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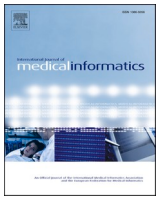

General Practitioners' needs and wishes for clinical decision support Systems: A focus group study

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ABSTRACT

Background: Shared decision making (SDM) can be beneficial for patients, healthcare professionals, but is often not applied in practice. A clinical decision support system (CDSS) can facilitate SDM. However, CDSS acceptance rates are rather low. One context in which SDM between a general practitioner (GP) and patient regarding medication can be of great value is older patients' medication-related fall risk. Applying user-centered design to optimally tailor the CDSS to the needs and wishes of GPs can help overcome the low CDSS-acceptance rates. The current study aims to learn GPs' needs and wishes for a CDSS focused on diminishing medication-related fall risk.
Materials and Methods: Participants were recruited through the Amsterdam Academic Network of General Practice and were sent a web-lecture as preparation. Three online focus groups with a total of 13 GPs were performed and were led by two moderators. The focus groups were recorded and transcribed verbatim. Transcripts were analyzed using Atlas.ti.
Results: GPs' views on the workflow, risk presentation and advice of the system were elicited. The fit with the GPs' *workflow* was elaborately discussed, for instance how the CDSS could support the selection of patients at risk. GPs articulated a strong preference for a visual *risk presentation*, in the form of a gradient scale ranging from bright green to dark red. Furthermore, they preferred receiving both medication-related and non-medication-related *advice*, which should be presented on request.
Discussion: The findings provide a valuable insight into GPs' needs and wishes for a CDSS focused on medication-related fall prevention. This will inform the design of a first prototype of the CDSS which will be subjected to usability tests. The findings of this study can also be used to support the development of medication-related CDSSs in a broader context.

1. Introduction

Shared decision making (SDM) can result in various benefits for patients, healthcare professionals and the healthcare system, such as increased patient knowledge, less anxiety, better health outcomes and a reduction of costs [1]. However, despite its great potential, SDM is often not applied in practice [2]. SDM is a process during which a healthcare related decision is made by the patient and healthcare professional together [3]. Healthcare professionals explore what the patient's goals are, discuss the best available evidence and treatment options, explain the (dis)advantages, and together with the patient come to a decision [4]. A clinical decision support system (CDSS) has the potential to facilitate SDM in practice [5]. A CDSS is a system that links patient health data with health knowledge to guide the clinical decision making process [6]. However, it has also been established that CDSS acceptance rates can be rather low due to many barriers perceived by the clinician [7]. Clinicians are not always satisfied with CDSSs, in part because of poor consideration of their preferences and requirements during the

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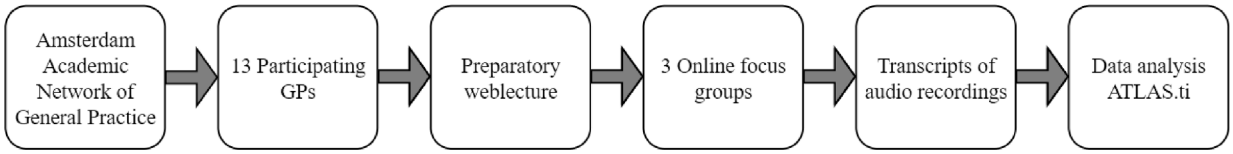

Fig. 1. Visualization of the study's procedure.

development process of such systems [8].

One context in which SDM is very relevant and a CDSS could be of substantial value is preventing medication-related falls among older patients. Falls have become one of the leading health issues and the leading cause of traumatic injury among citizens aged 65 and older [9,10]. In the Netherlands, every 4 min an older person is presented to the emergency department because of a fall [11]. Without fall prevention measures, the number of falls among older people will continue to increase [12]. Falls can cause a downward cycle in which fear causes inactivity, decreased strength and decreased balance resulting in lower quality of life [13]. Furthermore, healthcare costs will also increase, both because of the high number of falls and because of the high healthcare costs associated with severe falls [14].

Medication plays an important role in older people's fall risk [15,16]. Contrary to other risk factors for falls such as orthopedic or vestibular impairments, medication can be considered a modifiable risk factors for falls [17], and altering a patient's medication can significantly contribute to lowering the fall risk [18]. General practitioners (GPs) are used to performing medication reviews, which are an effective way to reconsider indications. However, altering the medication is a precarious process as older patients usually do take their medication for good reasons [19].

