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## Applying Participatory Design to a Pharmacy System Intervention

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### Abstract

**Background:** Stakeholder engagement is an important component of the research process for improving the use and uptake of patient-centered health care innovations. Participatory design (PD), a method that utilizes the involvement of patients and other stakeholders, is well-suited for the design of multifaceted interventions in complex work systems, such as community pharmacies, that have diverse and dynamic end-users.

**Objective:** The objective is to describe a blueprint for how to use PD when designing a community pharmacy intervention. This paper outlines the steps of PD and highlights the advantages and disadvantages of this method.

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**Methods:** PD is explained step-wise to underscore the considerations required of researchers unfamiliar with PD. This includes the development of a tailored PD approach, PD session preparatory work, data collection, and intervention development and evaluation. The stakeholders recruited for the community pharmacy intervention were pharmacy staff and older adult patients who received prescriptions at the pharmacy corporation in which the intervention was being implemented. The PD process was a series of six adaptive sessions: (1) problem identification, (2) solution generation, (3) convergence, (4) prototyping, (5) initial evaluation, and (6) formative evaluation.

**Results:** A description of the PD process to design a community pharmacy intervention is provided. The process led to the development of a patient-centered prototype. The advantages of using PD included the opportunity to clarify problems faced by stakeholders, generation of novel solutions to incorporate into the intervention, and the ability to vet and fine-tune stakeholder design ideas in an iterative fashion. The insight gained was unprecedented and invaluable to the researchers. The biggest challenge of employing PD was the time-sensitive and time-intensive nature of developing each session, collecting data, and reflecting on the results in order to design subsequent sessions.

**Conclusions:** The PD process led to the development of a patient-centered prototype. PD enabled stakeholders to generate creative solutions and provide unique insight on addressing issues faced in healthcare redesign research and specifically in community pharmacies.

### Keywords

Community pharmacy; Dissemination and implementation; Participatory Design Medication safety; System redesign; Human Factors Engineering

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## Introduction

### Participatory Design

Participatory approaches – those involving stakeholders directly in design - can enhance the development and implementation of health service interventions that seek to improve patient outcomes across healthcare settings.[1–4] Stakeholders are defined here as individuals, groups, or organizations who may influence or be affected by decision-making on a particular action, policy or aim.[5, 6] The involvement of patients and other stakeholders in PD is well-suited for the design of interventions in complex work systems, such as community pharmacies, that have a great diversity of end-users. Some early healthcare-related interventions failed to create their expected impact due to insufficient stakeholder, or end-user, involvement in the design process. For example, during the blunted initial attempts to implement electronic health record systems, users were expected to simply accept and adapt to these new systems, which were slow to be adopted and ultimately, unsustainable.[7, 8] For researchers aiming to improve the uptake and utility of an intervention, it is becoming clear that participatory processes are more effective in comprehensively identifying and addressing user needs than non-participatory processes.[6, 9]

There are three major reasons to involve stakeholders in an intervention design process. First, it keeps the research relevant. Early input from end-user populations leads researchers

to a successively more in-depth understanding of the reality of problems faced by users as well as of considerations regarding the implementation and use of an intervention.[10–12] The result is improved sustainability and a reduced risk of failure and cost for an intervention.[2, 13] Second, stakeholder engagement keeps research transparent to the end-users of an intervention and allows them to build ownership of the intervention design. In turn, end-users are more likely to see value in the intervention and adopt it for use.[14] Third, by fostering collaboration between different organizations and stakeholder populations, a participatory approach can strengthen social networks and community involvement, potentially leading to further, unanticipated projects and activities.[15]

Participatory Design (PD) is a well-established method of stakeholder engagement used to achieve a range of outcomes including the development of computer-based systems,[16] software,[17] farming systems[18] and urban planning.[19] In contrast to traditional methods that solicit end-user input only prior to intervention development and rely on assumptions of users' needs, PD actively engages end-users in intervention design through an adaptive cycle of creation and reflection.[20] Decades of PD research and practice have produced several method variations, which have recently also been applied in the domains of health and healthcare.[21–23] Considering the advantages of participatory approaches to stakeholder engagement, PD is well-suited for the design of multifaceted interventions in complex work systems, such as community pharmacies, which have diverse and dynamic end-user and stakeholder populations.

Despite the benefits of PD, the relevance and usefulness of participatory approaches have only recently begun to be reported in community pharmacy services planning in Canada and New Zealand.[2] This paper presents the development and execution of a process for applying PD methods to develop a system redesign intervention for enhancing over-the-counter (OTC) medication safety in a community pharmacy setting.[24] Each year, over 1.1 million older adults (65+) are at risk of a major adverse drug event resulting from misuse of an OTC medication, warranting an intervention to address system-level barriers to medication safety for older adults by (1) creating an awareness about the dangers of OTCs and (2) fostering communication between older adult patients and a pharmacist.[24, 25] This paper demonstrates the application of a six-step PD process and discusses observed advantages and challenges.

Applying PD in pharmacy settings is accompanied by unique considerations. For example, in a community retail pharmacy setting, two diverse groups of stakeholders coexist: patients (consumers) and pharmacy staff. These two groups have different goals, motivations, and educational backgrounds, but may each be greatly affected by the same intervention. Community pharmacists are well-positioned to identify problems in daily practice that contribute to discrepancies between recommended and actual care.[26] The differing health literacy levels and the resulting power dynamic between the two groups of stakeholders are recognized as an influencing factor in the outcome of collaborative activities and discussion.

## Objective

The objectives of this paper are to present a pharmacy-based PD process, demonstrate its application for an OTC medication safety intervention, and discuss the observed advantages and challenges of applying PD in a community pharmacy setting.

## Application of PD for a System Redesign Intervention

### Stakeholder Recruitment

The research team recruited five pharmacy staff members (four pharmacists and one pharmacy technician) as well as five older adult patients aged 65 years or older who received prescriptions at a Shopko pharmacy in which the system redesign was taking place. Shopko is a Midwest-based mass merchandise chain with over 350 locations across the US. The number of stakeholders from each group was limited to five in order to allow for more involved participation from each stakeholder than would be possible with a larger group. The odd number had the added benefit of ensuring there would always be a tie-breaking perspective in each stakeholder group's discussions. It was important to recruit stakeholders who were familiar with the pharmacy in which the intervention would be taking place. The familiarity allows them to more effectively identify and articulate specific ways in which an intervention would be successful or unsuccessful in fitting with the existing work system components. In this paper, the intervention stakeholders are referred to as "stakeholders."

