admission orders. Physicians stated that they benefitted from the delegation of
17 administrative tasks to pharmacy technicians. Regarding the interprofessional collaboration, we found
18 that pharmacy technicians in the study acted on a preliminary administrative level and did not become
19 part of the larger treatment team. There was no direct interaction between pharmacy technicians and
20 physicians, but rather, the supervising pharmacists acted as intermediaries.

21 Conclusion: The tasks assumed by pharmacy technicians need to be clearly defined and fully
22 integrated into existing processes. Engaging pharmacy technicians may generate new patient safety
23 risks and inefficiencies due to process fragmentation. Communication and information flow at the
24 interfaces between professional groups therefore need to be well organised. More research is needed
25 to understand if and under which circumstances such a model can be efficient and contribute to
26 improving medication safety.

27 Article summary

28 Strengths and limitations of this study

- 29 • The qualitative study design allowed an in-depth exploration of the implications for different health
30 care professionals when introducing a new interprofessional model.
- 31 • By interviewing pharmacy technicians, pharmacists, physicians and nurses, we were able to take
32 into account the perceptions of all health care professionals affected by the new model.
- 33 • Participants were recruited from two sites only. Findings need to be understood in the local
34 context and are only partly transferable to other settings.

- Participants were recruited by local study coordinators, sampling bias cannot be excluded.

Introduction

Transitions of patients between the hospital and other healthcare settings are vulnerable times for medication errors and adverse drug events (ADEs). Discrepancies such as inadvertent omissions and duplications of medications and dosing errors are common at hospital admission and discharge (1-6). Unintentional medication changes and communication failures at these interfaces are associated with potential harm and high utilisation of healthcare resources such as readmissions (7-9). Medication reconciliation is the process of thoroughly and accurately establishing a patient's medication list and using this list to provide correct medications to the patient (10). Over the past decade, medication reconciliation has been advocated in more and more countries as an important patient safety strategy for preventing medication discrepancies at transitions of care (11-17).

While medication reconciliation (or "med rec", as it is often called) has strong face validity and a large body of evidence points to its benefits (18-21), many questions still arise as to how to best conduct the process in routine care. An important implementation barrier is the resource intensity that is associated with med rec interventions (22). Systematic literature reviews have concluded that many successful interventions in medication reconciliation involved pharmacists (18-20). However, implementing interventions in which pharmacists conduct med rec for a majority of hospitalized patients is expensive (though this may still be cost-effective on a systems-level by reducing drug expenses and costly adverse drug events (23;24)). In recent years, the involvement of pharmacy technicians, supervised by pharmacists, in medication reconciliation has increasingly been investigated, the assumption being that this may offer many of the advantages of pharmacist-based interventions but at a lower cost. Evidence from numerous studies demonstrates that trained pharmacy technicians are able to gather medication histories with similar completeness and accuracy to other health care professionals (25;26). One study found that, compared to non-pharmacy personnel, pharmacy technicians had an absolute risk reduction of 50% in medication history errors (27). A three-arm randomized controlled study found that when adding a best possible medication history by either pharmacy technicians or pharmacists to usual care processes, errors in the admission history were reduced by over 80%. There was no difference in the benefits provided by pharmacy technicians versus pharmacists (28).

For pharmacy technicians, participating in the medication reconciliation process represents a new professional role not included in their initial training. Obtaining a best possible medication history (BPMH), for example, includes a systematic interview with the patient and/or his or her carers in order to capture all medications currently being taken (figure 1). To our knowledge, only few studies have explored the views of pharmacy technicians regarding new patient-centred tasks. The studies concluded that pharmacy technicians indicate a desire to take on more clinical or managerial tasks; however, their current training and education may not sufficiently equip them for these new roles (29;30). With a growing interest to involve pharmacy technicians in medication reconciliation, it is important to understand how pharmacy technicians perceive their role in the process and to

1 understand the consequences for the interprofessional collaboration within the care team. Knowing
2 more about these aspects may have important implications for successfully implementing this novel
3 interprofessional medication reconciliation model. We thus conceived this study in the context of a
4 larger multi-site quality improvement programme led by the Swiss Patient Safety Foundation. The aim
5 of the study was to investigate the new role of pharmacy technicians in obtaining a BPMH from the
6 perspectives of pharmaceutical, medical and nursing staff as well as its implications for the
7 interprofessional collaboration.

8 **Methods**

9 **Study design**

10 This qualitative sub-study was conducted as part of the Swiss national quality improvement
11 programme *progress! Medication Reconciliation* which aimed to promote medication reconciliation in
12 acute care hospitals in Switzerland. The *progress!* programme was designed and led by the Swiss
13 Patient Safety Foundation (SPS). One of the cornerstones of the programme was to test the feasibility
14 of performing the first step of medication reconciliation, namely obtaining a BPMH at admission. Eight
15 hospitals participated in the programme. Each hospital committed itself to defining and testing a new
16 process for obtaining a BPMH on a designated internal medicine “pilot unit”. The new process had to
17 be based on quality standards as defined by the programme (figure 1).

18 ---- Insert figure 1 ----

19 The hospitals were otherwise free to design workflows, tools and responsibilities adapted to their local
20 conditions. As a result, the roles and responsibilities for obtaining a BPMH varied among the hospitals.
21 In some hospitals, the BPMH was obtained by physician residents, in others, pharmaceutical staff was
22 involved in the process. In two hospitals, pharmacy technicians (supervised by pharmacists) were
23 responsible for obtaining a BPMH. The present sub-study focuses on the experiences with this novel
24 model in these two hospitals.

