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Research and Applications

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Research and Applications

Opportunities for addressing gaps in primary care shared decision-making with technology: a mixed-methods needs assessment

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ABSTRACT

Objectives: To analyze current practices in shared decision-making (SDM) in primary care and perform a needs assessment for the role of information technology (IT) interventions.

Materials and Methods: A mixed-methods study was conducted in three phases: (1) ethnographic observation of clinical encounters, (2) patient interviews, and (3) physician interviews. SDM was measured using the validated OPTION scale. Semistructured interviews followed an interview guide (developed by our multidisciplinary team) informed by the Traditional Decision Conflict Scale and Shared Decision Making Questionnaire. Field notes were independently coded and analyzed by two reviewers in Dedoose.

Results: Twenty-four patient encounters were observed in 3 diverse practices with an average OPTION score of 57.2 (0–100 scale; 95% confidence interval [CI], 51.8–62.6). Twenty-two patient and 8 physician interviews were conducted until thematic saturation was achieved. Cohen's kappa, measuring coder agreement, was 0.42. Patient domains were: establishing trust, influence of others, flexibility, frustrations, values, and preferences. Physician domains included frustrations, technology (concerns, existing use, and desires), and decision making (current methods used, challenges, and patients' understanding).

Discussion: Given low SDM observed, multiple opportunities for technology to enhance SDM exist based on specific OPTION items that received lower scores, including: (1) checking the patient's preferred information format, (2) asking the patient's preferred level of involvement in decision making, and (3) providing an opportunity for deferring a decision. Based on data from interviews, patients and physicians value information exchange and are open to technologies that enhance communication of care options.

Conclusion: Future primary care IT platforms should prioritize the 3 quantitative gaps identified to improve physician–patient communication and relationships. Additionally, SDM tools should seek to standardize common workflow steps across decisions and focus on barriers to increasing adoption of effective SDM tools into routine primary care.

Key words: primary health care, decision making, medical informatics, physician–patient relations, needs assessment

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INTRODUCTION

National policy such as the Health Information Technology for Economic and Clinical Health (HITECH) Act, has promoted technology to become a larger part of healthcare delivery.[1] This has driven clinicians to adopt electronic health record (EHR) systems in both inpatient and outpatient settings with 96% of nonfederal acute care hospitals and over 86% of office-based physicians reporting adopting some type of EHR in their practices by 2015 and 2017, respectively.[2,3] There is evidence that technology has improved patient safety, organizational efficiency, and patient satisfaction in healthcare.[4–6] In the decades that have passed since, there has been a significant effort to utilize technology to improve all aspects of health care.[7,8]

Recent studies have shown that patients demonstrate a willingness to utilize technology to engage with their health care such as with mobile applications or internet resources.[9,10] In a 2017 study surveying 121 patients in the Chicago metropolitan area, interest in a mobile health app for patient education was 63.7% and increased to 68.4% when physicians referred the app.[11] In addition, there is emerging evidence that increased patient engagement leads to better outcomes and increased patient satisfaction.[12] Technology is increasingly becoming an accepted medium through which to provide access to information and may represent an opportunity to reach historically difficult to access populations including adolescents, young adults, low-income populations, less educated adults, and those with unstable home addresses as these populations have the highest rates of mobile phone usage.[13–15]

One major challenge with current technological solutions is that they often focus predominantly on either the provider or the patient without considering both parties together to make a joint informed or shared decision. However, research and technology is starting to focus on these joint decisions with benefits to both the patients and providers. An example of this can be seen with a patient-centered clinical decision support app created by one of the authors that was used in the emergency department for minor head injury and resulted in an increased awareness of the utility of CT imaging after head injury for patients with a high degree of clinician acceptability.[16] Decision aids are a particularly appealing tool because they can be individualized to treatment options and patient conditions, contributing to a more patient-centered approach to primary care as has been well documented with diabetes.[17,18] However, barriers remain to the widespread adoption of such tools. These include perceptions among clinicians that such tools may reduce professional autonomy, incur additional medico-legal responsibilities, and impose new technical and usability problems.[19]

