

# Implementing an Electronic Clinical Decision Support Tool Into Routine Care: A Qualitative Study of Stakeholders' Perceptions of a Post-Mastectomy Breast Reconstruction Tool

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## Abstract

**Objective.** To explore barriers and facilitators to implementing an evidence-based clinical decision support (CDS) tool (BREASTChoice) about post-mastectomy breast reconstruction into routine care. **Materials and Methods.** A stakeholder advisory group of cancer survivors, clinicians who discuss and/or perform breast reconstruction in women with cancer, and informatics professionals helped design and review the interview guide. Based on the Consolidated Framework for Implementation Research (CFIR), we conducted qualitative semistructured interviews with key stakeholders (patients, clinicians, informatics professionals) to explore intervention, setting characteristics, and process-level variables that can impact implementation. Interviews were transcribed, coded, and analyzed based on the CFIR framework using both inductive and deductive methods. **Results.** Fifty-seven potential participants were contacted; 49 (85.9%) were eligible, and 35 (71.4%) were enrolled, continuing until thematic saturation was reached. Participants consisted of 13 patients, 13 clinicians, and 9 informatics professionals. Stakeholders thought that BREASTChoice was useful and provided patients with an evidence-based source of information about post-mastectomy breast reconstruction, including their personalized risks. They felt that BREASTChoice could support shared decision making, improve workflow, and possibly save consultation time, but were uncertain about the best time to deliver BREASTChoice to patients. Some worried about cost, data availability, and security of integrating the tool into an electronic health record. Most acknowledged the importance of showing clinical utility to gain institutional buy-in and encourage routine adoption. **Discussion and Conclusion.** Stakeholders felt that BREASTChoice could support shared decision making, improve workflow, and reduce consultation time. Addressing key questions such as cost, data integration, and timing of delivering BREASTChoice could build institutional buy-in for CDS implementation. Results can guide future CDS implementation studies.

## Keywords

breast cancer, breast reconstruction, clinical decision tool (CDS), decision aids, shared decision making

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## Introduction

Clinical decision support (CDS) tools help patients and clinicians make better decisions about clinical care through a centralized platform.<sup>1</sup> CDS tools have the potential to enhance patient care delivered from

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clinicians and other medical staff. These tools can improve knowledge, provide an algorithm or strategy for choices, and sometimes offer an individualized risk prediction model based on the patients' health history.<sup>1</sup> When used to support shared decision making, CDS tools can provide information to patients, help them clarify their preferences, and prepare them for decisions and possible outcomes.<sup>1</sup>

Despite their utility, CDS tools are often not incorporated into routine care. Documented barriers to adopting CDS tools in practice include limited consultation time, resource constraints, complexity surrounding technological implementation, and institutional challenges for sustaining the use of these tools over time.<sup>2</sup> In addition to demonstrating clinical utility, implementing CDS tools into routine care requires engaging stakeholders, understanding their preferences, and addressing potential barriers to their routine adoption.<sup>2</sup> A treatment decision that would benefit greatly from decision support is the choice about breast reconstruction after mastectomy. About 40% of patients choosing a mastectomy opt to undergo post-mastectomy breast reconstruction to restore breast shape when a natural breast is removed.<sup>3</sup> Although it is a preference-sensitive decision with no single best option for all patients, and should be guided by both clinical evidence and patient preferences, not all patients and clinicians engage in shared decision making about post-mastectomy breast reconstruction.<sup>4,5</sup> In fact, many patients report feeling ill-prepared for the potential risk of complications after immediate breast reconstruction, and many clinicians underestimate the patients' risks.<sup>6</sup> In the broader population, there is about a 25% risk of complications associated with immediate breast reconstruction, but this risk varies widely and is affected by patient characteristics.<sup>4,7</sup> Immediate breast reconstruction after mastectomy has a higher rate of complications and higher risk of flap or tissue expander/implant failure, compared to delayed reconstruction.<sup>8,9</sup> However,

more women opt for immediate breast reconstruction compared to delayed reconstruction because it can improve aesthetic results and reduce the amount of time a woman is without a breast shape.<sup>9,10</sup>