### Development of a Custom PD Process

The PD process included a series of six two-hour sessions – four concurrent sessions for older adults and pharmacy staff and two combined sessions with both stakeholder groups present. The diversity in the application of PD warranted investigation into the customization of PD for each unique research goal. The research team began by applying the framework referenced by Spinuzzi, which includes the three basic stages in participatory design research: (1) Initial exploration of work, (2) Discovery process, and (3) Prototyping.[27] This framework was the template from which the researchers derived the six steps in conducting participatory design: (1) Problem identification, (2) Solution generation, (3) Convergence, (4) Prototyping, (5) Initial evaluation, and (6) Formative evaluation (Figure 1). All sessions were audio-recorded and transcribed, and they were located in an accessible, centrally-located building. The researchers determined the six sessions, which correspond to the six steps, would be appropriate given the proposed time and funding for developing the community pharmacy intervention.

The researchers' previous pilot work had included ethnographic methods to characterize the domain of their research.[28, 29] So, they instead began with an open-ended conversation on problem identification in order to reach a common understanding of the background information. They used this consensus as a foundation for building critical bonds between participants with the expectation, based on the pilot work, that it would foster trust and confidence in voicing unique opinions.[29]

At the outset, the research team aimed to conduct two concurrent but separate sessions with their two groups of stakeholders – older adults and pharmacy staff. They recognized that the

engagement of and feedback from each stakeholder group would be categorically different. They were also cognizant of a potential power differential between the two groups due to the difference in medication expertise that could impact participant comfort levels in providing feedback during sessions.[30] They planned joint sessions with both stakeholder groups present during the evaluation of the intervention. The researchers believed this would allow for direct debate and comprehensive feedback on the use of the design elements, which would then lead to general agreement on the intervention design prior to its implementation. There was approximately 4.5 weeks between sessions with the exception of a 6-week gap between the fourth session and fifth session, which marked the transition from separate sessions to joint sessions with both stakeholder groups present. The time between sessions allowed for qualitative analysis of feedback and creation of a detailed plan for the following session.

The researchers used a variety of techniques to address the goals of each session. This paper focuses on the methods used to develop those techniques and the agenda of each session using feedback from preceding sessions.

### Step 1: Problem Identification

**Goal:** Elicit and understand the problems stakeholders face.

The first session must allow time for participants to become familiar with one another and to define the research problem in their own terms, in a way that is meaningful to them. It is critical for researchers to set aside any assumptions derived from past experience or pilot work at this stage.

**Task:** In order to understand OTC medication selection and use, both groups of stakeholders were asked to describe their current experience in community pharmacies as well as the barriers that prevent older adults from making safe OTC medication purchases. They were split into separate groups for this session, pharmacy staff and older adults.

**Pharmacy staff:** The pharmacy staff stakeholders were presented with the researchers' flowchart of the steps involved in a pharmacist's thought-process for recommending an OTC to patient based on a pilot study.[29] The pharmacy staff were asked to comment on the validity of the flowchart and to point out any steps in the process that were missing or needed to be changed. The research team made adjustments to the flow chart as specified by the group (Figure 2). Stakeholders were then asked to identify how each step in the process would ideally occur in the pharmacy as well as what may prevent each ideal step from occurring. Each barrier that was identified was written on large sticky note and placed under the corresponding step.

**Older adults:** The older adult stakeholders were presented with notecards, each with a task involved in the process of choosing an OTC. The list of tasks was generated during pilot work.[28] Examples of tasks include: reading the warnings on medication labels, comparing the strengths of different medications, and determining if the OTC was safe to take with prescription medications. They were then asked to add any missing tasks to the list and to sort the task notecards based on their level of difficulty and frequency.

**Outcome:** The importance of this step is particularly evident as it facilitates opportunities for new issues or problems to be identified. The pharmacy stakeholder group reported they use a circular narrowing process in which they gather data and then analyze and then repeat the cycle until they can confidently make an OTC recommendation by asking questions that gradually eliminate OTC options using heuristics and an abductive reasoning method. This contrasted with the researchers' initial understanding of the process as well as OTC curriculum guidelines [31]; based on prior research, the researchers had believed that pharmacists use a linear process to advise patients on OTCs. The process was thought to first involve the gathering of data and then analysis of the data followed by an OTC recommendation.[29] Also, of critical importance during this step was the identification of the steps in which stakeholders identified they could use support. For example, although the research team had first envisioned an intervention that would assist pharmacy staff in gathering information from patients, this session revealed that the area in which pharmacy staff felt they needed the most support was being able to make the initial connection with patients that was made more difficult by the several barriers they identified such as the OTC aisles being located physically far away from the pharmacy. The older adult stakeholders helped the researchers to understand the most important (difficult and frequent) barriers to OTC safety that would need to be addressed by the intervention from their perspective (Figure 3). The researchers sought to identify the most difficult and frequent barriers in order to focus their design efforts on those and thereby increase the potential of the intervention to have a greater positive impact. The older adults reported that determining the unit cost of medications and determining if an OTC was safe to take with their prescription medications were the most difficult tasks. They also reported that reading the warnings on medications labels and determining the relevance of medication warnings were the most frequently done tasks when selecting an OTC medication. It was found that confidence in choosing an OTC and wait-time for a pharmacist consultation are factors that influenced the likelihood of an older adult approaching a pharmacist with OTC questions. The height at which OTCs are displayed on shelves also played a significant role in older adults' OTC selection process due to their physical and visual limitations.

## Step 2: Solution Generation

**Goal:** Encourage stakeholders to creatively generate solutions.

Once all problems are identified, solutions must be brainstormed in a way that inspires creativity and insight on the part of the stakeholders. Invisible Design is a tool that researchers use to foster creativity in participant discussions and encourage the generation of all solutions, regardless of how "out-of-the-box" they may seem. Invisible Design helps participants generate solutions by presenting stakeholders with a scenario in which characters discuss innovations that are not shown directly. The stakeholder then brainstorms what those innovations might be.[32] It is important to maintain a welcoming rather than restrictive environment so that the creativity of participants remains unhindered.