A CDSS can support the GP during the SDM process and can be used to prevent medication-related harm in patients [20]. As such, GPs can use recommendations provided by the CDSS to discuss appropriate medication decisions with the patient to lower the medication-related fall risk. Currently a CDSS focused on diminishing medication-related falls among older patients does not exist. We plan to develop such a system in order to stimulate SDM between GP and older patient regarding the medication-related fall risk. The existing body of literature contains some information on CDSSs specifically for GPs [21,22] and antecedents of its adoption in general, but much is still unknown. Existing scoping- and systematic literature reviews specific to general practice focus on diagnostic CDSSs and on their effectiveness rather than the user's acceptance of the systems [21,22]. Furthermore, it has, for instance, been well established that a fluent integration of a CDSS into the practitioner's workflow is of great importance for acceptance of the system [7,23]. However, there are few recommendations for how to accomplish this for GPs specifically. The current study provides details that aren't found yet in existing literature. Previous research also emphasized the importance of co-producing with GPs when developing a CDSS for this target group [24] and the current study aims to provide a more generalizable insight into the input of GPs when it comes to this development.

Implementing decision support in the general practice environment is challenging due to the high variability in patients and workflows, and understanding user needs can provide insight into the requirements for CDSSs in general practice on the whole. Research has shown that applying user-centered design can contribute to making CDSSs more effective [25] and will ideally help overcome the low acceptance rates. As the end users of our CDSS will be GPs, it is important to include them during the design and development process of the CDSS to make it more optimally adapted to the needs and wishes of these intended users [26]. Conducting focus groups is a suitable way to understand the needs, wants and expectations of the users. The current study uses focus groups to assess GPs' needs and wishes to inform the development of a CDSS focused on preventing medication-related falls. The implementation will take place within an existing CDSS already used by Dutch GPs called NHGdoc (for more information on NHGdoc see Appendix I).

2. Methods

2.1. Design and participants

A qualitative design was used for this study as this allows for obtaining the relevant needs and wishes of end users, needed for successful design of the CDSS. To ensure optimal trustworthiness of this qualitative study, methods and findings are reported in accordance with the Consolidated Criteria for Reporting Qualitative Research (COREQ) [27]. Thirteen GPs participated in three focus groups, after which data saturation was reached. GPs were recruited though the Amsterdam Academic Network of General Practice Amsterdam UMC in two steps. First, these GPs were emailed to explain the project and ask them to participate. As the data collection of this study took place amidst a peak in COVID-19 infections, many GPs felt overwhelmed and there was a big primary care backlog. Therefore, the response rate to this email was rather low, and a number of GPs were personally contacted by one of the authors (HW). The study was carried out between February and March 2021. The Medical Ethics Committee of the Amsterdam UMC issued a waiver for this study (W21_013 # 21.015), stating it does not fall under the Human Medical Research Law of the Netherlands. Ethical approval was then obtained by the Ethics Review Board of the Faculty of Social and Behavioral Sciences, University of Amsterdam (2021-PC-13079). Informed consent was obtained from all subjects. The procedure of this study as explained in the methods section has been visualized in Fig. 1.

2.2. Focus group sessions

Prior to the focus group sessions an eight-minute web lecture was created and shared via email with all participants as preparation for the focus group (supplementary file 1). The web lecture covered an overview of the project so that participants would be familiar with the topic of the focus group before it commenced. At the beginning of each focus group the participants were asked whether or not they had viewed the web lecture. In one focus group this was not the case for two participants and additional explanation was then given by one of the moderators. The participating GPs were asked to evaluate the web lecture with a grade between one and ten and evaluated the web lecture as useful ($M = 8$). The focus groups were conducted by two moderators (LW, KW), using a semi-structured focus group guide developed through an iterative process involving all authors. The four main topics for discussion were drawn from a systematic literature review regarding barriers and facilitators perceived by clinicians for accepting medication-related CDSSs [7] and on the team's expertise.

Each focus group started with a short introduction offered by one of the moderators and afterwards consisted of four parts. Part one covered how the system would fit best into the GPs' workflow. GPs were shown a timeline covering the entire workflow (more information on this workflow can be found in Appendix I). They discussed and adjusted it together according to their preferences and their vision on how to best fit the system into their existing workflow. Part two covered the risk presentation and focused on how the GPs preferred the personalized fall risk of the patient presented to them. Several options were shown and GPs could also express their own ideas. Part three focused on the advice