Over the last several decades, clinical practice has evolved to place greater value on patient involvement in making personal health care decisions.[20] Patient-centered care is reflected in SDM practices, which emphasize information exchange between the patient and physician, as well as their joint involvement in deciding on a treatment plan.[21,22] Prior work has noted the difficulty of implementing SDM due to limited time, training, and available decision aids.[23] To date, analyses have mostly focused on paper-based decision aids and have suggested improvements in patient engagement with decision making. The attitudes of clinicians and patients toward incorporating technological solutions into this process have remained unexamined. Therefore, in this study, we aimed to assess the current level of the quality of SDM in primary care clinical encounters and to perform a needs assessment for opportunities for SDM that could benefit from health information technology (IT) interventions. This information can be used to inform development of applications or platforms that foster communication and SDM between the clinician and patient for decisions such as chronic disease medications, contraception, or screening test options. Our long-term goal is to inform the development of IT solutions that improve SDM in primary care.

OBJECTIVES

Though the use of technology in health care delivery has expanded in recent years, few health (IT) tools exist that can be used jointly by patients and physicians during a clinical encounter.[16] In this study, the current extent of shared decision-making (SDM) in primary care was measured and a needs assessment for health IT interventions was conducted to identify key gaps for future IT development to improve clinical experiences for both patients and physicians.

MATERIALS AND METHODS

Study design

This was a mixed-methods study conducted in three phases: (1) ethnographic observation of clinical encounters, (2) patient interviews, and (3) physician interviews. Patients and clinicians were interviewed and observed at three separate outpatient clinic sites. Verbal consent was obtained from all study participants prior to clinical encounter observations and interviews. Neither patient nor physician study participants were compensated for their involvement in the study.

The study protocol (ID #2000022272) was reviewed by our institution's IRB and deemed exempt under (Category 2) 45 CFR 46.101(b)(2) for research involving use of interview procedures or observation not recorded in a manner that leaves subjects identifiable.

Study setting and population

The practices were purposively selected based on their representativeness of academic and private locations, lower and higher socioeconomic patient populations, and urban and suburban settings. Study participants were drawn from three practice settings in southern Connecticut known to the authors between January 19, 2018 and January 31, 2018: (1) an adult primary care resident clinic in an urban, community hospital; (2) an HIV/AIDS clinic in an urban, academic hospital; and (3) a primary care office in a suburban community. Observations and interviews continued until the multidisciplinary team determined that thematic saturation had been achieved.

At site (1), approximately 288 patients are seen per week, 87% are covered by Medicare/Medicaid, and on average 20 health care providers including attendings, residents, APRNs, PAs work on a given day. At site (2), 35–40 patients are seen per week, approximately 80% are covered by Medicare/Medicaid, and 3–9 health care providers work on a given day. At site (3), 380–400 patients are seen per week, approximately 60% are covered by Medicare/Medicaid, and on average 5–7 healthcare providers work on a given day.

Patients whose primary language of communication during the clinical encounter was not English were excluded from the study.

Physician participants were recruited by email outreach for sites (1) and (2), and by phone call for site (3).

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Study protocol

Patient encounter observations

Trained observers, A.M. and S.O., observed clinical encounters and recorded field notes. The observers identified problems undergoing a decision-making process by the patient and physician. During a single encounter, multiple problems requiring a decision were sometimes identified. The observers scored separate decisions from the same encounter independently of another using the OPTION scale (Supplementary Appendix S1) for each, a validated 12-item inventory developed for use by external observers to assess overall SDM.[24] Each OPTION item is evaluated with a Likert scale ranging from 0 (strongly disagree) to 4 (strongly agree), summing to a raw total score between 0 and 48. The raw total score is then scaled to range from 0 to 100. Higher scores indicate stronger SDM practices were observed. Each OPTION item assesses a separate aspect of SDM meaning that scores can be used to identify specific aspects of SDM that are strong or weak.