In a past project, we developed a CDS tool called the Breast Reconstruction Education and Support Tool (BREASTChoice), a web-based decision aid for women with breast cancer considering post-mastectomy breast reconstruction.<sup>6</sup> To address the variable and often high risk of complications, knowledge gaps, and support women's decision about options, BREASTChoice incorporates plain language about breast reconstruction, allows women to consider their preferences for reconstruction options, and provides a personalized prediction for risk of complications from immediate breast reconstruction.<sup>6</sup> Findings from the earlier randomized trial showed that it improved patients' knowledge and decision confidence without affecting consultation time. However, clinicians were often not aware of which patients used the CDS tool. Electronic health record (EHR) integration with a summary of risk and preferences could help clinicians and patients engage together in shared decision making rather than focusing mostly on activating patients.<sup>6</sup>

We refined BREASTChoice such that the risk prediction model—built and validated in over 17,000 people<sup>9</sup> and updated with institutional data—would be auto-populated with data from the patient's EHR, and the summary of her risk and preferences would be sent back to the EHR for use at the point of care.<sup>6,11</sup> The purpose of this article is to describe stakeholder perceptions of implementing the refined BREASTChoice tool into the EHR and ultimately into routine care. For this study, the women interviewed were past the decision-making process and reflecting on their experiences. We report on a series of qualitative semistructured interviews conducted based on a well-established framework, the Consolidated Framework for Implementation Research (CFIR).<sup>12</sup>

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## Methods

### *Conceptual Framework*

Interview guides were developed for participants (patients, clinicians, and informatics professionals) using CFIR constructs. The CFIR framework guided interview questions about ways to adapt and refine BREASTChoice and was used to develop the codebook for analyzing interview transcripts. A stakeholder advisory group (SAG) and the study team reviewed and modified the guide for clarity and relevance to the

research questions. The CFIR constructs comprise five main domains:

1. *Intervention Characteristics*: Stakeholder perceptions about the intervention (e.g., adaptability and relative advantage over other existing interventions)
2. *Outer Setting*: The extent to which outside influence such as external policy at other organizations may impact decisions considered during the implementation process (e.g., patient needs and resources)
3. *Inner Setting*: Attributes of the organization that might affect the implementation process (e.g., implementation climate)
4. *Characteristics of Individuals*: Attributes of individuals involved with the intervention and how that will affect the implementation process (e.g., other personal attributes, knowledge and beliefs, and intervention complexity)
5. *Process*: Methods that impact the implementation process of the intervention (e.g., engaging local champions)

### *Study Team*

We engaged a SAG of cancer survivors, clinicians who discuss and/or perform breast reconstruction in women with cancer, and informatics professionals from academic and community sites. The SAG complemented the scientific research team, which included plastic and reconstructive surgeons, epidemiologists, informatics experts, decision scientists, biostatisticians, and research coordinators.

### *Recruitment and Eligibility*

Prior to recruitment, approval for the study was obtained from the Institutional Review Board (IRB: reference # 201908112) at Washington University's school of Medicine from the Human Research Protection Office (HRPO). We engaged stakeholders from multiple geographic areas and practice sites, using purposive and snowball sampling with the aim that at least 50% of our patient interviews would be with Black and/or elderly women over age 65. We partnered with the SAG and community and national organizations, including the Breakfast Club, Inc.; Living Beyond Breast Cancer; and the Plastic Surgery Foundation, to identify a range of participants to approach for interviews. We also leveraged local and regional connections to identify patients, clinicians, and informatics professionals. Potentially

eligible participants were contacted by phone or email to determine eligibility and interest

Eligible patients were 18 years or older, English-speaking, who had a mastectomy for malignancy within the last 5 years, and completed surgical therapy. We aimed to recruit women who previously had stage 0 to 3, non-metastatic breast cancer (since those with metastatic disease face different surgery decisions). Eligible clinicians were included if their primary practice area was counseling or caring for patients with breast cancer who were considering breast reconstruction. Clinicians were recruited from three institutions (including two academic and one community health center) and one national foundation. Clinicians included plastic and reconstructive surgeons, surgical oncologists, medical oncologists, radiation oncologists, and primary care clinicians. Interest and experience with shared decision making was not a criterion for eligibility. Eligible informatics professionals included individuals with expertise in integrating CDS tools into EHRs. Informatics experts were all affiliated with one of two academic institutions who used the same EHR system; however, the informatics experts also had knowledge about other EHR systems.