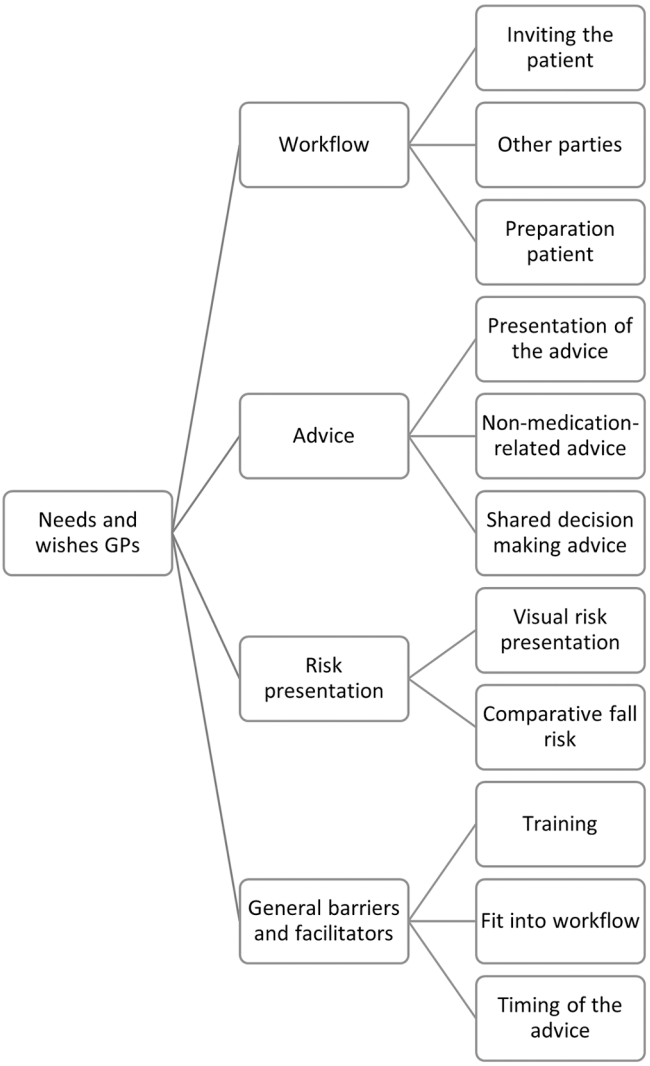

Fig. 2. Coding tree.

provided by the CDSS. GPs discussed what advice they would need and how this advice should be presented. Lastly, during part four, GPs discussed general barriers and facilitators they perceived for using the CDSS.

2.3. Data analysis

The focus group sessions were recorded and transcribed verbatim. Transcripts were uploaded and analyzed in ATLAS.ti, a software program that allows for qualitative data analysis as it can be used to attach codes to excerpts from the transcripts and subsequently organize these codes. All transcripts were coded by the first author (LW) and a subset of the data (one transcript, i.e. 33 %) was coded by a second author (GB). Coding of these authors was well aligned and any disagreement was resolved through discussion. The general inductive approach, which provides a structured set of procedures for analyzing qualitative data, was used for coding the data [28]. Firstly, the transcribed text was read closely in order to get familiar with its content and themes. Secondly, a first set of codes was created. The upper-level codes were based on the topics of the focus group guide (e.g. workflow, risk presentation) and the lower level codes were derived from the raw data. These latter codes arose from an iterative process of coding subsets of the data and recoding these subsets every time new themes and codes arose. Subsequently, the codes were organized in a hierarchical coding frame (Fig. 2). To allow for triangulation, a brief overview of the findings was shared with all participants, giving them the opportunity to comment on our interpretations. All participants approved the findings.

Table 1
Participant Characteristics.

Variable		N	%	Mean	SD
Gender	Male	7	53.8		
	Female	6	46.2		
Age				48.77	11.7
Years of experience as GP				15.85	10.68
Years of experience in current practice				11.08	3.37

3. Results

Characteristics of all 13 participating GPs can be found in Table 1. All results could be categorized in the four predefined themes of workflow, risk presentation, advice and general barriers and facilitators. To illustrate the findings, quotations are provided.

3.1. Workflow

3.1.1. Inviting the patient

The first point of discussion related to the workflow concerned how and by whom the patient is identified as having a high fall risk and subsequently invited for a consultation. All GPs indicated that they preferred the possibility to proactively generate a list of all patients at risk of falls. Originally, we envisioned that the system would send an alert to the GP whenever a high fall risk is identified, meaning the patient could visit for a different reason and the GP would get an alert about their fall risk at that point. However, the GPs indicated that this is likely to be ignored both because of alert fatigue and because they are focusing on a different problem at that moment. One participant explained:

> *"[…] you're not working on a fall risk assessment at that moment, so the question is how relevant such an alert is at that point and if you will act upon it. I can imagine that you would rather pro-actively generate a list with all alerts every once in a while […]".*

3.1.2. Role of other parties

The GPs also discussed the role of other healthcare professionals. Many practices have a general practice-based nurse specialist for elderly care and the GPs see an important assisting role for them. Non-medication-related advice, such as the importance of physical activity, can be discussed with the patient by the nurse specialist according to the participants:

> *"If medication is not an issue, then the GP wouldn't… in fact: the general practice based nurse specialist can discuss this with the patient much better.".*

Furthermore, the pharmacist should also be involved somehow according to some of the GPs. The CDSS is supposed to assist in reviewing the patient's medication. Medication reviews are already conducted on a yearly basis for patients with polypharmacy in cooperation with the pharmacist. GPs indicated that they envision a similar cooperation for a fall risk-related review of a patient's medication, as they also expect to see overlap between these two patient groups. One GP explained:

> *"I suspect that if a high fall risk is identified in my practice, based on the medication, that this will be incorporated in the yearly medication review with the pharmacist.".*

3.1.3. Preparation of the patient

The GPs considered a question prompt list (QPL) to be a useful patient preparation tool. A QPL is a list of example questions for the patient

to choose from, which might be relevant to discuss with the GP during the consultation [29]. This QPL would be presented to the patient through a patient portal after the GP invited them for a fall risk consultation. Participants also indicated that preparation by the patient should not be essential for performing the consultation, since they can never be certain that the patient will actually perform all of the required preparatory steps. This is especially relevant for the target group of this project according to the GPs. They are worried that the group of older patients is less motivated, or simply unable to perform the necessary preparations for the consultations. This could either result in unprepared patients, or in extra burden for the GP or nurse specialist because they would have to assist the patient in preparing.