25 **Setting and processes for obtaining a best possible medication history**

26 Both hospitals included in the study are mid-sized acute care hospitals located in Switzerland. In each
27 of the hospitals an interdisciplinary project team defined a process to obtain a BPMH upon admission
28 (figure 2). The new process was tested on an internal medicine pilot unit for the duration of one year
29 (November 2015 - November 2016). In both hospitals, no pharmaceutical personnel was involved in
30 obtaining a medication history prior to the project. Medication histories were obtained by physician
31 residents and sometimes nurses. Pharmacy technicians already working in the hospital pharmacy
32 were trained for the new role. The SPS programme team supplied a training guide, training resources
33 (e.g. role-playing exercises and presentations) as well as a patient interview guide. The training
34 sessions were organised and conducted by the local study teams.

35 ---- Insert figure 2 ----

1 Sample

2 Twenty-one semi-structured interviews with six pharmacy technicians, two pharmacists, six members
3 of the nursing staff, five physician residents and two senior physicians were conducted in the two
4 hospitals (table 1). The interviews took place during a two-day site visit from the SPS programme team
5 at six months after implementation of the new processes.

6 --- Insert table 1 ---

7 Participants were purposely sampled to represent members of all professional groups who are
8 affected by the new BPMH process, i.e. pharmacy technicians, pharmacists, physicians and nurses.
9 To be eligible for an interview, pharmacy technicians had to be directly involved in obtaining the
10 BPMH. Pharmacists had to have an active part in supervising the pharmacy technicians in the BPMH.
11 Nurses, residents and senior physicians were recruited from the participating pilot units and had to
12 have experienced the new BPMH process for at least four weeks. Due to rotations, not all of the
13 interviewed residents in hospital A still worked on the pilot unit at the time of the interview. One senior
14 physician was not working on the pilot unit, but was responsible for instructing the residents on the
15 new BPMH process and was therefore selected to be interviewed. Participants were recruited by the
16 local study coordinator. Written informed consent was obtained from all participants prior to the
17 interview.

18 Data collection

19 The interview guide (see appendix 1) was developed and iterated by the SPS programme team. The
20 guide contained several thematic sections. Participants were first invited to describe their own role, as
21 well as the role of other health care professionals in obtaining a BPMH. They were then asked to
22 evaluate their collaboration with the other health care professionals and whether they had noticed any
23 positive or negative changes or implications for their daily practice since implementation of the new
24 process. Respondents were also asked to comment on the advantages and disadvantages of
25 involving pharmacy technicians in obtaining a BPMH. In the last section, which was not included in the
26 present analysis, participants were asked about the perceived benefits of a BPMH on medication
27 safety, the impact on patients and general suggestions for improving implementation of the new
28 processes. For each section, various sub-questions and prompts were included.

29 The personal interviews were conducted by LF (physician, project lead for the *progress!* programme)
30 and AN (social scientist). ChZ (nurse and social scientist) was present in three of the interviews to take
31 notes. Both interviewers trained in interviewing techniques beforehand. The interviews were
32 conducted face-to-face at the respective hospital and lasted between 30 and 40 minutes each. With
33 the exception of the participant and the researchers, no one else was present during the interview.
34 The interviewers introduced themselves and reiterated the background and aims of the study before
35 the interview. Handwritten notes were taken during the interview. The interviews were audio-taped and

1 transcribed verbatim by a professional transcriptionist. No repeat interviews were conducted.

2 Transcripts were not returned to participants for comment.

3 **Data analysis**

4 All analysis was performed by using the software ATLAS.ti 7. A conventional qualitative content
5 analysis approach was applied (31;32). The data was analysed by AN and ChZ. In a first step, both
6 researchers each read three randomly selected transcripts. They first applied an inductive approach of
7 data coding, taking notes on recurring topics or concepts that emerged from the interviews. Based on
8 this, both researchers developed a first set of codes. These two sets were then compared and merged
9 into one coding structure. The code structure was completed by comparing it to the interview guide. In
10 a next step, both researchers independently applied the new code structure to three more transcripts.
11 The code structure was then discussed and revised anew, as new codes were added and some were
12 removed. This iterative process continued until each of the researchers had coded one half of the
13 transcripts. The code structure was reflected, discussed and finalized together with DS (senior
14 researcher) and transcripts were recoded accordingly. To increase reliability, AN and ChZ jointly
15 applied the finalized code structure to the three initial transcripts. Following this, each of the
16 researchers independently coded the second half of the transcripts. The final coding tree consisted of
17 the following main categories: "tasks" (in BPMH process), "impact on own work", "interprofessional
18 collaboration", "evaluation of the pharmacy technician's involvement", and "evaluation of current
19 processes". Subcategories were developed for a more differentiated organisation of the data content.
20 Through code by code comparison, discrepancies were identified, reviewed together and resolved.
21 These intensive discussions also allowed the two coders to reflect upon the personal assumptions and
22 preconceptions that they may have applied to the interviews. Data was organised into major themes
23 relevant to the research question and quotes were analysed accordingly. Final results were discussed
24 in a joint session with all four authors. Findings were not discussed with participants. Quotations were
25 translated from German to English for this publication by the authors.