### *Interview Procedures*

Participants were sent a .pdf containing screenshots of the BREASTChoice tool prior to the interview, and a link to BREASTChoice housed on a website outside the EHR to navigate through the pages. On the day of the interview, the purpose of the study was explained, and participants completed informed consent. Interviews were conducted by a masters-level research coordinator either in-person or over the telephone between December 2019 and May 2020. She was trained and supervised by the principal investigators (PIs) of the study, who both have experience with qualitative interviewing and analysis. Interview questions were designed to assess CFIR constructs such as stakeholders' views on implementation barriers and facilitators, perceptions of the tool, views on relative advantages of implementation, difficulty of implementation, time of implementation, and external policies and incentives as they pertained to the BREASTChoice tool (see Supplementary Appendix A for the interview guide). Interviews were audio recorded, conducted at the workplace or by phone, and lasted about 20 to 40 minutes. Field notes were taken during each session. After the interview, participants completed a brief survey to assess demographic and professional characteristics. Participants received a \$20 gift card as an incentive.

## Data Analysis

Methods and results are reported in accordance with the Consolidated Criteria for Reporting Qualitative Studies (COREQ).<sup>13</sup> Recordings were transcribed using a professional transcription service and de-identified. Transcripts were coded using QSR NVivo 12 using a codebook developed by research team members (CG, JB, MP, CL) based on the CFIR framework. Two team members (JB and KS) supervised by the principal investigator (MP) double-coded seven transcripts and checked for interrater reliability ( $\kappa > 0.8$  and percent agreement  $> 95\%$ ). They discussed discrepancies, revised the codebook as needed, and double-coded six more transcripts. Once interrater reliability was obtained a second time, the remaining transcripts were coded independently.

## Funding Source

Financial support for this study was provided by a grant from the Agency for Healthcare Research and Quality (AHRQ; R18 HS026699). The funding agency had no role in designing the study, interpreting the data, writing, or publishing the report.

## Results

Fifty-seven potential participants were contacted; 49 (85.9%) were eligible, and 35 (71.4%) were enrolled. Eight were ineligible, and 14 did not respond to requests to schedule interviews or were not interested. The final sample included 13 patients, 13 clinicians, and 9 informatics professionals. The team discussed findings after three to five interviews and continued this process until thematic saturation was achieved. For example, we interviewed more informatics experts when we learned we had not reached saturation in this stakeholder group. We reached data saturation because we were focusing on EHR integration, rather than the tool content itself or on patients' experiences with breast reconstruction. Table 1 displays participant characteristics. Below, we describe themes that emerged from the data within specified CFIR constructs, with illustrative quotes.

*Theme 1: When asked about the advantages of the tool, stakeholders found the tool useful and thorough overall [CFIR constructs: Relative Advantage, Knowledge and Beliefs]*

*Theme 1.1: Clinicians, informatics professionals, and patients agreed that BREASTChoice provided a source*