Patient interview guide development and interviews

Our multidisciplinary research team included a pre-med student with clinical research experience, 3 primary care residents with previous work experience in the health IT industry, and a clinical informatics researcher with extensive qualitative research experience. The multidisciplinary team developed a preliminary semistructured patient interview guide (Supplementary Appendix S2) to determine patients' perceived level of involvement in clinical decision making and their ideas for resources that could increase their comfort with decision making. The interview guide was developed with reference to the validated Traditional Decisional Conflict Scale[25] and underwent iterative revision throughout data collection in response to the quality and relevance of data gathered. Trained interviewers, A.M. and S.O., conducted one-on-one interviews with patients after their clinical encounters. Field notes were recorded on paper and later transcribed for qualitative analysis. An anonymous key was assigned to each patient and data was recorded on the major decision made during the encounter.

Physician interview guide development and interviews

The multidisciplinary team developed a preliminary semistructured physician interview guide (Supplementary Appendix S3) to assess physicians' current use of IT during clinical encounters and the capacity of IT to improve SDM practices. The interview guide was developed with reference to the validated Shared Decision Making Questionnaire (physician version)[26] and underwent iterative revision throughout data collection in response to the quality and relevance of data gathered. Trained interviewer A.M. conducted one-on-one interviews with physicians. An anonymous key was assigned to each physician and data were collected in a word processor during the interviews.

Data analysis

OPTION data from the observed encounters were analyzed using descriptive statistics to describe overall SDM performance. For each of the 12 items within the OPTION scale, the average score and standard deviation across encounters were computed.

Data collected from patient and physician interviews were formatted and uploaded by S.O. into Dedoose (version 8.0.42; Socio-Cultural Research Consultants, LLC; Los Angeles, CA, USA), a web-based application for qualitative data analysis. S.O. and S.K. independently identified relevant excerpts from the data and coded them within Dedoose. Notes were analyzed using the constant comparative method of grounded theory, an iterative coding process to establish a hierarchy of domains and themes.[27] To test inter-rater reliability, Cohen's kappa was calculated using the Dedoose Training Center. A third reviewer, A.G., was blinded to the themes assigned by S.O. and S.K., and independently assigned themes to the data excerpts. The data excerpts were then jointly reviewed by A.G. and S.O. to reconcile discrepancies and refine the original themes. A coding manual was then created describing each theme and organizing them into a hierarchy under larger domains. This manual was then analyzed by the other members of the research team for final approval.

RESULTS

Between January 19, 2018 and January 31, 2018, 24 encounters were observed and scored using the OPTION scale, and 22 patient interviews with patients and 8 physician interviews were conducted until thematic saturation was achieved.

Demographic characteristics of the study subjects are reported in Table 1. The patients interviewed and observed were representative of the patient populations in sites (1), (2), and (3): 58.3% male, 33.3% Black or African American, 12.5% Hispanic or Latino, and 87.5% covered by Medicaid or Medicare. The physicians interviewed were: 62.5% male, 25% Hispanic or Latino, and had an average 5.4 years of experience practicing primary care.

A.M. and S.O. conducted ethnographic observations of 24 encounters (A.M. 22 of 24 and S.O. 2 of 24) that encompassed 26 medical decisions (Supplementary Appendix S4). The OPTION scale data from encounter observations were analyzed to identify additional areas for improvement in SDM. On a scale of 0 to 48, the mean of total scores was 27.5 (95% confidence interval [CI], 24.9–30.0). Adjusted to a scale from 0 to 100, the mean was 57.2 (95% CI, 51.8–62.6). Average raw scores per item in the OPTION scale are reported in Table 2, on a scale of 0 to 4.

During the 24 observed encounters, the highest average scores on the OPTION scale were in items 1, 2, and 3 (the clinician identifies a problem needing a decision-making process, the clinician *states* that there is more than one way to deal with an identified problem ["equipoise"], the clinician *lists* "options" including the choice of "no action" if feasible). The lowest average scores were in items 5, 10, and 11 (the clinician checks the patient's preferred information format [words/numbers/visual display], the clinician asks for the patient's preferred level of involvement in decision making, an opportunity for deferring a decision is provided).