**Task:** In accordance with the guidelines for Invisible Design, the researchers developed a video of an older adult with knee pain seeking an OTC in a community pharmacy.[32] The

scripts for the video incorporated barriers identified by older adult and pharmacy staff stakeholders.

**Pharmacy staff:** The pharmacy staff stakeholders were shown the Invisible Design video, which included three key scenes: (1) an older adult with knee pain searching for an OTC and encountering problems identified by stakeholders during Step 1, (2) a censored, “invisible” scene in which one must speculate what is occurring, (3) the older adult confidently selecting a safe OTC that will not cause any foreseeable adverse drug event. The purposeful ambiguity in Invisible Design served to trigger participants to think in a creative yet tangible way about what possible solutions could have occurred in the “invisible” scene to result in the safe OTC selection outcome. The research team also encouraged the stakeholders to think out of the box by providing an example idea: a 3D avatar arrives in the aisle and guides older adults to safe OTCs. The research team believed a creative mindset was essential in ensuring that all solutions, regardless of how feasible or realistic, were brainstormed. The research team kept the discussion focused on ways to facilitate the initiation of contact between older adults and pharmacy staff and on improving pharmacist information gathering and analysis.

**Older adults:** The older adult stakeholders were given the same prompts and tasks as the pharmacy staff for this step. The research team kept the discussion focused on ways to alert older adult customers of the dangers of some OTCs as well as on ways to improve the initiation of contact between older adults and pharmacy staff.

**Outcome:** During this step, the older adults brainstormed 28 solutions and the pharmacy staff brainstormed 24 solutions that, if implemented in their community pharmacy, may result in safer OTC selection outcomes. After creating a composite list of solutions and accounting for similar solutions from the different groups of stakeholders, the researchers consolidated the list to 48 solutions. There was a broad range of generated solutions for both groups, including technology, product organization, signage, and staffing in the OTC aisles. The researchers avoided immediately ruling out seemingly unfeasible ideas because it was possible that certain aspects of a seemingly unfeasible solution were in fact desirable for the final design of the intervention. For example, the older adults envisioned the installment of a phone booth in the OTC aisles in order have privacy while making a call to a pharmacist. This idea was beyond the scope of the study and yet, the discussion about the phone booth was critical to the final intervention design because it underscored the importance of privacy to older adult stakeholders.

### **Step 3: Convergence**

**Goal:** Evaluate solutions based on a set of predetermined criteria.

Step 3 calls for the solutions generated during Step 2 to be analyzed with a more critical lens in order to pare down the list of potential solutions and to begin to identify the most appropriate combination of solutions. By breaking down how each solution is perceived by stakeholders, researchers can learn what aspects of solutions will be most useful in the end product or intervention.

**Task:** After staying open to all solutions, stakeholders rated the solutions according to seven criteria determined by the research team. All stakeholders were provided with a list of solutions as well as the criteria, such as “complexity” and “likelihood of being used,” which the researchers determined were important to stakeholders based on feedback from earlier sessions. Criteria were ranked on 3-point scale (low, moderate, high). The research team coding each of the solutions into one of three categories: patient self-help, alert and magnetic pull, and pharmacist recommendation. The patient self-help category included solutions affecting a patient choosing an OTC without the help of pharmacy staff. The alerting and magnetic pull category included solutions aimed at connecting an older adult with a pharmacist. The pharmacist recommendation category included solutions that would assist a pharmacist in providing OTC advice to an older adult. The stakeholders were asked to discuss their top-rated solutions and provide reasoning.

**Pharmacy staff:** The pharmacy staff were asked to complete a creativity exercise requiring them to think of every possible use of a paper clip. The pharmacy staff stakeholders had more difficulty in generating out-of-the-box solutions compared to the older adult stakeholders at thinking creatively about change. The creativity exercise served to stimulate out-of-the-box thinking to prepare the pharmacy staff for thinking about how each solution could be integrated into an intervention. They were then asked to rate each of the 48 solutions, including six solutions that would only directly affect the work of pharmacy staff if implemented.

**Older adults:** The older adults were asked to rate each of 42 solutions, which excluded the six solutions that only directly affected the work of pharmacy staff.

**Outcome:** After this session, the researchers reviewed the stakeholders’ ratings of each solution and then consolidated the list of solutions down to the ten most highly rated solutions to be kept for further consideration (Table 2). The researchers took note of the aspects of solutions that were strongly supported in discussion and brainstormed combinations of these aspects to form new solutions. For example, stakeholders supported the implementation of improved lighting and a magnifying glass in order to facilitate reading OTC medication labels. The research team thus suggested a lighted magnifying glass as a possible combination of the ideas. The research team noted that the pharmacy staff were more articulate at this meeting after completing the paper clip creativity task. Overall, this convergence step allowed researchers to create a consolidated list using only the solutions or aspects of solutions that were rated highly by stakeholders.

#### Step 4: Prototyping

**Goal:** Operationalize solutions and propose the design of an initial prototype.

Once a consolidated list is formed, stakeholders must envision the fit and functionality of each solution. To help stakeholders do this, researchers should allot time for a prototyping activity in which the stakeholders build a representative prototype consisting of the top-ranked solutions from Step 3. This allows for researchers to gain further insight into the



needs of the stakeholders and serves to get both researchers and participants on the same page as far as how a user may interact with components of the prototype.

**Task:** The stakeholders were provided with a floorplan of the pharmacy and OTC aisles laid out on a poster board. They were also provided with a variety of tools for the prototyping exercise, including picture representations of solutions, Lego blocks, and Play-Doh.