**Table 1** Participant Characteristics ( $N = 35$ )

Characteristics	Number (%) unless indicated
Patient	$N = 13$ (100)
Age	
Mean (SD, range)	51.8 (12.2, 41–71)
Gender	
Female	13 (100)
Racial group	
White	9 (69.2)
Black/African American	2 (15.4)
Another race	2 (15.4)
Current health insurance	
Private	10 (76.9)
Government (Medicare and Medicaid)	3 (23.1)
Household income	
Less than 30,000	2 (15.4)
30,000 to 60,000	2 (15.4)
More than 60,000	7 (53.8)
Prefer not to answer	2 (15.4)
Breast cancer stage	
Stage I	2 (15.4)
Stage II	4 (30.8)
Stage III	5 (38.5)
Don't know	2 (15.4)
Type of reconstructive surgery	
Implant	9 (69.2)
Flap or tissue-based	3 (23.1)
No reconstruction	1 (7.7)
When did you start reconstruction	
Immediately	9 (69.2)
Delayed	3 (23.1)
N/A	1 (7.7)
Clinician	$N = 13$ (100)
Gender	
Male	4 (30.8)
Female	9 (69.2)
Racial group	
White	9 (69.2)
Asian American	3 (23.1)
Another race	1 (7.7)
Clinician background	
MD	9 (69.2)
PA/physician assistant	2 (15.4)
NP/nurse practitioner	1 (7.7)
RN/registered nurse	1 (7.7)
Years in practice (range)	
Less than 10	7 (53.8)
10–20	3 (23.1)
21 or more	3 (23.1)
Geographic area of practice	
Urban	8 (61.5)
Suburban	3 (23.1)
2 or more	2 (15.4)
Informatics professionals	$N = 9$ (100)
Gender	
Male	3 (33.3)
Female	6 (66.7)

(continued)

**Table 1** (continued)

Characteristics	Number (%) unless indicated
Racial group	
White	5 (55.6)
Black/African American	1 (11.1)
Asian American	3 (33.3)
Type of work	
Healthcare informatics	6 (66.7)
Hospital administration	1 (11.1)
Both	2 (22.2)
Years in informatics or hospital administration (range)	
Missing	1 (11.1)
Less than 10	3 (33.3)
11–15	3 (33.3)
16–20	2 (22.2)
Experience with CDS tools	
Yes	6 (66.7)
No	3 (33.3)

CDS, clinical decision support.

*of centralized, evidence-based information about reconstruction.*

It gives the patient a realistic outline of pros and cons of what their selected choices are, and . . . takes away the overwhelming information that they may seek if they were Googling this information. It's just giving a very straightforward, "This is your pro. This is your con." (Clinician #129)

It was good at gathering and pulling my thoughts together in one place. That is definitely something that is going to help . . . most women . . . especially right at the time when they get their diagnosis and they're trying to decide what they're going to do . . . their brain is all over the place. (Patient #150)

You get more information [from BREASTChoice]. . . . I remember when I was making my decisions. I just talked to my surgeon and my plastic surgeon, in hindsight, I didn't have maybe a full picture of all of my range of choices . . . it would've been nicer to have—to have had a little bit more information to—to make those decisions. (Patient #152)

*Theme 1.2: Clinicians and patients felt that BREASTChoice could support shared decision making, improve workflow, and save consultation time.*

It would not only help patients make the decisions but also, you know, improve efficiency. . . . Given the limited time we have with each patient, it allows us to then focus on . . .

individualized and critical topics of discussion with them rather than kind of going over some of the basic aspects of reconstructive surgery. (Clinician #121)

From a physician's standpoint, it would help me get a better understanding of the patient's concern because the report has put them in a good format. And then I could go over those concerns and help with the patient and come up with a plan that works for all parties. (Clinician #132)

I like . . . that [the] conversation can be started where the clinician and the patient are jointly making the decisions together and going through that . . . decision process together. (Patient #150)

Some women . . . may feel like they're being rushed into making a decision, but with this tool, they can kind of sit back and say, "Okay, here are my options. I thoroughly understand what's in front of me. Now it's up to me to make a decision that's best for me." (Patient #159)

*Theme 1.3: Stakeholders thought that personalized risk information can help clinicians explain to patients why certain options might not be the right fit.*

It would only enhance the conversation—because I think patients who are higher risk—those who have been radiated, have high BMIs [body mass indices], have multiple comorbidities, it's good for them to know at the beginning that the doctor may recommend not doing immediate reconstruction, may recommend that you wait so you can quit smoking before you do this elective operation . . . something like that. (Clinician #134)

[The personalized risk] would be good because then they can explain further why these are higher risk . . . they'll be there to reiterate . . . the risk factors. (Clinician #131)

If you put all that in and it comes back and says, your risk of complications is 95%. That makes me say, it's not worth it. I mean maybe I shouldn't look at that avenue, or I should just do this type of reconstruction or no reconstruction, because it could be a useful tool for some people who are on the fence. (Patient #155)