Cohen's kappa, measuring agreement between coders in the qualitative side of this study, was 0.42. The revised coding manual was used to produce the domains and themes from patient and physician interviews presented in Table 3.

From the patient interviews, we identified 5 domains (establishing trust, influence of others, patient flexibility, patient frustrations, and patient values and preferences) with 21 key themes that reflect patients' priorities and experiences with health-related decision making. From the physician interviews, we identified 8 domains (concerns with technology, current methods used in decision making, education and information gathering, existing decision challenges, existing use of technology, frustration, patient understanding of decision, and technology wish list/desires) with 30 key themes that reflect physicians' current use of IT and needs for further use in SDM. These domains and themes were reviewed and approved by all members of the research team and are reported in Table 3.

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Table 1. Baseline characteristics of the study subjects (patients and physicians)

Characteristic	Patients		Physicians	
Number of participants	24		8	
Age (years), mean (range)	50.5	(32–77)	32.9	(28–51)
Sex				
Male	14	(58.3)	5	(62.5)
Female	10	(41.6)	3	(37.5)
Race				
Black or African American	8	(33.3)	0	(0)
White	14	(58.3)	8	(100)
Asian	1	(4.2)	0	(0)
Other	1	(4.2)	0	(0)
Ethnicity				
Hispanic or Latino origin	3	(12.5)	2	(25)
Not of Hispanic or Latino origin	21	(87.5)	6	(75)
Hospital type				
Academic	19	(79.2)	6	(75)
Community	5	(20.8)	2	(25)
Education				
Some vocational training	2	(8.3)		
Some school	4	(16.7)		
Some high school	2	(8.3)		
High school	6	(25)		
Some college	5	(20.8)		
College graduate or higher	5	(20.8)		
MD	N/A		8	(100)
Insurance				
Private/HMO	2	(8.3)		
Medicaid	12	(50)		
Medicare	9	(37.5)		
Uninsured	1	(4.2)		
Experience (years), mean (range)	N/A		5.4	(1–25)

HMO: health maintenance organization; MD: doctor of medicine.
Note: Data are reported as *n* (%) unless otherwise noted.

Patients frequently mentioned that trust and relationships, whether with physicians or their family and friends, were important factors in their decision making. Patients wanted to feel informed and involved in the decision-making process in order to personalize their medical care to their preferences. When patients felt these needs were met, it resulted in increased patient engagement in decision making. When patients felt ignored or uninvolved, they felt frustration with their physicians and dissatisfied with the decision overall.

Physicians valued being able to accurately convey information about clinical options to patients and were interested in the potential of IT interventions to facilitate patient-centered decision making. Awareness of the potential negative, or distracting, impacts of IT in a clinical encounter made some physicians cautious about its incorporation into their workflow.

Representative quotes from patients and physicians that illustrate many of the key themes are reported in Table 3.

DISCUSSION

From ethnographic observation of 24 clinical encounters and subsequent scoring using the OPTION scale, we found that within the context of a shared medical decision, physicians regularly identify a problem that needs a decision-making process, state there are multiple options (equipoise), and list available options. We also found that physicians did not reliably check a patient's preferred information format, preferred level of decision-making involvement, or provide opportunities to defer a decision until a later date. Additionally, we identified items from the OPTION scale that physicians only sometimes performed, such as exploring patients' expectations or ideals on how a problem can be managed, exploring a patient's fears or concerns, verifying patient understanding, allowing opportunities for patients to ask questions, and setting a follow-up date to review the decision. These data reflect the practice variation between physicians and the difficulty in performing a complete set of steps to encompass a decision, which can be influenced by a variety of factors such as background, training, patient volume, and level of autonomy.[28]

During interviews, we found that patients repeatedly mentioned the effect of trust and relationships on decision making and a desire to feel informed and engaged in the process in order to personalize their ultimate decision to their preferences, values, and goals. We found recurring themes ("Trust in the doctor," "History of good communication," "Decision based on information from friends/family") that reflected the importance patients placed on close relationships in decision making. On the other hand, themes such as "Patient is frustrated with the doctor," "Patient is frustrated with the outcome," and "Not actively involved in decision making" demonstrated the resulting dissatisfaction when this process went poorly. When patients did mention the impact of technology, it was in regards to how it would fit into this framework, as noted by the themes, "Values having information to take away" and "Values tracking health using technology." Overall, we found that patients were most concerned with the provider–patient relationship and considered technology an underutilized resource for strengthening the relationship. Providers should be mindful that patients might evaluate technology by different criteria than themselves and that the impact on the patient–provider relationship should be considered prior to adopting new technologies in their practice.