26 **Patient and public involvement**

27 Patients or public were not involved in any stages of this study.

28 **Results**

29 Two major themes emerged to be pertinent to the research question: the impact of the pharmacy
30 technicians' new role on the daily work of all involved health care professionals and its impact on the
31 interprofessional collaboration.

32 **Impact on the daily work**

33 The pharmacy technicians' new role had impacts on the daily work of each professional group. We
34 report the results from the perspective of each of the groups interviewed.

1
2
3 1 *Perspective of pharmacy technicians*

4
5 2 The new BPMH process had positive and negative impacts on the daily work of pharmacy technicians.
6 3 A majority of them mentioned that their new tasks were interesting or enriching and that they made
7 4 their day-to-day operations more varied.

8
9
10 5 *“For us there is a lot of variety and I like to interact with people, so in this regard I also find it*
11 6 *adds value to me and to my profession.”* Pharmacy technician 4

12
13 7 By conducting structured patient interviews, pharmacy technicians work with patients in a much closer
14 8 way than they did before. Throughout the interviews it became clear that, unlike nurses or physicians,
15 9 pharmacy technicians are not much used to, nor specifically trained for direct patient interaction. Most
16 10 participants reported enjoying the new contact with patients, however, they also mentioned that it had
17 11 required them to learn new ways on how to interact with patients (e.g. using disinfectant before
18 12 greeting the patient) and how to handle difficult or unexpected situations (e.g. when patients are
19 13 unwilling or unable to answer questions).

20
21
22
23 14 *“You always have to be very careful. Some try to tell you about their entire life. How do you*
24 15 *interrupt, without insulting the patient, but so that you know enough? This is difficult at times.”*
25 16 Pharmacy technician 4

26
27
28 17 In hospital A, where pharmacy technicians obtained the BPMH from elective as well as emergency
29 18 patients, the elective patients were interviewed in a separate booth in the main lobby after registering
30 19 in the hospital and before being admitted to the ward, whereas emergency patients were interviewed
31 20 in their ward rooms. The pharmacy technicians in this hospital enjoyed interviewing patients entering
32 21 for elective treatments, but did not feel at ease interviewing patients on the ward.

33
34
35 22 *“I don’t find it interesting to go to the ward and into the room. I don’t like that too much.”*
36 23 Pharmacy technician 3

37
38
39 24 One pharmacy technician explained that she chose her profession in order to keep a certain distance
40 25 to the clients. She didn’t consider herself to be sufficiently trained to adequately handle difficult
41 26 situations.

42
43
44 27 *“And I feel, for me, as a pharmacy technician you enjoy the contact with clients, but not if it’s*
45 28 *too close. And in the patient room it is different, compared to when the patient is here [in the*
46 29 *admission booth]. Here you still have a certain distance. And yes, sometimes I find it difficult*
47 30 *upstairs [on the ward], well, depending on the patient you have, because we weren’t trained or*
48 31 *prepared for something like that. [...] If you then really have to interview a patient who’s in*
49 32 *serious pain [...], then I don’t feel at ease with him.”* Pharmacy technician 2

1 Pharmacy technicians in hospital B did not mention this issue of being too close to the patients.
2 However, they only interviewed patients on the ward and therefore did not have a similar opportunity
3 to compare the different situations.

4 Lastly, the new tasks of pharmacy technicians had a significant impact on the planning of their day-to-
5 day operations. The time required for obtaining a BPMH had to be fit in within their other daily duties.
6 In hospital A, this was perceived as burdensome and stressful by some.

7 *“It extremely influences and impairs the daily operations. [...] I manage the medicine stock on
8 the intensive care unit. I’m there and then I’m called, ‘someone is here’, then I have to leave
9 [the ICU] and come here. I cannot plan my daily operations anymore. They are interrupted or
10 are falling short. The medication history requires a lot of time.”* Pharmacy technician 3

11 *“It is just difficult in our current situation. You have too little resources, you notice, you have to,
12 or you can, or you should do this as well, and as precisely as possible. [...] and then you make
13 some further inquiries and sometimes it really takes a lot of time. Sometimes not, sometimes it
14 does. And I notice, sometimes this becomes a burden.”* Pharmacy technician 1

15 In hospital B, pharmacy technicians also mentioned challenges with integrating the BPMH into their
16 daily routine. However, they also mentioned that they have the option of not obtaining a BPMH if there
17 is too much conflict with their other tasks.

18 *“When it gets really bad, you have to say, today we can’t do it. But otherwise, I don’t feel that
19 stressed because of it. It already happened that I had three or four patients to interview. I
20 arrive [on the ward], but then one is being seen by the doctor, the second is having
21 physiotherapy, the third is in an examination. In the end I have four patients and I would have
22 had the time but could not interview anyone. This has happened before.”* Pharmacy technician
23 4

24 *Perspective of pharmacists*

25 Pharmacists in both hospitals reported an increased workload.

26 *“It certainly has gotten more laborious. You have to think about it more, that you have to do it
27 [...] and then the next day we have to check everything, this takes a lot of time.”* Pharmacist 1

28 *“Yes, it is additional, something you do as well.”* Pharmacist 2

29 As supervisors, pharmacists coach and advise pharmacy technicians before and after the patient
30 interviews, for example on how to interact with patients or how to better understand the individual
31 medication in relation to the diagnoses, as illustrated by the following quote:

1
2
3 1 „They are experiencing so much through the interaction with the patients that I try to meet
4 2 them there too, in order to discuss their experiences, to talk about what the patient told them
5 3 [...] On the other hand also to give them explanations about why he takes [a medication].”
6 4 Pharmacist 2

8
9 5 In hospital A, interview partners explained that an additional check of the preadmission medication list
10 6 by pharmacists was introduced directly after the pharmacy technicians had obtained a BPMH and
11 7 before sending it to the physicians. Pharmacists control the plausibility and accuracy of the recorded
12 8 information, for example by taking into account patients' diagnoses. This check was not intended in
13 9 the original design of the BPMH process, but was introduced after pharmacists had received feedback
14 10 from physician residents that in some cases pharmacy technicians hadn't recognised the relevance of
15 11 certain information concerning a patient's medication in relation to his diagnoses. Thus, they hadn't
16 12 forwarded important information immediately to the physician.