*Theme 1.4: Clinicians and patients particularly liked the realistic and diverse photos of reconstruction outcomes.*

Having the pictures were very helpful for patients, too, so that they can get an idea of realistically what to expect after breast reconstruction or no reconstruction. (Clinician #127) There were some really good outcomes of the surgeries and then there were some that weren't as great . . . people could get kind of a picture of both. (Patient #150)

It was really good to see [from the pictures], oh, that's [my result] not that bad. . . . I got used to the image, so it's not a problem. But when you see yourself at the mirror, the first time, even if you think you're ready, you're not, so I think—the image [photos] is really good. (Patient #162)

*Theme 2: When asked specifically about the content, color, graphics, and aesthetics of the tool, some stakeholders suggested content or formatting edits [CFIR constructs: Design Quality Packaging and Compatibility]*

*Theme 2.1: Clinicians and informatics experts thought having more graphics will help women understand the information better.*

It's important that women see what it looks like in clothes also. (Clinician #132)

Using some more graphs or figures to summarize would be much easier for patients. (Informatics #102)

*Theme 2.2: The tool felt long at first to some stakeholders, but no one had suggestions for parts to remove, and in fact, many had suggestions for additions to consider. Most patients indicated that the tool was the right length.*

Because it's so sophisticated and thorough, it's very long, for people to go through . . . if they go through it, they're going to find it very helpful. I just think that they're going to have to be prepared. . . . They're going to have to know that this is . . . a lot of information. (Clinician #130)

It was a little bit lengthy, but there's a lot of considerations, when you're making that decision. So, I don't know how you would shorten it. (Patient #152)

You know, at first when I was looking at it, I said, "Oh, my God, this is long." But then as I got into it, it didn't really feel like it was because it was providing me with information that I needed. (Patient #159)

*Theme 3: When asked about possible challenges with integrating the tool within the EHR, some worried about the cost, timing, and security of integration, and suggested ways to simplify the programming [CFIR constructs: Adaptability, Cost, Complexity, and Intervention Source]*

*Theme 3.1: Informatics professionals worried about the expenses associated with developing and implementing BREASTChoice into the EHR.*

It comes at a cost because you have to be able to maintain it . . . and sometimes that can be difficult to do . . . as staff changes, the level of knowledge changes and the ability to do that—familiarity with how it works. (Informatics #109)

It's going to cost you a lot of money to build this. That's just the reality. (Informatics #101)

*Theme 3.2: Informatics professionals and patients expressed concern about the security of protected health information (PHI) and cautioned about the length of time to get the process approved.*

You'll need to make sure that you . . . discuss this with some of our legal representatives . . . you want to make sure that that data governance is very clear of who owns data and where it's stored and so that it's not, there's no PHI that's being shared. (Informatics #107)

We're really conservative from an information-security standpoint, so if it's not really in [the EHR] but it's essentially an outside tool, then how is it going to get information out? . . . those things are not trivial . . . you'd have to get all the right authorizations . . . going to link out of [the patient portal], and then you're pulling information back in, so just the general technical and privacy related to that. (Informatics #108)

I'm definitely curious about how safe it is. Like how is it being managed? You know, what's the chance of maybe being leaked to, third party companies or other for-profit people who just wanted my data for their money? (Patient #153)

So, the issue here is there is a [patient portal name] build. There's an [EHR] integration. There's an [EHR] calculator . . . there's multiple pieces here. This is a big build. (Informatics #101)

*Theme 3.3: Patients felt comfortable with the EHR auto populating the risk model with their health information, if that information would be safeguarded. It was important that patients could modify their health risk information in case some data were inaccurate or missing.*

As long as it's like a password-protected login situation, I'd probably be happy that they [health care team] had my information and knew who I was and my specifics. (Patient #151)

As long as it's all within the same medical channels, I don't have any problem with that. . . . I think it's good to have that information shared as long as it's not sharing that information with other private organizations that can use it to maybe target me for ads or like marketing or whatever that would be where I would not want things shared. (Patient #156)

You might actually get better information if you just ask patients directly [some of the risk questions] . . . all of the questions are things that I think most patients would be able to answer . . . with more reliability than pulling it from a health record. . . . Although it's cool to hook this up to the EHR, it might actually be easier to just have them answer. (Informatics #103)