> *"I think it will be interesting to see if the patient group that we're talking about here is able to use a patient portal. […] They often don't make use of the available options currently offered to them."*.

3.2. Risk presentation

3.2.1. Visual risk presentation

During the focus group, the participants were shown several options of risk presentation. The risk in our CDSS entails the percentual risk of a fall in the upcoming year. Participants discussed presenting just the percentage, adding color or using a visual risk presentation in the shape of a gradient scale or pie chart. They articulated a clear preference for a visual representation of the fall risk and preferred having the risk visualized on a gradient scale ranging from bright green (i.e. low fall risk) to dark red (i.e. high fall risk). Participants indicated that they would like to see this combined with the exact percentage and a sentence reminding them of what this number exactly entails.

> *"I actually found the third option [gradient scale] very intuitive. […] You can see that the risk is a gradual scale and don't wonder why one risk is orange and the other red."*.

3.2.2. Comparative fall risk

Another point related to the fall risk concerned comparing the personalized fall risk to a "normal" fall risk for a person from the same age group. This elicited a lot of discussion and participants were not certain whether or not this would be a desirable feature to incorporate in the CDSS. On the one hand, GPs would argue that a comparative fall risk would help them to put the personalized fall risk into perspective and to see how much room for improvement is available.

> *"It [the comparative risk] also helps you to form certain expectations… Like… This is what we want to work towards."*.

On the other hand, some participants were afraid that showing this comparative fall risk could have a demotivating effect. If a patient's fall risk is just slightly above the "normal" value, the GP might be less motivated to take action. Even though lowering the fall risk might be possible and is always desirable. One GP explained:

> *"You have to be careful not to influence the behavior towards saying 'oh… there's nothing to win here anyway'. When in fact improvement is definitely possible."*.

3.3. Advice

3.3.1. Presentation of the advice

GPs discussed how they would want the advice regarding a patient's medication to be presented to them. They indicated that they would like to see the advice separated per medicine. Furthermore, GPs discussed that they would not want to see all the full recommendations at once, as this would cause too much clutter on their screen. They preferred seeing a short sentence or the name of the medicine and only seeing the full advice after clicking on it. Lastly, participants indicated that it would be useful to be able to check off an advice once they are done with it. One participant elaborated:

> *"It would be nice to have an expand option, I think. Because then I can go through the medicines one by one. […] And also being able to check the advice if you've thought about it and made a decision."*.

3.3.2. Non-medication-related advice

The main goal of the system that will be developed is to advise the GP about the patient's fall risk increasing medicines. However, participants articulated that they want a complete picture when deciding to use a CDSS. Therefore, since medication is not the only factor related to a person's fall risk, they would like the system to include advice about non-medication-related factors as well. The previously discussed expand option would be especially important for this category of advice, as the advice presented here would generic. Scrolling through this for every single patient would cause annoyance according to the GPs.

> *"I would like the possibility to read it to be there. And yeah.. If I would have to actively close it every time that wouldn't be nice. But the option to read it should be there."*.

3.3.3. SDM advice

As explained in the introduction, SDM is an important part of the intervention. Therefore, GPs were asked if they would like the CDSS to provide advice about how to implement SDM techniques during the consultations. All GPs were very clear about not wanting the system to provide advice about this. They explained that SDM is the core of their job as a GP and that reading advice about this would likely cause annoyance. One GP said:

> *"I think it's good to leave this [SDM advice] for the specialist doctors. But for us, in primary care, this is a bit superfluous."*.

3.4. General barriers and facilitators

3.4.1. Training

GPs indicated that ideally the system is intuitively so easy to use and understand that training is not necessary. They did mention that it might be useful to develop some sort of training for the entire intervention. For this training several options were discussed. Some GPs preferred a web lecture, as this allows them to access it whenever it is convenient for them. Others preferred an in-person workshop, as this allows for interaction and asking questions. Both of these would be focused mainly on the entire intervention, and not on the usability of the system, as they expect this to be very simple. One participant indicated:

> *"Ideally the system itself is so simple that I won't need any training."*.

3.4.2. Fit into workflow

The most important barrier/facilitator indicated by the GPs was how it fits into their existing workflow. This can be a motivator if done correctly, but if it does not fit well it will be a dealbreaker. The participants' preferences for making the system fit into the workflow were discussed already (see subheading "workflow"). But they once again stressed the importance of making sure that it will fit as a general barrier:

> *"It should fit into the workflow of the individual practice very well. And that is also the challenge for you guys."*.