18
19 13 “We received one or two feedbacks that the pharmacy technicians didn't record something
20 14 that was important. Somehow, marcumar®, an anticoagulant, had been discontinued some
21 15 days before and she had written it down in the comments. And for the physician it is essential
22 16 to know that [the patient] had it. [...] A physician would have noted it at the very top. But a
23 17 pharmacy technician has her list and her interview guide that she goes through, and she may
24 18 not be aware for all the medications how important they are and how they match with a
25 19 diagnosis. [...] We should have noticed it. From there on, we looked over it before it is sent to
26 20 the physician.” Pharmacist 1

28
29 21 Finally, in both hospitals, pharmacists also conduct the final step of medication reconciliation at
30 22 admission. Once the patient's preadmission medication list is established by pharmacy technicians,
31 23 pharmacists compare that list with the admission orders and review the medication orders for potential
32 24 drug-drug interactions.

34
35 25 “And [the pharmacists] also looked at it again and gave us feedback on interactions, or that
36 26 they cannot find a correct diagnosis for this and that medication.” Physician resident 1

38 28 *Perspective of physicians*

40
41 29 The impact of the BPMH obtained by pharmacy technicians on the daily work of physicians was
42 30 experienced differently by the respondents of the two hospitals. In hospital A, physicians used the
43 31 preadmission medication list of the pharmacy technicians in order to write their admission orders.
44 32 Hence, their work built on the BPMH previously obtained by pharmacy technicians. They noted that
45 33 involving the pharmacy technicians relieved them of certain time-consuming administrative duties.

47
48 34 “The administrative burden [of our work] was clearly reduced.” Physician resident 1

1
2
3 1 „And now, everything is already documented and a tedious part of our work is already done.“

4 2 Physician resident 2

5
6 3 In addition, physician residents in hospital A stated that the multi-staged processes led to a more
7 4 systematic and thorough assessment of a patient's medication. They also expressed comfort in the
8 5 thought that there was someone else looking at the patient's medication.

9
10 6 *“I think, what is good about it, is that I know that one of the pharmacists will have a look at it,*
11 7 *that there certainly is a better control of the medication in general. If there are things that need*
12 8 *to be changed. This is certainly something that helps.”* Physician resident 3

13
14 9 In hospital B, at the start of the project, physician residents were trained to obtain a more complete
15 10 medication history compared to the previous status quo, and to document it in a new, more structured
16 11 electronic form. In this hospital, the BPMH obtained by pharmacy technicians and pharmacists was
17 12 implemented in complement, rather than in substitution of the medication history obtained by
18 13 physicians. The physician residents interviewed did not report any noticeable change to their daily
19 14 work since pharmacy technicians were involved in obtaining a BPMH. Rather, one of them stated that:

20 15 *„We don't rely on the work of pharmacists or pharmacy technicians. We're trying to obtain a*
21 16 *best possible medication history ourselves.”* Physician resident 4

22
23
24 17 *Perspective of nurses*

25 18 In both hospitals, nursing staff was only peripherally involved in obtaining a BPMH. However, all
26 19 nurses reported experiencing positive impacts on their daily work since implementation of the new
27 20 BPMH process. Since both hospitals implemented various elements at once (e.g. new electronic form,
28 21 new process for hospital discharge), for nursing staff it was not possible to clearly discern whether it
29 22 was the work of pharmacy technicians or other elements that contributed to this impact.
30 23 Notwithstanding, they all stated that medication orders had improved in clarity and completeness.

31 24 *“Prior to this, we often experienced that we came in the morning, distributed the pills and then*
32 25 *it was said [by the patients] ‘this one is missing and that one is missing’. Then we went to ask*
33 26 *[the doctors]: ‘Yes, that's not important.’ Or: ‘Oh, I didn't know that.’ Only those from the*
34 27 *general practitioner [were recorded], but something that [the patient] took himself wasn't*
35 28 *recorded.”* Nurse 5

36 29 With preadmission medication recorded more thoroughly, the nurses found that they spent less time
37 30 asking physicians about incomplete or imprecise orders as well as discussing missing medication with
38 31 patients. Furthermore, one nurse pointed out that knowing that someone else would record all
39 32 preadmission medication relieved nursing staff from the perceived responsibility of ensuring that the
40 33 patient received all his necessary medication.

1
2
3 1 *"I think it is really a relief for us. Even when patients come in late in the evening or during the*
4 2 *night, you don't have to think too much about their medications, rather you know someone will*
5 3 *come who conducts an interview with them and records everything."* Nurse 4
6

7 4 **Impact on interprofessional collaboration**

8
9 5 We were particularly interested in analysing how the involvement of pharmacy technicians would affect
10 6 the existing structures and team dynamics between the professional groups. The following central
11 7 themes emerged from the interviews.