We found that physicians valued being able to accurately convey information about clinical options to patients ("Desires to convey full list of medical options"), even if it were currently difficult in practice ("Challenging to present accurate cost information", "Balancing the amount of information presented"). Clinicians expressed a complicated relationship with technology, conveying optimism that it may improve their ability to communicate with patients ("Values simplified patient-facing tools" and "Values visual presentation of data") yet also skepticism about how this would happen in practice ("Concerns about technology taking doctor's attention away from the patient," "Cost burden of technology," and "Challenging to incorporate existing technology").

The mixed-methods nature of this study allowed for quantitative identification of specific areas for improvement in SDM, as well as qualitative exploration of themes, factors, issues, and ideas patients and physicians consider important. The quantitative analysis of the OPTION scale data complemented our qualitative approach to interview analysis and helped us identify areas for improvement that may have otherwise been overlooked. Multiple coding by two independent reviewers, as well as revision of codes in collaboration with a third independent reviewer, increased the rigor of our qualitative analysis.

Our study had several limitations. In general, a qualitative needs assessment focuses on a small, targeted sample to establish initial needs. The generalizability of our findings is limited as a result. The sample sizes of patients and physicians were relatively small. Additionally, while the authors had pre-existing relationships with each

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Table 2. OPTION scores from encounter observations by inventory item

OPTION scale item	Average score (0–4)	Standard deviation
(1) The clinician identifies a problem(s) needing a decision-making process	4.0	0.0
(2) The clinician *states* that there is more than one way to deal with an identified problem ("equipoise")	3.6	1.1
(3) The clinician *lists* "options" including the choice of "no action" if feasible	3.5	1.1
(4) The clinician *explains* the pros and cons of options to the patient (taking "no action" is an option)	2.9	1.2
(5) The clinician checks the patient's preferred information format (words/numbers/visual display)	0.0	0.2
(6) The clinician explores the patient's expectations (or ideas) about how the problem(s) are to be managed	2.7	1.3
(7) The clinician explores the patient's concerns (fears) about how problem(s) are to be managed	2.3	1.4
(8) The clinician checks that the patient has understood the information	2.5	1.1
(9) The clinician provides opportunities for the patient to ask questions	2.5	1.1
(10) The clinician asks for the patient's preferred level of involvement in decision making	0.0	0.0
(11) An opportunity for deferring a decision is provided	1.0	1.7
(12) Arrangements are made to review the decision (or the deferment)	2.4	1.8

of the practices selected, sufficient data were gathered to allow for thematic saturation and subsequent qualitative analysis.[29] The sites were intentionally selected to reflect demographic diversity. The physician sample was less representative of the general population of physicians and was weighted disproportionately towards young, white physicians compared to national level demographic data on physicians, which indicate 72.5% of primary care physicians are white[30] and the average American physician age is 52.04.[31] Given increasing interest in SDM in recent years, the physicians involved in our study may be biased towards performing SDM and its practice among the older general population of physicians may be rarer than observed here. Notably, when observers noted an opportunity for a clinical decision, the physician was often responsible for guiding the decision-making process. This may have led to some missed decision-making opportunities that clinicians did not explicitly identify. However, this is a natural limitation of all time-limited encounters, where clinicians must ensure important topics are addressed.