3.4.3. Timing of the advice

Lastly, GPs mentioned the importance of timing. Alerts should be presented at the right time. If not, they are very likely to be ignored according to the GPs. They emphasized that alerts regarding the fall risk should not pop-up when the GP is working on a different issue. This once

again emphasizes the importance of dedicating a separate consultation to the fall risk, and not incorporating this during consultations about different topics. One participant stated:

> *"[…] it's mainly about whether or not it is provided at the wrong time, the information. Right? If you have to treat a urinal tract infection because someone has a fever, then I'm not especially interested in something that is preventive in the long term, so to say.."*.

4. Discussion

4.1. Findings and implications

This study provides valuable insights in the needs and wishes of GPs for a medication-related CDSS focused on patients' fall risk. The study was applied to the context of fall prevention, but the findings can also be useful to inform the development of medication-related CDSSs in other contexts. First of all, several themes related to the workflow arose from the data. Identifying and inviting high-risk patients should take place in a way that causes as little disturbance as possible for the GP. Participants indicated that alerts about a high fall risk would very likely be ignored while working on a different issue and could cause reluctance to act. Therefore, being able to create a list of all patients with a high fall risk on demand would be a more effective alternative. This provides a more profound insight into a barrier that was also found in the systematic literature review assessing barriers and facilitators for medication-related CDSS usage, namely that intrusive alerts are considered annoying and cause reluctance among clinicians [7]. This should also be considered during the development of other CDSSs which identify patients at high risk of a certain condition or disease, in order to make the process of identifying at-risk patients as efficient as possible.

GPs also saw a clear assisting role for the general practice-based nurse specialist and the pharmacist during this intervention. This would help with burdening the GP as little as possible, thereby contributing to the effectiveness of the intervention. In order for a CDSS to be accepted and used by clinicians, it is important for the system to burden the clinician as little as possible and for the system to fit into their existing workflow as seamlessly as possible [7,30]. Furthermore, GPs considered a QPL to be a useful method of preparation for the patient. Research shows that using a QPL to prepare for a consultation helps to empower patients and facilitates SDM during the consultation, especially when usage is encouraged by the clinician and the QPL is discussed during the consultation [31,32]. Therefore, the fact that GPs consider this type of patient preparation to be useful is a desirable outcome that will positively influence the effectiveness of the intervention. It is, however, important to note that GPs also expressed worries about older patients' capability and willingness to perform this preparation, which could possibly decrease the positive effects of the intervention.

Regarding the risk presentation, GPs had a clear preference for a visual risk presentation in the form of a gradient scale, combined with the exact percentual fall risk. This finding is very well generalizable to other CDSSs presenting other medical risks to the clinician. It indicates a clear preference for a visual display, as this allows the clinician to grasp the risk at a glance. GPs also discussed the option of comparing the fall risk to a "normal" fall risk for a person in the same age group. This resulted in mixed opinions and consensus regarding this topic was not reached. If it is decided to incorporate such a comparative (fall) risk in a CDSS, this should be done with great caution, as the comparison could also have a demotivating effect according to the participating GPs.

Lastly, GPs shared some clear views on the advice presented by the CDSS. One important theme that arose here was having as little clutter on screen as possible. Meaning that each full piece of advice is only shown after clicking an expand button. This finding is in line with previous findings from the systematic literature review [7], considering that conciseness of the presented information was an important factor for CDSS acceptance. Furthermore, GPs wanted to be able to check off an advice after they considered it. This is also very applicable in other CDSSs, considering that this is not related to falls specifically. Checking off the advices helps to keep the clinician's work structured. Interestingly, GPs did not want to receive advice specifically about SDM, meaning that no major design considerations had to be made regarding SDM. This suggests that using the CDSS by itself without explicit advice about practicing SDM could already facilitate SDM. Of course, the question remains whether GPs think they don't need additional advice about how to apply SDM during the consultation or whether they really don't need it. This should be assessed in future research.

4.2. Limitations and future research

There are a number of limitations to this study, partly inherent to the challenges related to conducting qualitative research. First, we spread an email among all GPs from the AmsterdamUMC's network of general practice. However, response rates to this email were low, resulting in a more purposive sampling strategy where one of the authors personally contacted a number GPs from the network. This resulted in a group of relatively motivated GPs participating in our focus groups. This may affect generalizability of the results, as less motivated GPs might think of different barriers or facilitators for using the system. However, purposive sampling also has advantages and is not uncommon when conducting qualitative research. Furthermore, the results do reflect topics that would also fit with less motivated GPs, such as ways to prevent alert fatigue.

Second, while the focus group guide was developed using the expertise of several team members during an iterative process, its components were not pilot tested previous to the focus groups. Pilot testing the guide before commencing the real focus groups can enhance its quality. On the other hand, this also means that the participants contributing to the pilot test cannot participate in the actual focus groups anymore, for which we did not have enough participants.