12 8 *Pharmacy technicians act outside of the care team*

13 9 With the new BPMH process, pharmacy technicians became an additional professional group that
14 10 requires access to the patient. In spite of this, the interviews suggest that the pharmacy technicians
15 11 did not become part of the larger care team, but rather assume an outside role. Pharmacy technicians
16 12 reported having to work their way around other health care professionals' schedules and spending a
17 13 lot of time coordinating with nursing staff to find a good time to conduct the interview.

18 14 *"What can often be a little bit of a problem, maybe there's the nutritionist with the patient, then*
19 15 *the physiotherapist comes in, and then we come in as well. Then the patient gets annoyed at*
20 16 *some point. So you have to watch this a little bit, then I'll go interview the other two [patients]*
21 17 *first and maybe only in the afternoon I'll go see this patient. They are less cooperative, when*
22 18 *the physiotherapist is there, she doesn't show consideration for me. They certainly also have*
23 19 *their schedule."* Pharmacy technician 4

24 20 Other health care workers don't pay a lot of attention to the pharmacy technicians. This is also
25 21 illustrated by the fact that some physicians were not able to clearly distinguish between pharmacy
26 22 technicians and pharmacists in the interviews. Some nurses reported that the presence of pharmacy
27 23 technicians was hardly noticed on the wards.

28 24 *"Well, we don't actually see them that much. They sneak upstairs quickly [...] and then they do*
29 25 *it, actually calmly and quietly, well, they rarely come to ask us anything and then they leave*
30 26 *again."* Nurse 2

31 27 *"The pharmacy technicians are not really part of our team. They come as if they were guests."*
32 28 Senior physician 2

33 29 Some pharmacy technicians also described themselves as "someone from the outside". They
34 30 attributed positive characteristics to this role, stating that this way they could act as a link between the
35 31 patients and the physicians and gather more information from a patient.

36 32 *"I see myself as an intermediary, somehow. I'm not anyone's competitor, but I'm coming from*
37 33 *the outside. I can also see this with the patients. They notice 'aha, someone is coming, she's*

1
2
3 1 *not part of the nursing staff, she's coming from a different place in the hospital.' I notice that*
4 2 *sometimes they tell me almost more [...].*" Pharmacy technician 4

5
6 3 *No direct interaction between pharmacy technicians and physicians*

7
8 4 Pharmacy technicians and physicians reported that there is almost no direct interaction between them.
9 5 In each hospital, one of the pharmacy technicians said that she considers herself a "link" or an
10 6 "intermediary" between the physician and the patient. However, the interviews suggest that the way
11 7 the BPMH processes were defined in both hospitals does not allow pharmacy technicians to fulfil such
12 8 a role. Rather, information flows in one direction only and passes the pharmacists as another
13 9 checkpoint before reaching the physician. Pharmacy technicians do not know what happens to the
14 10 information collected from the patient after it has been transmitted from the pharmacists to the
15 11 physicians and they receive little feedback from the physicians on how their work is perceived.

16 12 *"I can't say much about [the role of the physicians], because it's all done by our pharmacists. I*
17 13 *just hand them over the sheet. I tell the pharmacist: "[...] 'here and here you will probably have*
18 14 *to take a closer look' or 'here I'm not quite sure', but I hardly ever see a physician."* Pharmacy
19 15 technician 4

20 16 *"On the ward, I do not have any contact with the physicians."* Pharmacy technician 3

21 17 *Strengthened collaboration between pharmacists and physicians*

22 18 Pharmacists and physicians both reported that their collaboration had intensified since the new
23 19 medication reconciliation processes were introduced. Because they control the work of pharmacy
24 20 technicians and reconcile preadmission lists with admission orders, pharmacists were also provided
25 21 with an opportunity to analyse patients' individual medication and provide feedback on interactions.
26 22 Physicians in both hospitals found this feedback to be helpful for their work. Pharmacists in turn
27 23 considered it of high value to be more involved in the medication process and to better know and
28 24 interact with physicians.

29 25 *"[...] it sometimes happens that the residents approach me about something in the hallway or*
30 26 *that they ask questions or call me. It is not just because it's interesting for me, but I also think*
31 27 *that it's better for medication safety when one is less inhibited to ask someone, because ... If*
32 28 *one asks everything and doesn't hesitate to ask because one doesn't want to disturb."*
33 29 Pharmacist 1

34 30 **Discussion**

35 31 Our study found that pharmacy technicians who obtain a BPMH generally enjoy and benefit from their
36 32 new tasks. Their daily work becomes more varied and interviewing elective patients in particular
37 33 seems to be a welcoming change. However, these tasks also come with challenges for pharmacy
38 34 technicians. Being responsible for conducting the BPMH makes their planning of day-to-day duties
39 35 more difficult, since the daily number of admissions is not predictable and the pharmacy technicians