*Theme 4: When asked about the best timing to deliver the tool, stakeholders differed in their perspectives, but felt that patients needed some time before or after a clinical encounter to process a cancer diagnosis to think about reconstruction [CFIR constructs: Implementation Climate and Other Personal Attributes]*

*Theme 4.1: Clinicians and patients had different opinions on when to deliver the tool.*

[The timing of sending them the tool?] . . . that's hard. I guess whenever they meet with a plastic surgeon . . . they're going to be discussing reconstruction. . . . I guess it depends on how soon they're having surgery if they're doing a mastectomy right away but aren't ready to go through the reconstruction process. That's a tough question. (Clinician #131)

Right after they're diagnosed, they come and talk to the breast surgeon. Most of the surgeons, then, either talk to them again after that, or they'll set them up for another appointment. I think after that they need a little bit of time to process what this diagnosis is. So, I think if you do it [send out the link], say a week after their diagnosis—that might be helpful. (Clinician #133)

At least for me, I was trying to plan and schedule everything, and they're like oh, three weeks for an appointment, you know, four weeks for this if you have this, cool. In that time while you're waiting, you would feel somewhat productive, and then you would have the information to take to the different doctors. (Patient #155)

*Theme 4.2: Informatics professionals and patients emphasized making the tool accessible from multiple devices, to maximize flexibility for patients.*

Making it as accessible as possible, so giving them an option of how to do it, whether on the computer and a mobile device, letting them do it at home or in the clinic, so having some flexibility. (Informatics #107)

That's another reason why a link from an email is good because you can go there from your phone or from your laptop. Because . . . you're sitting at chemo and your infusion, but you're on your phone. You're probably not bringing your laptop. And then, you're home resting. Then, you're on your laptop because you don't want to be holding your phone. (Patient #151)

*Theme 4.3: Clinicians and patients differed regarding where patients should complete the tool.*

The only hesitation that I have with them doing it in the waiting room is that we generally have a mix of patients . . . it may make the breast patient uncomfortable to, have pictures of different kind of breast reconstruction and then the guy next to her is there for a broken hand, and he's like, "Oh, what's that?" (Clinician #129)

Making it as accessible as possible, so giving them an option of how to do it, whether on the computer and a mobile device or letting them do it at home or in the clinic, so having some flexibility with how patients are able to use it. (Informatics #107)

I would think [patients should complete it] at home. You know, when you're in the waiting room, there's distractions when—and you don't know how long you're going to wait, so you might get halfway through the tool, and they call you back. I think—at home would—be the least distracting and would enable you [the patient] to complete it all in one sitting. (Patient #152)

*Theme 5: Stakeholders commented that institutional support is important before implementation; several clinicians and informatics professionals mentioned individual champions to contact about BREASTChoice implementation [CFIR constructs: Implementation Climate, Engaging, Champions]*

*Theme 5.1: Clinicians and informatics experts suggested that we include key personnel within health institutions to encourage potential uptake of the tool.*

The other cancer plastic and reconstructive surgeons that I work with would all very much support and embrace the

concept and use of something like BREASTChoice. (Clinician #121)

The first hurdle is finding the right stakeholder group [to approve the CDS process]. Once you find the stakeholder group, making sure that the request gets there and is represented . . . the stakeholder group is really the most important one, so make sure the project's vetted and it's, aligned with our organizational goals [listed several informatics professionals to contact]. (Informatics #105)

When I say showing the benefit, I mean, showing that it applies to both the patient and clinician who is seeing that patient, too. Because the more accurate information and the more people that use the tool the more likely it is that people are going to keep using it. As well as the more informed the clinician's going to be when they see that patient at that visit. (Informatics #109)

*Theme 5.2: Clinicians and informatics experts indicated it might be difficult to implement a new tool that would alter clinicians' routines.*

All of us have a very wide variable practice pattern even though we are all fellowship-trained, surgical oncologists, breast surgical oncologists. And, we also have varying lengths of practice having been in practice and so I think there's going to be a ton of variation in usage. (Clinician #126)