**Pharmacy staff:** The pharmacy staff stakeholders were asked to work in two 2–3 person teams and use the materials to create a prototype of the intervention design. They were instructed to decide optimal locations for the pictures of solutions so that they fit intuitively in the OTC selection process of older adults. The stakeholders were asked to think about where solutions might work best to meet the 2 primary goals of the study: (1) creating an awareness about the dangers of OTCs and (2) fostering communication between older adult patients and a pharmacist (Figure 4). In order to conceptualize this, the research team asked the stakeholders to verbalize their thought-process and to keep in mind how an older adult patient searching for an OTC would move through the store. The researchers challenged the stakeholders to articulate the benefits or drawbacks in the implementation of their prototype. The pharmacists were then asked to brainstorm a possible selection of OTCs that could be considered safer for older adult patients. The pharmacy technician provided experiential input on which OTCs were popular among their older adult patients.

**Older adults:** The older adult stakeholders were given the same initial prompts and tasks as the pharmacy staff for this step. Instead of being asked about the OTC selection, the older adults were asked to brainstorm language and designs for warning signage.

**Outcome:** As a result of this activity, researchers identified many common features across the different prototypes developed by the older adults and pharmacy staff stakeholders. There was building consensus on which solutions to include in an intervention and on how the intervention could fit into the existing community pharmacy work system. The prototyping step is the first time at which stakeholders were asked to talk-through a hypothetical interaction with a physical draft of the intervention design and then to critique it. Following the completion of these groups and taking into account the designs brought forth by the stakeholders, the research team created a composite prototype including the common features of the prototypes built by the stakeholders (Figure 5).

### Step 5: Initial Evaluation

**Goal:** Evaluate the first consolidated draft of the prototype.

Keeping feasibility in mind, researchers at this step can present a composite prototype draft based on the prototypes built by the stakeholders in Step 4. This prototype draft should then be reviewed by stakeholders.

**Task:** This is the first time that the five older adult and five pharmacy staff stakeholders were asked to participate in a joint session. In order to identify the pros and cons of the research team prototype, the pharmacy staff and older adults were asked to work together in mixed groups of 3–4 participants to evaluate each component of the composite prototype

presented by the researchers. The small groups were chosen by researchers based on their assessment of the assertiveness of participants during previous sessions. The goal was to make sure that all participants were placed in groups that allowed them to feel most comfortable and confident in providing input during discussions.

**Outcome:** The pharmacy staff and older adult perspectives at this step prompted immediate discussion about aspects of the prototype that were detrimental to one group of stakeholders while being beneficial to the other. The presence of input from different stakeholder groups at this session helped prevent the groupthink effect in the evaluation process. For example, the older adults suggested installing a doorbell in the OTC aisles for older adults to press whenever they had questions for a pharmacist. The doorbell would set off a buzzer in the pharmacy to get the pharmacist's attention. This idea was liked by older adults, but it was immediately rejected by pharmacy staff who were able to directly provide their rationale against it to the older adults; the pharmacy staff were concerned about the negative impact of interruptions on their work. The merging of the two groups provided all members with a fresh perspective on the prototype and a new lens through which analysis could proceed. Because this was the first joint session, pharmacy staff were able to receive a first-hand understanding of the older adult perspective and vice versa, which allowed the stakeholders to brainstorm ways to refine the intervention more quickly. The stakeholders took different approaches to coming up with improvements to the design and the discussions eventually led to consensus.

### Step 6: Formative Evaluation

**Goal:** Evaluate the final draft of the prototype.

This step allows the research team to receive feedback from stakeholders on a final prototype draft as well as to continue identifying improvements to the design based on that feedback. It is imperative to have this final review of the prototype to catch any criticism that may have been missed during the review of the first prototype draft.

**Task:** During this step, the researchers presented a full-size 2D model of the prototype (Figure 6) as well as several to-scale drawings from various views. Both groups of stakeholders, older adults and pharmacy staff, were present for this review and were able to physically interact with the mock-up. A member of research team role-played as an older adult in a hypothetical OTC selection process. The researcher stopped at certain points in the role-play to probe stakeholders for reactions to each component of the intervention. For example, at a warning sign about OTCs (brainstormed by stakeholders in Step 4), the researcher froze to probe stakeholders with questions about how this component of the intervention was making it easier or harder for an older adult to choose a safe OTC.

**Outcome:** The stakeholders had a positive reaction to the intervention design with only a few minor suggestions for improvement, such as revising the wording and location of signage. They saw that the previous suggestions were operationalized in the way they initially conceptualized it. The PD process had allowed researchers to create a final design that addressed the goals of the project and that both groups of stakeholders believed would

be helpful and feasible. The final intervention design included several components to improve the safe selection of OTCs by older adults and to facilitate the interaction between pharmacy staff and older adults (Figure 7). The PD process as a whole was useful to the researchers in that it allowed for the creation of a final design that was different from what the researchers would have created without stakeholder engagement.

## Discussion/Evaluation of the PD Process

By reflecting on the role of PD in the study, it is possible to gain a better understanding of its usefulness as well as its challenges. The research team found that by actively engaging stakeholders at each stage of the design process, it was possible to create an intervention that has a greater potential to meet the needs of its end-users. In addition to an analysis of the advantages and challenges of PD, this section includes the lessons learned by the research team that serve as both recommendations and cautionary advice for researchers interested in PD.

## Advantages of Participatory Design

A number of advantages to PD were identified during the generation of “out-of-the-box” ideas for the design of the community pharmacy intervention.

PD provided a framework for utilizing feedback from each session in the preparation of future sessions. The plan for each session was developed using qualitative analysis of the previous sessions results. Though each session was dependent on the preceding session, the timeline of PD sessions was created at the outset. The research team was able to predict how long the PD process would be in advance, which was helpful in informing the stakeholders and the University Wisconsin Institutional Review Board of research plans. PD allowed researchers to set goals for each session and map out the process of working toward the end-goal as well as setting the plan for transitions between sessions. For example, in the transition from session 1 and 2, invisible design videos were developed to engage the pharmacy staff and older adult stakeholders in describing possible ideas for the intervention.

The way in which the research team conducted the PD sessions resulted in a safer environment for stakeholders to articulate their ideas. The stakeholders who were initially unfamiliar with one another were able to bond through a respectful debate and deliberative dialogue, steadily evolving into a cohesive, trusting and productive team. This was particularly important in motivating the stakeholders to think creatively when brainstorming solutions. Characteristics of seemingly outlandish, unfeasible ideas were incorporated into the final intervention. For example, the phone booth idea, which indicated that privacy was a concern for older adults when speaking to their pharmacists, prompted the consideration of privacy in the final intervention design. The pharmacy stakeholders required additional guidance, such as the inclusion of the paper clip creativity task, in preventing feasibility considerations from hindering their ability to think creatively. The pharmacy stakeholders greatly benefited from the adaptive nature of PD, which allowed the researchers to customize the sessions in a way that was effective in helping the stakeholders achieve each session’s goal.