Looking ahead, the findings of the current study will be used to develop the first prototype of a medication-related CDSS focused on facilitating SDM regarding older patients' fall risk. These prototypes will be subjected to elaborate usability testing and eventually the full intervention will be thoroughly evaluated during a trial. Furthermore, future research can look into how the findings from this study relate to other medication-related CDSSs and other types of personalized risk presentation.

5. Conclusion

The current study provides an in-depth overview of GPs' needs and wishes for a medication-related CDSS facilitating SDM between patient and GP regarding the patient's personalized fall risk. GPs' views on the workflow, risk presentation and advice of the system were elicited. The findings will be used to inform the development of this CDSS designed especially for GPs. However, these findings should also be interpreted in a broader light, as the ideas expressed by the GPs in this study can also be applied to the development of other, similar CDSSs. All in all, the current study provides valuable insight into GPs' needs and wishes for a CDSS, explored in the context of fall prevention but generalizable to other contexts as well.

Summary Table.

What was already known on the topic

- Shared decision making (SDM) can be beneficial to patients, healthcare professionals, and the healthcare system, but is often not applied in practice.
- Clinical decision support systems (CDSSs) have the potential to facilitate SDM, but are also known to have low acceptance rates.
- Applying user-centered design during the development phase of a CDSS will help to create a more effective system and overcome low acceptance rates.

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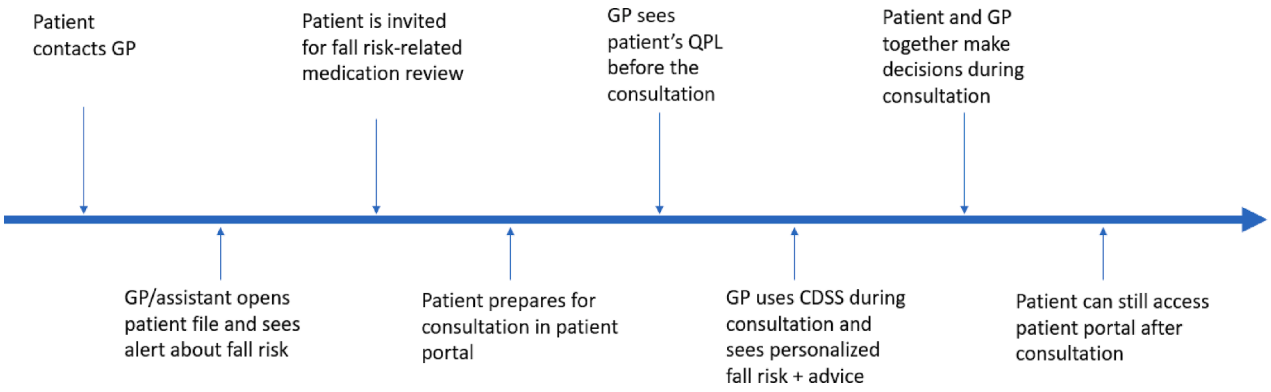

Fig. 3. Presented workflow.

(*continued*)

What this study added to our knowledge

- This study provides a valuable insight into general practitioners' (GPs) needs and wishes for a CDSS focused on lowering older patients' medication-related fall risk.
- The findings of this study should be interpreted in a broader light, as they can also be applied to the development of CDSSs in other contexts.

Author contributions

Conceptualization - LW, GB, HW, SM, AA, JW. Data curation - LW. Formal analysis - LW, GB. Methodology - LW, GB, HW, SM, AA, JW, KW. Writing – original draft - LW. Writing – review & editing - GB, HW, SM, AA, JW.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix I:. Workflow and CDSS

During the focus groups, GPs were presented an envisioned workflow of the entire intervention (see Fig. 3) and were asked to comment on– and adjust this workflow according to their own ideas. The original envisioned workflow that was presented to the GPs looked as follows (translated from Dutch):

The findings of this study will be used to implement a medication-related fall risk module within the existing CDSS NHGdoc, already used by some of the participating GPs. NHGdoc contains several modules and falls prevention will be added as a new module based on the results of the focus groups. We purposely did not provide the GPs with too much information on NHGdoc, as we wanted them to attend the focus groups with an open mind and share all of their preferences regardless of what NHGdoc currently looks like.