1 have to work their way around the schedules of other health care professionals. Direct patient
2 interaction can be another challenge for pharmacy technicians, since they are usually not used to, nor
3 trained to be in direct contact with seriously ill patients. Simple questions such as whether or not to
4 shake a patient's hand illustrate the dimension of uncertainty for pharmacy technicians. This finding
5 underlines the importance of a dedicated training programme for pharmacy technicians on how to
6 obtain a BPMH which includes practical elements such as role-playing exercises, as stated in other
7 studies (25;33). Our findings suggest that for some pharmacy technicians, direct patient interaction
8 may be too close and that not all pharmacy technicians may be equally willing and apt to deal with
9 these challenges. This is an aspect that should be considered when recruiting pharmacy technicians
10 for these tasks. Choosing pharmacy technicians who demonstrate good interpersonal, communication
11 and problem-solving skills has been identified as one of the best practices when engaging pharmacy
12 technicians in medication reconciliation efforts (25). The situation for pharmacy technicians in our
13 study is different when they are interviewing elective patients at admission, who are generally stable
14 and not in urgent need for medical care. In this case, the neutral space of the admission booth may
15 convey a sense of distance and better control of the situation. As for their place within the team, we
16 found that pharmacy technicians did not become members of the treatment team. They have no
17 proper position awarded in the pre-existing spatial and social structures on the ward, but rather act on
18 a preliminary administrative level.

19 Our findings indicate a benefit for the daily work of nurses as well as for the integration of pharmacists
20 in the medication process. However, due to the complexity of the processes it is not clear to what
21 extent these implications are linked to the BPMH being obtained by pharmacy technicians, and to what
22 extent they are a result of the other elements introduced as part of the programme.

23 The findings suggest that involving pharmacy technicians in obtaining a BPMH can also have positive
24 effects on the daily work of physicians. In particular, physician residents benefit from the delegation of
25 administrative tasks to pharmacy technicians (such as collecting additional sources for the medication
26 history). However, we also found that certain tasks were still performed by pharmacy technicians as
27 well as physicians. In line with other research (34), our analysis indicates that physicians may be
28 reluctant to hand off tasks to other professional groups, because they consider obtaining a medication
29 history a cornerstone for deciding on the treatment regime. Boockvar et al. found that medication
30 reconciliation is challenging for physicians because it competes for their time with other tasks and that
31 they prioritise more urgent care responsibilities. The authors thus suggest that efficacy and perceived
32 capability regarding the completion of medication reconciliation might be improved by dividing the task
33 into parts more easily manageable by individual team members (35).

34 The results also demonstrate that there was a shift of workload from physician residents and nurses to
35 pharmacy technicians and pharmacists. In both hospitals, pharmacy technicians and pharmacists
36 performed the BPMH tasks in addition to their other daily duties. As a consequence, they had to
37 interrupt other tasks or at times chose not to obtain a BPMH (hospital B). This raises safety concerns,

1 since shifting the attention away from an original task and returning back to it later can increase the
2 likelihood of errors (36). In hospital A, more pharmaceutical staff was eventually hired to better
3 redistribute some of the workload. This underlines the fact that without adding additional human
4 resources, such a model can hardly be sustainable.

5 We also found that in both hospitals, engaging pharmacy technicians in obtaining a BPMH was, at the
6 time of the interviews, not possible without the substantial involvement of pharmacists. Pharmacists
7 coached and supported pharmacy technicians and, in one hospital, controlled their work before it was
8 transmitted to the physicians, thus becoming important intermediaries. This implies that the efficiency
9 gained by delegating administrative tasks from physicians to pharmacy technicians may be lost if
10 pharmacists assume a similarly important role in the new process. As other studies have pointed out,
11 once it is established that a pharmacy technician has enough practice to collect an accurate
12 preadmission medication list, removing routine pharmacist verification could improve efficiency in the
13 process (27).

14 It is also important to note that the need for the additional check by pharmacists may be due to
15 different expectations as to what is included in the process of obtaining a “best possible medication
16 history”. Obtaining a BPMH means to compile an accurate and complete list of all preadmission
17 medications of a patient. It does not include any sort of clinical analysis of the preadmission
18 medication. If pharmacy technicians are to be involved in obtaining a BMPH, this distinction needs to
19 be clear to all health care professionals involved, because it clearly delimits which tasks pharmacy
20 technicians can assume and which tasks need to be performed by other health care professionals.

21 Lastly, transferring the task of obtaining a best possible medication history from physicians to another
22 professional group adds to the fragmentation of the process. In our study, pharmacy technicians did
23 not become part of the wider care team, there was no direct communication between the pharmacy
24 technicians and the physicians, and pharmacists were added to the process as a third group. This
25 raises patient safety concerns, because it creates new interfaces prone to errors and information loss.

26 In summary, we found that pharmacy technicians are willing and able to take over responsibilities in
27 obtaining a BPMH. However, their engagement can also generate new risks and inefficiencies,
28 especially if new responsibilities are added on top of their other daily duties, if tasks are not clearly
29 delimited or if a pharmacist’s active involvement is required to transmit relevant information from the
30 pharmacy technicians to the physicians. These issues need to be addressed in order for this model to
31 really be a safe and cost-effective alternative to more traditional ways for obtaining a BPMH.