PD enabled the research team to take a second look at the problems faced by stakeholders and to ultimately propose an intervention that could address the most important user-identified barriers to medication safety. The process helped the researchers retrospectively identify the limitations of relying solely on the researcher perspective when designing the intervention. Initially, the researchers' pilot work had led them to believe that the best way to improve OTC safety for older adults was through the provision of a quick-reference guide for pharmacists to use during interactions with patients that helped them collect patient information and provided recommendation information. Within the first session, it became clear that pharmacy staff did not think the most pressing barrier was gathering information and making recommendations, but instead it was being able to bring the pharmacist and patient together so that the pharmacist could be of assistance. The researchers also found great utility in the role-play activities that prompted a debate over the accessibility of the intervention to the relatively diverse population of older adults as well as the way in which an intervention could fit into the existing steps older adults take to choosing OTCs. The older adult stakeholders were particularly vocal in developing and reacting to drafts of signage. They provided suggestions to the researchers on language and placement of signage that would attract older adults toward the intervention. These were ideas that the researchers would not have thought to consider had they not consulted the stakeholders.

## Challenges of Participatory Design

One of the most prominent challenges of employing a PD method for the research team was the fact that it was a time-sensitive process that restricted the planning of a session to only after data analysis for the preceding session had been completed. This was a significant undertaking – it required the researchers to do individual prep work and attend bi-weekly meetings. The time crunch not only limits the amount of time to prep for a session, but it also limits the analysis that can be done for the preceding session. It was also time-intensive because the researchers were planning two separate, concurrent groups for the first four sessions, requiring the researchers to avoid imposing certain expectations on one group solely based on what had occurred in a session with the other group of participants.

Another challenge of PD for the research team was the management of different stakeholder personality types. When certain people exhibited assertive behaviors at the outset, this dynamic tended to transcend all sessions. The researchers attempted to counteract this by keeping more assertive stakeholders together in small group activities so that quieter participators would also be able to provide input and be heard. In addition to balancing personality types, the researchers also had to account for power differentials with the potential to influence participation. For example, a power differential exists between a pharmacist and their older adult patient as a result of a societal acknowledgement of a difference in their health literacy levels. This could prevent a patient from speaking up to disagree with a statement made by the pharmacist. The researchers tried to counteract this as well by beginning all discussions with the encouragement of feedback from older adult participants and by having a research team member moderate each small group discussion.

The high number of solutions evaluated during Step 3 (Convergence) resulted in a unique challenge: observable participant response fatigue. The task of independently evaluating

multiple aspects of possible solutions took a significant portion of the session time, leaving hardly any time for group discussion. During the group discussion, the stakeholders were unable to engage in the group with the same energy and enthusiasm that they had exhibited in previous sessions. Following Step 3, the researchers avoided designing independent activities, instead focusing on collaborative, team-building exercises.

A final major challenge to participants was that as time went on, it seemed to become more difficult for them to critically evaluate the intervention, a product of their own creativity. To help mitigate this effect, the researchers broke down the different components of the intervention and presented them separately. Isolating individual components of the intervention helped stakeholders think critically about areas for improvement in their intervention brainchild.

## Lessons Learned

One aspect of the research team's PD approach that was not drawn from existing literature was the fact that, for the first four sessions, they managed two concurrent groups of participants; the older adult and pharmacy staff stakeholders met separately until the fifth session, which was a joint session. The researchers often functioned as a bridge between the conversations of the two different groups of stakeholders. This was advantageous because the researchers could ask participants to honestly respond to certain, specific comments made by participants in the other group. For example, by relaying the pharmacy staff's assertion that they welcome OTC questions from customers, the older adult stakeholders reacted by saying that they had no way of knowing that this was the case.

The researchers also found that five was a suitable number of participants to invite for the 2-hour group sessions. An odd number was useful especially within the pharmacy staff stakeholder group who often did not reach consensus on different topics of discussion. Also, the relatively small number of participants allowed for more in-depth discussion over the thoughts they shared with fellow participants and the researchers. The relatively small number of participants also created a close-knit environment in which participants could be more vocal in sharing abstract ideas and contribute to discussions in a more meaningful way.

One critical but easily over looked component of stakeholder meetings is choosing an accessible meeting location. The researchers identified and used a building that was centrally located, accessible, and had free parking. It also had available whiteboards and projection capabilities. The researchers were aware that if location was a barrier, it would reduce the likelihood that participants would attend all the sessions. Participants were also provided refreshments and \$50 for their participation at each session.

## Conclusion

It is important to seek input from end-users throughout the process of designing an intervention. Participatory Design offered an effective approach to clarifying the details about the barriers stakeholders face in preventing OTC misuse by older adults. Through the application of PD, researchers gain insight that can change their implicit assumptions and improve their ability to conceptualize the needs of stakeholders. The experiences of

stakeholders are critical to the design process and the result of their active engagement is an intervention that has a greater potential to be well-tailored to the existing work system and the target population.