I think anything new that comes out, especially even with clinicians sometimes they're so used to their routine that introducing new changes to them can be difficult to adopt without you proving why it's useful. So, I think, that the marketing and adoption piece is probably the thing that I would think would be the most difficult, even if us looking at it and go like, "Huh. This is a great tool." (Informatics #109)

## Discussion

This project explored stakeholder perceptions of implementing a CDS tool into routine care. Stakeholders felt BREASTChoice could support shared decision making if delivered at the right time during the care pathway. Many stakeholders had no strong preference for where to place the summary of risk and preferences in the EHR but wanted guidance and a brief training to help them identify the location and remember to look there prior to an encounter. Informatics professionals cautioned about the cost associated with building and maintaining the tool and gave us insight into the importance of testing the tool using an external link prior to integration into

the EHR. They also suggested ways to maintain the privacy of patients' health information when integrating a tool into the EHR. All stakeholders acknowledged the importance of flexibility in accessing the tool from various devices and getting buy-in from key leaders at the organization to support routine adoption. Several participants mentioned specific clinician and informatics champions to engage. Overall, findings suggest that CDS tools should be designed with extensive stakeholder engagement and that usability testing can be built into project timelines to address workflow and security concerns before implementation.

It is important to engage multiple stakeholder groups to ensure that tools designed to work within health care systems respond to the unique needs and goals of each. Integration processes involve several approval stages, interfacing with informatics teams and the appropriate governance groups at each study/implementation site.<sup>14,15</sup> Moving forward, the tool could be automated and emailed to the participants who are eligible and give consent. Clinicians did mention clinical nurse coordinators as possible people to send the tool to patients.

Results are consistent with past work exploring stakeholder perspectives about CDS.<sup>5</sup> For example, in the context of cardiovascular health, clinicians were satisfied with CDS tools to support decisions, though they raised concerns about how to incorporate the tool into routine care due to workflow and time constraints<sup>16</sup> that could be addressed through usability testing and stakeholder engagement. Similarly, a scoping review analysis on CDS tools found an increased interest in communication between clinicians and patients and an increase in clinician knowledge about patients' health after using these tools.<sup>11</sup> CDS tools can improve patient-centered care and enhance health outcomes<sup>17</sup> when barriers to implementation are addressed. Several stakeholders commented on the importance of collaboration across multiple professional backgrounds to design and implement a CDS tool such as BREASTChoice.

## *Strengths and Limitations*

This project engaged stakeholders from across geographic areas and practice sites, using principles of designing for dissemination<sup>18</sup> and the CFIR framework to increase the likelihood that the CDS tool can be incorporated into routine care.<sup>12</sup> This process provided input on data integration and privacy concerns from each site. Interview questions were open-ended and allowed participants to express their views in-depth. Limitations of these interviews is that they were primarily conducted at





sites familiar with implementing CDS in EHRs and thus might not reflect the viewpoints of those who are less experienced with the process. In addition, we did not send a live, EHR-integrated tool during this step, because we had planned to incorporate feedback from these stakeholders into the content, format, workflow process, and EHR based components of the tool prior to EHR integration. We did not include non-English-speaking patients in this study or create a CDS tool in a language other than English. Patients were also mostly insured and might not represent the needs of the general population of women considering post-mastectomy breast reconstruction. Additionally, patients contacted through the community and national organizations might have more knowledge about breast cancer compared to women who are not. Few nurses and other support staff participated, and they might counsel women about breast reconstruction, in addition to surgeons. Informatics experts were from institutions that used the same EHR platform (Epic) in their work, though they had experience with others; other EHR systems may present unique barriers to CDS implementation.

## Conclusion

Developing and implementing CDS tools requires extensive stakeholder engagement to ensure clinical utility and applicability. Usability testing and institutional support can help address workflow and resource limitations that might emerge during formative work. Future studies will evaluate the implementation process for BREASTChoice, assessing both clinical and implementation outcomes to strengthen support for broader dissemination.

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## Supplemental Material

Supplementary material for this article is available on the *Medical Decision Making Policy & Practice* website at <https://journals.sagepub.com/home/mpp>.

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