32 **Strengths and limitations**

33 With this study we shed light on the implications of a specific interprofessional model for obtaining a
34 best possible medication history. The sampling of medical, pharmaceutical and nursing staff allowed
35 an in-depth exploration of the perception of all health care professionals directly affected by such a
36 new model. However, participants were recruited from two hospitals only. Each hospital designed its

1 own process adapted to its local structures and culture. The understanding of the new BPMH process
2 may have varied among the interviewed staff. Furthermore, in each hospital the implementation of the
3 BPMH was accompanied by the introduction of other tools and processes that had a possible impact
4 on the perceptions and answers of the participants. Results therefore need to be interpreted in the
5 local context and findings may not be generalisable to other institutions. Transferability of our findings
6 to other settings and countries may also be limited, because prerequisites and traditional education for
7 pharmacy technicians are likely to vary. Regulatory and cultural factors may determine both choice
8 and design of an intervention that aims to involve pharmacy technicians in medication reconciliation,
9 and how successfully such an intervention can be implemented. Nevertheless, because the main
10 themes emerged across both hospitals and align with the results from other studies, we believe that
11 our findings can be relevant to other hospitals that consider implementing such a model. Since the
12 new process was tested in only two hospital pilot units, the number of staff members eligible to
13 participate was very limited. Hence, it is possible that more themes would have emerged if more staff
14 members could have been interviewed. Staff members were selected for interviews by local study
15 coordinators. We have no knowledge of how many staff members declined to participate. Due to the
16 small number of staff eligible for interview, it is unlikely that many refused. Yet, we cannot exclude the
17 possibility that highly motivated individuals were more likely to be selected for the interviews than
18 colleagues with less interest in the new process. In this case, the interviewees in our sample may have
19 conveyed a more positive view about the effects of the new BPMH process on their roles and daily
20 work. Finally, it is likely that such a new interprofessional model requires some time in order to
21 become established and efficient in the daily routine. Follow-up interviews could have shed more light
22 upon the long-term effects of the new model.

23 **Conclusion**

24 To our knowledge this is the first qualitative study that specifically explored the implications on
25 professional roles and collaboration of transferring certain tasks of obtaining a BPMH to pharmacy
26 technicians. We derive some important implications for practice. First, it is crucial that pharmacy
27 technicians receive sufficient time and training to perform their new tasks. Furthermore, the scope of
28 the tasks assumed by pharmacy technicians needs to be clearly defined and fully integrated into
29 existing processes, so that work is not duplicated. Pharmacy technicians can be involved in
30 establishing a complete list of preadmission medication, however, the expertise of pharmacists or
31 physicians is required to analyse potential clinical problems regarding the patient's medication.
32 Ultimately, it remains the physician's responsibility to assess whether treatment is appropriate. Due to
33 a fragmentation of the process it is essential that communication and information flow at the interfaces
34 between professional groups is well organised. Institutions considering this model need to account for
35 sufficient resources for training and task completion and be attentive to the implications which the
36 involvement of a further professional group has on teamwork dynamics and workflow design. More
37 research is needed to understand if and under which circumstances such a model can be efficient and
38 contribute to higher medication safety.

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Ethics approval: This study was conducted as part of a quality improvement programme. The quality improvement programme and all data collected obtained a Declaration of no objection from the Ethics Committee of the Canton of Zurich.

Data sharing statement: No additional data are available.

Figure legend:

Figure 1: Quality standards for obtaining a best possible medication history (BPMH)

Figure 2: Processes defined to obtain the best possible medication history

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1 Table 1

Table 1: Interviewees

Profession	Hospital A	Hospital B	Total
Pharmacy technician	3	3	6
(Clinical) pharmacist	1	1	2
Resident physician	3	2	5
Senior physician	1	1	2
Nurse	3	3	6
Gender			
Male	1	3	4
Female	10	7	17

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For peer review only

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13 **Figure 1: Quality standards for obtaining a best possible**
14 **medication history (BPMH) (16)**
15

- 16 • Use at least two reliable sources (e.g. medication list from the
17 general practitioner, patient's medication list, drug packages).
18 Whenever possible, one of the sources should be a systematic
19 patient interview conducted with a structured guide.
- 20 • Record all current medications (incl. OTC, vitamins, herbals,
21 "as needed" etc.).
- 22 • Make preadmission medication list accessible to the whole
23 healthcare team by filing it in a central place.
- 24 • Obtain the BPMH within 24 hours after admission
- 25 • Define roles and responsibilities for obtaining the BPMH and
26 train accordingly.
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41 150x150mm (300 x 300 DPI)



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9 **Figure 2: Processes defined to obtain a best possible**
10 **medication history**

11 ***Hospital A:***

12 BPMH is obtained for all elective patients admitted to the general internal
13 medicine department and for patients admitted between 12 midnight and
14 5 am from the emergency department to the general internal medicine
15 department (approx. 30 admissions/month). Pharmacy technicians con-
16 duct systematic patient interviews using available information sources and
17 record the preadmission medication list on a special form in the electronic
18 patient chart. Physicians receive the list and document further action for
19 each medication (e.g. stop, continue, modify). They then order the
20 admission medications. Subsequently, clinical pharmacists check the
21 admission orders and provide feedback to the physicians on any
22 discrepancies identified.

23 ***Hospital B:***

24 BPMH is obtained for all patients aged 40 to 85 years admitted through
25 the emergency department to one general internal medicine ward (approx.
26 40-60 admissions/month). At admission, a medication history is obtained
27 by physician residents. To this end, a new electronic form was introduced
28 where information on preadmission medication is recorded. Physician
29 residents then write the admission orders. Once patients are transferred
30 to the ward, pharmacy technicians conduct a structured patient interview
31 to systematically capture all preadmission medications and record this
32 information on a paper form. If necessary, other sources are consulted
33 for additional information. Pharmacists then compare the preadmission
34 medication to the medication orders, check for potential drug-drug inter-
35 actions, control doses and provide feedback to the physicians. The paper
36 form is filed in the patient record.
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41 150x150mm (300 x 300 DPI)