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**Figure 1:**  
Six Steps in conducting Participatory Design

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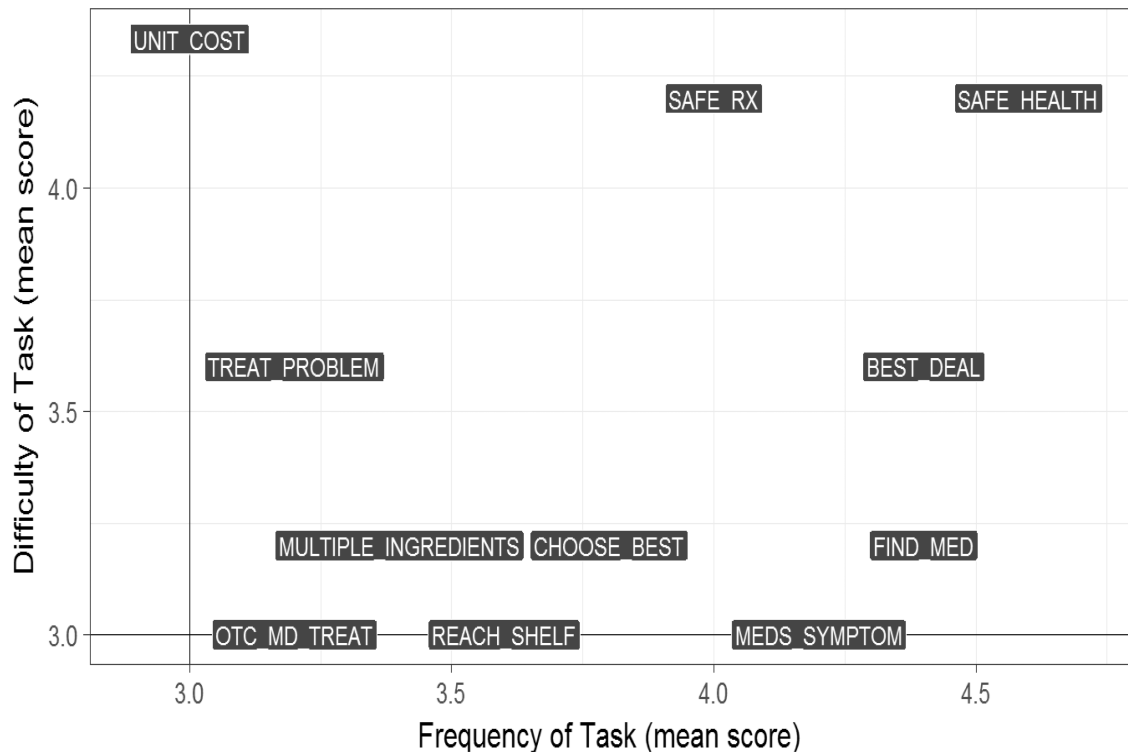
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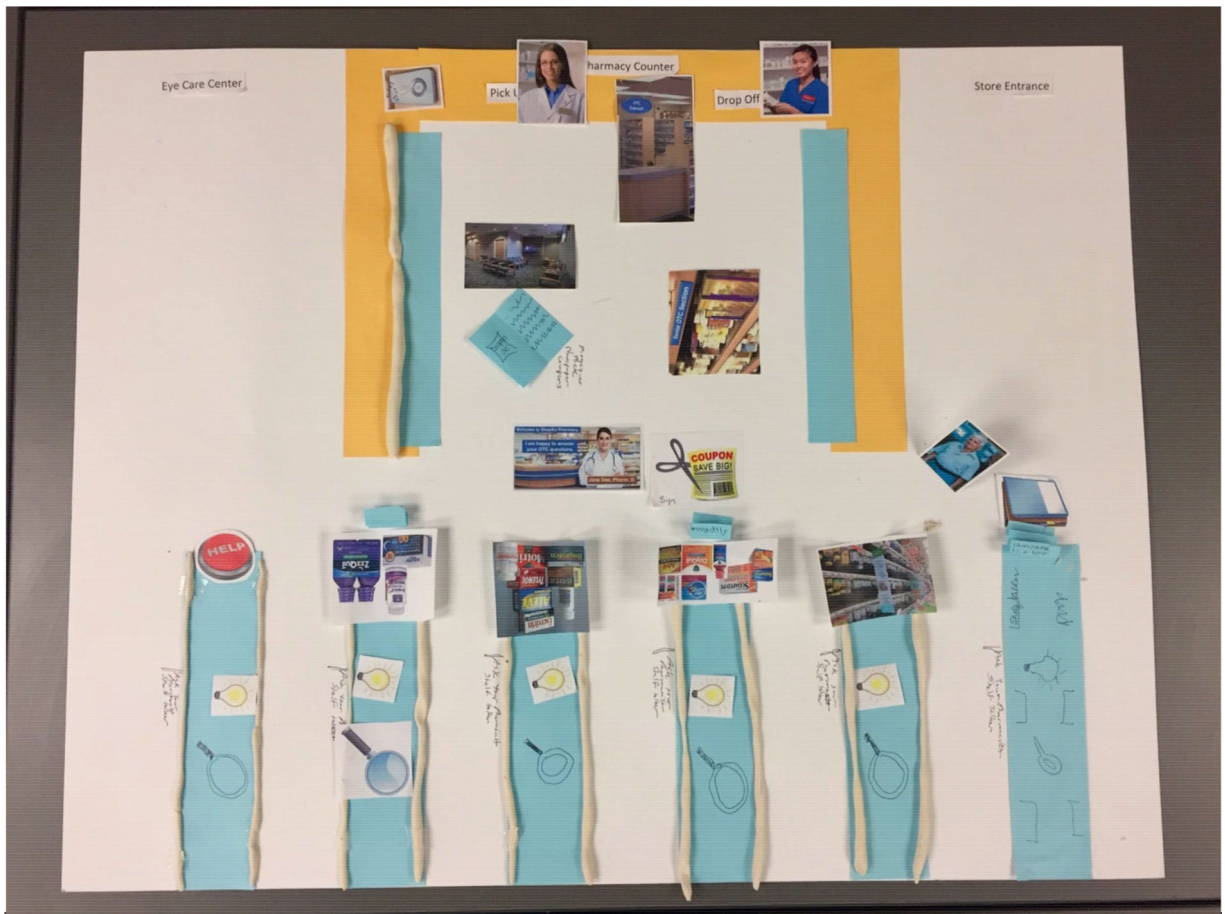
**Figure 2: Pharmacist OTC Recommendation Thought-Process.**

The blue notecards denote researchers’ initial understanding of the steps involved in the pharmacist thought-process for OTC recommendations. In Step 1, pharmacy staff stakeholders were asked to comment on the validity of the blue flowchart. Stakeholders were then asked to identify how each step in the process would ideally occur in the pharmacy as well as what may prevent the ideal step from occurring. Each barrier that was identified was written on large sticky note (colored pink, orange, or green) and placed under the corresponding step.