References

[1] E. Oshima Lee, E.J. Emanuel, Shared Decision Making to Improve Care and Reduce Costs, N Engl. J. Med. 368 (2013) 6–8, https://doi.org/10.1056/NEJMP1209500.
[2] F. Légaré, R. Adekpedjou, D. Stacey, S. Turcotte, J. Kryworuchko, I.D. Graham, A. Lyddiatt, M.C. Politi, R. Thomson, G. Elwyn, N. Donner-Banzhoff, Interventions for increasing the use of shared decision making by healthcare professionals, Cochrane Database Syst. Rev. 7 (2018) CD006732. https://doi.org/10.1002/14651858.CD006732.PUB4/EPDF/FULL.
[3] F. Légaré, D. Stacey, S. Turcotte, M.J. Cossi, J. Kryworuchko, I.D. Graham, A. Lyddiatt, M.C. Politi, R. Thomson, G. Elwyn, N. Donner-Banzhoff, Interventions for improving the adoption of shared decision making by healthcare professionals, Cochrane Database Syst. Rev. 9 (2014), https://doi.org/10.1002/14651858.CD006732.PUB3/EPDF/FULL.
[4] G. Elwyn, M.A. Durand, J. Song, J. Aarts, P.J. Barr, Z. Berger, N. Cochran, D. Frosch, D. Galasiński, P. Gulbrandsen, P.K.J. Han, M. Härter, P. Kinnersley, A. Lloyd, M. Mishra, L. Perestelo-Perez, I. Scholl, K. Tomori, L. Trevena, H. O. Witteman, T. Van der Weijden, A three-talk model for shared decision making: multistage consultation process, BMJ. 359 (2017) 4891, https://doi.org/10.1136/BMJ.J4891.
[5] C.M. Ruland, S. Bakken, Developing, implementing, and evaluating decision support systems for shared decision making in patient care: a conceptual model and case illustration, J. Biomed. Inform. 35 (2002) 313–321, https://doi.org/10.1016/S1532-0464(03)00037-6.
[6] R. Hayward, Clinical decision support tools: do they support clinicians? Can. Med. Assoc. J. 170 (2004). FP66-68.
[7] L. Westerbeek, K.J. Ploegmakers, G.J. de Bruijn, A.J. Linn, J.C.M. van Weert, J. G. Daams, N. van der Velde, H.C. van Weert, A. Abu-Hanna, S. Medlock, Barriers and facilitators influencing medication-related CDSS acceptance according to clinicians: A systematic review, Int. J. Med. Inform. 152 (2021), 104506, https://doi.org/10.1016/J.IJMEDINF.2021.104506.
[8] C.L. Tolley, S.P. Slight, A.K. Husband, N. Watson, D.W. Bates, Improving medication-related clinical decision support, Am. J. Heal. Pharm. 75 (2018) 239–246, https://doi.org/10.2146/ajhp160830.
[9] H.M. Vu, L.H. Nguyen, H.L.T. Nguyen, G.T. Vu, C.T. Nguyen, T.N. Hoang, T. H. Tran, K.T.H. Pham, C.A. Latkin, B. Xuan Tran, C.S.H. Ho, R.C.M. Ho, Individual and Environmental Factors Associated with Recurrent Falls in Elderly Patients Hospitalized after Falls, Int. J. Environ. Res. Public Health. 17 (2020) 2441, https://doi.org/10.3390/ijerph17072441.
[10] Centers for Disease Control and Prevention, Leading Causes of Death and Injury - PDFs|Injury Center|CDC, (n.d.). https://www.cdc.gov/injury/wisqars/LeadingCauses.html (accessed March 19, 2021).
[11] VeiligheidNL, Feiten & cijfers | Valpreventie | VeiligheidNL, (2019). https://www.veiligheid.nl/valpreventie/feiten-cijfers?gclid=EAIaIQobChMI2rK474G87wIVkuh3Ch3DKgswEAAYASAAEgJ11fD_BwE (accessed March 19, 2021).
[12] B. Olij, V. Erasmus, L. Barmentloo, A. Burdorf, D. Smilde, Y. Schoon, N. van der Velde, S. Polinder, Evaluation of Implementing a Home-Based Fall Prevention Program among Community-Dwelling Older Adults, Int. J. Environ. Res. Public Health. 16 (2019) 1079, https://doi.org/10.3390/ijerph16061079.
[13] T.A. Soriano, L.V. DeCherrie, D.C. Thomas, Falls in the community-dwelling older adult: a review for primary-care providers, Clin. Interv. Aging. 2 (2007) 545–554, https://doi.org/10.2147/cia.s1080.
[14] M.R. de Jong, M. Van der Elst, K.A. Hartholt, Drug-related falls in older patients: implicated drugs, consequences, and possible prevention strategies, Ther. Adv. Drug Saf. 4 (2013) 147–154, https://doi.org/10.1177/2042098613486829.
[15] A. Ham, M. Swart, A. Enneman, S. Van Dijk, S. Oliai Araghi, J. Van Wijngaarden, N. Van der Zwaluw, E. Brouwer-Brolsma, R. Dhonukshe-Rutten, N. Van Schoor, T. Van der Cammen, P. Lips, C. De Groot, A. Uitterlinden, R. Witkamp, B. Stricker, N. van der Velde, Medication-Related Fall Incidents in an Older, Ambulant Population: The B-PROOF Study, Drugs Aging. 31 (2014) 917–927. https://doi.org/10.1007/s40266-014-0225-x.
[16] J. Michalcova, K. Vasut, M. Airaksinen, K. Bielakova, Inclusion of medication-related fall risk in fall risk assessment tool in geriatric care units, BMC Geriatr. 20 (2020) 454, https://doi.org/10.1186/s12877-020-01845-9.