Appendix 1: Interview Guide

1. Please introduce yourself: what is your function and how long have you been working in this unit?
2. Were you informed about the new process to obtain a BPMH? How and by whom?
3. Could you please describe in your own words what a best possible or systematic medication history is?
4. *Nursing staff only*: Do you know where the preadmission medications are documented? If yes, do you work with this list? How useful is it for your work?
5. What is your role (tasks, responsibility, competency) in obtaining a best possible medication history?
6. What is, in your view, the role of the other professional groups (physicians, nurses, pharmaceutical staff)?
7. On a scale from 1 (very bad) to 6 (very good), how would you rate the current collaboration with the other professional groups in regard to obtaining a BPMH? Please explain.
8. Do you notice a difference compared to before? Has the collaboration changed since the introduction of the new processes (positively or negatively)? If yes, what exactly is different? How do you see this change?
9. In your opinion, has it proved to be of value that pharmacy technicians obtain a BPMH? Please explain. What advantages or disadvantages do you see with this model?
10. Has your own daily work changed since the introduction of a best possible medication history? If yes, what is different? Can you give an example?
11. *Physicians only*: In order for you to write a good admission order - do you think the additional effort required for a BPMH is worth the additional benefit? Please explain.
12. On a scale from 1 (not important at all) to 6 (very important), in your opinion how important is the best possible medication history to reduce medication errors in your hospital? Please explain.
13. What kind of medication errors can be avoided with obtaining a best possible medication history? Can you give an example of an error that was avoided?
14. In your experience, how do patients react when they are being interviewed about their preadmission medication?
15. Did you experience a change in their behavior since the introduction of the structured patient interview?
16. If you had to narrow it down, for which patient group would you consider the BPMH to be especially beneficial?
17. On a scale from 1 (not smooth at all) to 6 (very smooth), how smoothly is the new BPMH process running in your hospital?
18. Where do you see room for improvement?
19. Would you recommend extending the new processes to other units? Why / why not?
20. Do you have any additional comments?

Translated from German original. Questions analyzed for this study are highlighted.

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Page numbers refer to the revised MS copy without track changes.

Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

Developed from:

Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

No. Item	Guide questions/description	Reported on page #
Domain 1: Research team and reflexivity		
<i>Personal Characteristics</i>		
1. Interviewer/facilitator	Which author/s conducted the interview or focus group?	p. 5 (data collection) p.15 (authors statement)
2. Credentials	What were the researcher's credentials? <i>E.g. PhD, MD</i>	p.1
3. Occupation	What was their occupation at the time of the study?	p.1
4. Gender	Was the researcher male or female?	p. 5 (data collection)
5. Experience and training	What experience or training did the researcher have?	p. 5 (data collection)
<i>Relationship with participants</i>		
6. Relationship established	Was a relationship established prior to study commencement?	p. 5 (sample) p. 5 (data collection)
7. Participant knowledge of the interviewer	What did the participants know about the researcher? <i>e.g. personal goals, reasons for doing the research</i>	p. 5 (data collection)
8. Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? <i>e.g. Bias, assumptions, reasons and interests in the research topic</i>	p. 5 (data collection)
Domain 2: study design		
<i>Theoretical framework</i>		
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? <i>e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis</i>	p. 6 (data analysis)
<i>Participant selection</i>		
10. Sampling	How were participants selected? <i>e.g. purposive, convenience, consecutive, snowball</i>	p. 5 (sample) p. 15 (limitations)
11. Method of approach	How were participants approached? <i>e.g. face-to-face, telephone, mail, email</i>	p. 5 (sample) p. 15 (limitations)
12. Sample size	How many participants were in the study?	p. 5 (sample) table 1
13. Non-participation	How many people refused to participate or dropped out? Reasons?	p. 15 (limitations)
<i>Setting</i>		
14. Setting of data collection	Where was the data collected? <i>e.g. home, clinic, workplace</i>	p. 5 (data collection)
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	p. 5 (data collection)
16. Description of sample	What are the important characteristics of the	p. 5 (sample)

	sample? <i>e.g. demographic data, date</i>	table 1
<i>Data collection</i>		
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	p. 5 (data collection) appendix 1
18. Repeat interviews	Were repeat interviews carried out? If yes, how many?	p. 6 (data collection)
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	p. 5 (data collection)
20. Field notes	Were field notes made during and/or after the interview or focus group?	p. 5 (data collection)
21. Duration	What was the duration of the interviews or focus group?	p. 5 (data collection)
22. Data saturation	Was data saturation discussed?	p. 15 (limitations)
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	p. 6 (data collection)
Domain 3: analysis and findings		
<i>Data analysis</i>		
24. Number of data coders	How many data coders coded the data?	p. 6 (data analysis)
25. Description of the coding tree	Did authors provide a description of the coding tree?	p. 6 (data analysis)
26. Derivation of themes	Were themes identified in advance or derived from the data?	p. 6 (data analysis)
27. Software	What software, if applicable, was used to manage the data?	p. 6 (data analysis)
28. Participant checking	Did participants provide feedback on the findings?	p. 6 (data analysis)
<i>Reporting</i>		
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? <i>e.g. participant number</i>	p. 6-12 (results)
30. Data and findings consistent	Was there consistency between the data presented and the findings?	p.12-14 (discussion)
31. Clarity of major themes	Were major themes clearly presented in the findings?	p.6 (results) p.6-12 (interview quotes) p 12-14 (discussion)
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	p.6-12 (results)