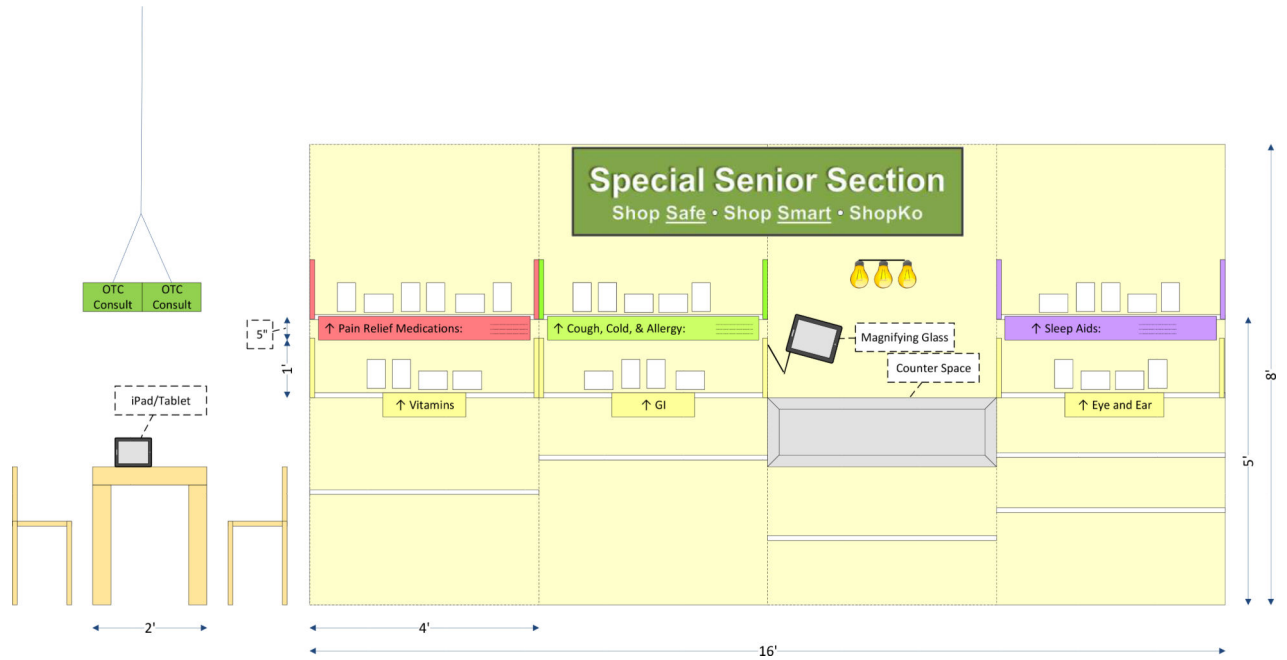
**Figure 3: Difficulty and Frequency of Tasks in OTC Selection Process.**

Each point on the graph denotes a task involved in OTC selection. In Step 1, older adult stakeholders ranked each of these tasks in terms of their difficulty and frequency. For example, “UNIT COST” refers to the task of “determining the unit cost of medications.” According to the stakeholders, this task was high in difficulty but low in frequency of occurrence in their OTC selection processes. The older adults reported that determining if an OTC was safe to take with their prescription medications (SAFE\_RX) was one of the most difficult and moderately frequent tasks in OTC selection. They also reported that determining if an OTC was safe to take given their health conditions (SAFE\_HEALTH) was the most frequent and also one of the most difficult tasks in their OTC selection process.



**Figure 4: Prototyping activity.**

During Step 4, the pharmacy staff stakeholders were asked to work in teams of 2–3 people and to use the materials to create a prototype of the intervention design. The stakeholders were provided with a floorplan of the pharmacy and OTC aisles (in blue) laid out on a poster board. They were also provided with a variety of tools for the prototyping exercise, including picture representations of solutions, Lego blocks, and Play-Doh. They were instructed to decide optimal locations for the solutions so that they fit intuitively in the OTC selection process of older adults. The stakeholders were asked to think about where solutions might work best to meet the 2 primary goals of the study: (1) creating an awareness about the dangers of OTCs and (2) fostering communication between older adult patients and a pharmacist.