[17] A.R. Huang, L. Mallet, C.M. Rochefort, T. Eguale, D.L. Buckeridge, R. Tamblyn, Medication-related falls in the elderly: Causative factors and preventive strategies, Drugs and Aging. 29 (2012) 359–376, https://doi.org/10.2165/11599460-000000000-00000.
[18] M.J. Costa-Dias, A.S. Oliveira, T. Martins, F. Araújo, A.S. Santos, C.N. Moreira, H. José, Medication fall risk in old hospitalized patients: A retrospective study, Nurse Educ. Today. 34 (2014) 171–176, https://doi.org/10.1016/j.nedt.2013.05.016.
[19] L. Yourman, J. Concato, J.V. Agostini, Use of computer decision support interventions to improve medication prescribing in older adults: A systematic review, Am. J. Geriatr. Pharmacother. 6 (2008) 119–129, https://doi.org/10.1016/j.amjopharm.2008.06.001.
[20] J.E. Van Doormaal, M.K. Rommers, J.G.W. Kosterink, I.M. Teepe-Twiss, F. M. Haaijer-Ruskamp, P.G.M. Mol, Comparison of methods for identifying patients at risk of medication-related harm, Qual. Saf. Heal. Care. 19 (2010) e26, https://doi.org/10.1136/qshc.2009.033324.
[21] T. Harada, T. Miyagami, K. Kunitomo, T. Shimizu, Clinical Decision Support Systems for Diagnosis in Primary Care: A Scoping Review, Int. J. Environ. Res. Public Heal. 2021, Vol. 18, 8435. 18 (2021) 8435. https://doi.org/10.3390/IJERPH18168435.
[22] M. Nurek, O. Kostopoulou, B.C. Delaney, A. Esmail, Reducing diagnostic errors in primary care. A systematic meta-review of computerized diagnostic decision support systems by the LINNEAUS collaboration on patient safety in primary care, (2015) 8–13. https://doi.org/10.3109/13814788.2015.1043123.
[23] S. Khairat, D. Marc, W. Crosby, A. Al Sanousi, Reasons For Physicians Not Adopting Clinical Decision Support Systems: Critical Analysis, JMIR Med Inf. 6 (2018) e8912.
[24] E. Ford, N. Edelman, L. Somers, D. Shrewsbury, M. Lopez Levy, H. van Marwijk, V. Curcin, T. Porat, Barriers and facilitators to the adoption of electronic clinical decision support systems: a qualitative interview study with UK general practitioners, BMC Med. Inform. Decis. Mak. 21 (2021) 1–13, https://doi.org/10.1186/S12911-021-01557-Z/TABLES/2.
[25] J. Brunner, E. Chuang, C. Goldzweig, C.L. Cain, C. Sugar, E.M. Yano, User-centered design to improve clinical decision support in primary care, Int. J. Med. Inform. 104 (2017) 56–64, https://doi.org/10.1016/j.ijmedinf.2017.05.004.
[26] P. Kashfi, B. Ab, H. Kashfi, Applying a user centered design methodology in a clinical context, Stud. Health Technol. Inform. 160 (2010) 927–931, https://doi.org/10.3233/978-1-60750-588-4-927.
[27] A. Tong, P. Sainsbury, J. Craig, Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups, Int. J. Qual. Heal. Care. 19 (2007) 349–357, https://doi.org/10.1093/INTQHC/MZM042.
[28] D.R. Thomas, A General Inductive Approach for Analyzing Qualitative Evaluation Data, Am. J. Eval. 27 (2006) 237–246, https://doi.org/10.1177/1098214005283748.
[29] J.E. Sansoni, P. Grootemaat, C. Duncan, Question Prompt Lists in health consultations: A review, Patient Educ. Couns. 98 (2015) 1454–1464, https://doi.org/10.1016/J.PEC.2015.05.015.
[30] T.L. Reynolds, P.R. DeLucia, K.A. Esquibel, T. Gage, N.J. Wheeler, J.A. Randell, J. G. Stevenson, K. Zheng, Evaluating a handheld decision support device in pediatric intensive care settings, Jamia Open. 2 (2019) 49–61, https://doi.org/10.1093/JAMIAOPEN/OOY055.
[31] K.J. McCaffery, S.K. Smith, M. Wolf, The Challenge of Shared Decision Making Among Patients With Lower Literacy: A Framework for Research and Development, Med. Decis. Mak. 30 (2009) 35–44, https://doi.org/10.1177/0272989X09342279.
[32] N. van der Meulen, J. Jansen, S. van Dulmen, J. Bensing, J. van Weert, Interventions to improve recall of medical information in cancer patients: a systematic review of the literature, Psychooncology. 17 (2008) 857–868, https://doi.org/10.1002/PON.1290.