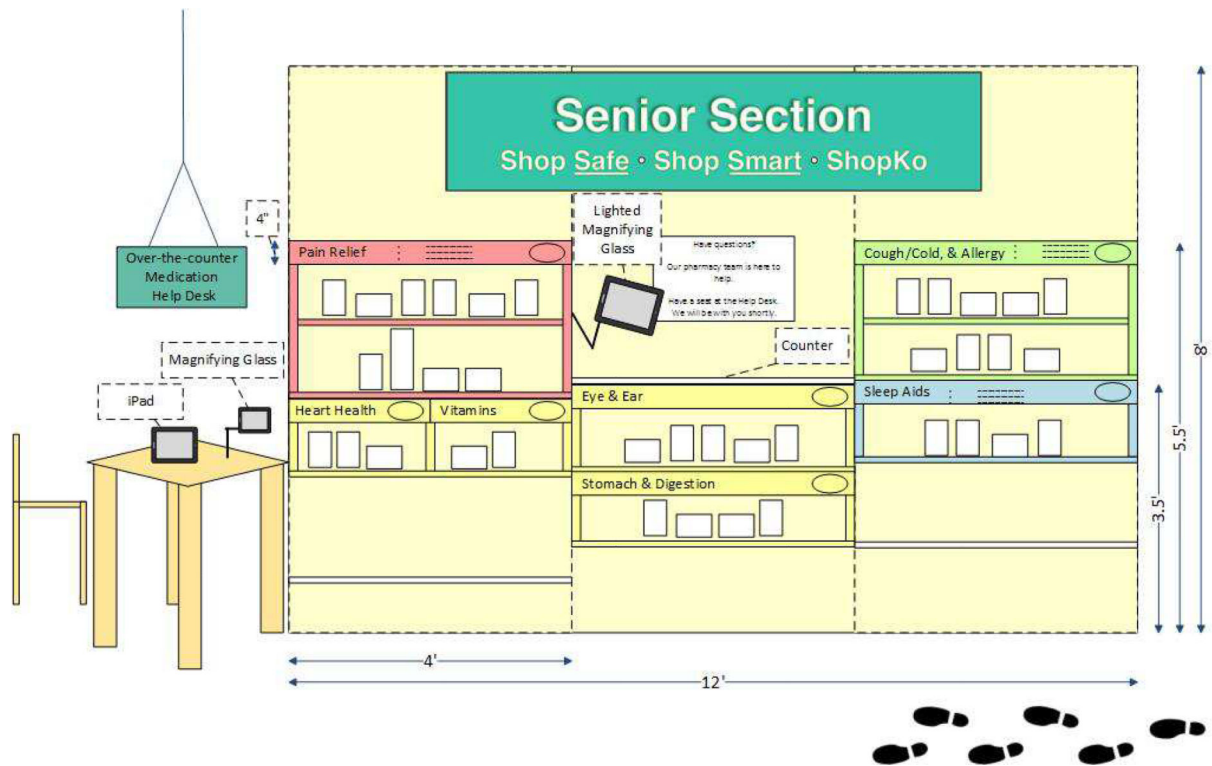
**Figure 5: Composite prototype.**

The research team created the composite prototype, which included the common features of the prototypes built by the stakeholders during Step 4. This composite prototype was presented to older adult and pharmacy staff stakeholders during Step 5 for the initial evaluation of the prototype.



**Figure 6: Full-size 2D Prototype.**

This prototype was used during Step 6 for the formative evaluation of the prototype. The design of this full-size prototype was based on feedback from Step 5 (the initial prototype evaluation).



**Figure 7: The Senior Section.**

This prototype was the final design resulting from the series of six iterative participatory design sessions. The Senior Section includes a twelve-foot pharmacist-approved selection of OTCs (represented by white boxes) for older adults organized into seven color-coded self-care categories. The counseling desk and counter space include magnifiers and enhanced lighting. Pharmacists have the option to bring an iPad to the counseling desk when speaking with patients. The products are located on shelves between 1.5' and 5.5' for best visibility. Signage is included to guide older adults in their selection of OTCs and encourages them to consult a pharmacist with questions. The proximity of this multicomponent intervention allows pharmacy staff to view older adults searching for OTCs and alleviates the time constraint on OTC counseling. It also improves the accessibility of prescription information that aids pharmacists in recommending safe OTC products to older adults.

**Table 1:  
The Six Steps in Participatory Design.**

The series of PD sessions are outlined in chronological order. The title of each session reflects the main goal for the session. The PD process consisted of six sessions with five pharmacy staff stakeholders and five older adult stakeholders. The first four sessions were conducted with each stakeholder group separately, and the final two sessions were conducted with both stakeholder groups present.

SESSION	GOALS	TASKS
<b>1. PROBLEM IDENTIFICATION</b>	Elicit and understand the problems stakeholders face	<u>Pharmacy Staff:</u> -- Confirm the steps and identify barriers involved in making a safe OTC recommendation to a patient <u>Older Adults:</u> -- Identify the relative difficulty vs. frequency of tasks involved in choosing an OTCs
<b>2. SOLUTION GENERATION</b>	Encourage stakeholders to creatively generate solutions	<u>Pharmacy Staff &amp; Older Adults:</u> --Use invisible design to generate solutions to previously identified problems for stakeholders
<b>3. CONVERGENCE</b>	Evaluate solutions based on a set of predetermined criteria	<u>Pharmacy Staff &amp; Older Adults:</u> -- Rate solutions based on: (1) <i>Technical feasibility</i> , (2) <i>Anticipated patient buy-in</i> , (3) <i>Relative advantage</i> , (4) <i>Effectiveness at addressing the problem</i> , (5) <i>Universality</i> , fit within current workflow, (6) <i>Workload</i> , (7) <i>Complexity</i>
<b>4. PROTOTYPING</b>	Operationalize solutions and propose the design of an initial prototype	<u>Pharmacy Staff:</u> -- Create diagram of solutions in optimal pharmacy locations for promotion of OTC safety -- Brainstorm selection of OTCs <u>Older Adults:</u> -- Create diagram of solutions in optimal pharmacy locations for promotion of OTC safety -- Brainstorm warning signage
<b>5. INITIAL EVALUATION (JOINT MEETING)</b>	Evaluate the first consolidated draft of the prototype	<u>Pharmacy Staff:</u> -- Discuss pros and cons of prototype presented in 2D rendition -- Brainstorm selection of OTCs <u>Older Adults:</u> -- Discuss pros and cons of prototype presented in 2D rendition -- Brainstorm warning signage
<b>6. FORMATIVE EVALUATION (JOINT MEETING)</b>	Evaluate the final draft of the prototype	<u>Pharmacy Staff &amp; Older Adults:</u> -- Watch older adult role-play interaction with full-size model of prototype to identify and resolve potential constraints of prototype design

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**Table 2:**  
**Consolidated Stakeholder Solution List.**

The 10 solutions in this table combine the most highly ranked aspects of the 48 solutions produced by stakeholders during Step 2 (the Solution Generation session). In order to create the consolidated list, solutions were rated by older adult and pharmacist staff stakeholders based on factors such as complexity of utilization and likelihood of use. Each solution represents an idea that may result in either directly preventing older adults from selecting an unsafe OTC or that facilitates the interaction of OTC-seeking older adults with pharmacy staff. Picture representations of these solutions were used in the prototyping activity of Step 4.

1	The pain, cough/cold, and sleep products are moved closer to the pharmacy so they are within the pharmacist's line of sight.
2	An OTC service station is constructed near the pharmacy for customers with over-the-counter questions.
3	Signage is posted to alert older adults of the potential harm caused by OTC misuse.
4	Improved lighting and a magnifying glass allow OTC packages to be read more easily.
5	Pharmacists are given portable access to interaction report resources (via a tablet).
6	Older adults receive coupons for asking OTC-related questions.
7	A technician first gathers information about each customer's OTC-related inquiries and then relays only the questions requiring pharmacist input to the pharmacist.
8	A customer presses a button in an OTC aisle to notify the pharmacy staff that they have an OTC-related inquiry.
9	A Senior OTC Section is created, and it includes only OTCs considered safe for seniors.
10	A chart with medication safety information for older adults is placed in the OTC aisles.