We used the OPTION scale to identify aspects of SDM that were deficient and, therefore, potentially amenable to high quality IT solutions. However, these deficient areas may benefit from non-IT related solutions as well. Because data collection was conducted during a single 2-week period, we were unable to assess temporal trends. We used a single OPTION scorer per clinical encounter to establish internal consistency in the quantitative data collection. However, a more rigorous methodology would utilize 2 reviewers with high inter-rater reliability scoring encounters simultaneously, while blinded to one another's scores. Future researchers may consider collecting data over a longer period of time, deliberately selecting a more representative physician sample, and involving an additional independent OPTION scorer in encounter observations.

The Cohen's kappa of 0.42 indicated moderate agreement between coders in the qualitative analysis. We attribute this to the inclusion of some overlapping and redundant codes in the original coding manual. This was addressed by the coders collaboratively revising the coding manual after calculating Cohen's kappa to eliminate unnecessary codes and refining the definition of each key theme. To mitigate coding discrepancies, the updated coding manual and final codes were reviewed and approved by all members of the team.

Compared to other studies, we chose to focus on the overall medical decision-making process in adult primary care clinics and interviewed both patients and providers instead of focusing on a single party,[32] decision or medical condition. While this increased the ability to draw generalized themes from the SDM process, it did limit the ability to analyze SDM using specific decision aids such as with statin initiation[33] or for specific medical conditions such as cancer care[34] and osteoarthritis of the knee.[35] Past studies report overall scaled OPTION scale scores between 14.3 and 49.7.[36,37] We found a higher overall scaled OPTION score of 57.2 in our study population, which is likely due to multiple factors including subjective scoring assessment, the sample of physicians observed (mainly recently trained in a program emphasizing shared decision making), and clinical practice changes compared to years prior, when past studies were conducted.

Unlike previous studies on physician-implemented SDM tools during the clinical encounter, our findings suggest a reconsideration of how best to engage patients and physicians in SDM. Physicians hesitate to incorporate SDM tools into clinical encounters because of concerns about the quality of their content and disruption to the regular workflow,[38,39] and our results illustrate their reluctance may extend to SDM practices in general. Using SDM tools solely during the clinical encounter may be inadequate in meeting patient and physician needs, as patients value making "decisions based on information from friends/family" and over longer time periods. Instead, our findings suggest a more successful approach may be a patient-facing SDM aid that is accessible to patients before and during the clinical encounter which they can engage with at their convenience and their preferred desired level of involvement. Compared to current SDM tools, such a design has the potential to combat asymmetric information exchange between patient and physician during the clinical encounter, and provide patients with the information they need to make the best possible decision.

An analysis of the needs assessment for SDM demonstrates several key findings based on positive and negative experiences described by patients and physicians. Patients mainly value trust in their physician, which is encompassed in understanding the decision to be made along with the manner in which it is communicated. While one theme showed that patients placed trust in relationships such as friends and family for help with medical decisions, more themes were expressed relating to trust in their doctor. Patient interviews also highlighted the need to encompass patient-specific values, preferences, and goals, which is an area that can be improved as noted previously.[22] Our interviews revealed a way to address patient frustrations by actively involving them in decision making. Current technology often impedes physician–patient communication. However, technology has the potential to improve communication and decision making,[40] and the needs assessment presented here demonstrates a path forward to do so.

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Table 3. Domains, key themes, and representative quotes from patient and physician interviews

Domain	Theme	Quote
Patients		
Establishing trust	Patient understands the scope of options that exist and feels able to make an informed decision	"[I know] the facts and what should be expected."
	Trust in the doctor	"I trust the doctors here. . . I trust you guys. This has been my primary care for years. My wife, my son, everybody comes here."
	Having a plan	"[I am] totally relieved to have a plan to help me feel better."
	History of good communication	
	Patient seeks doctor's approval	
	Patient has an understanding of their medical condition	
Influence of others	Decision based on information from friends/family	
Patient flexibility	Patient willingness to explore available options	
Patient frustrations	Patient is frustrated with the doctor	"Everybody knows their body" [but I was] "shot down" [by the doctor].
	Patient is frustrated with the outcome	"[I] didn't come out with any more information than I came in with."
	Lack of information	
	Technology too complicated	
	Not actively involved in decision making	
Patient values and preferences	Personal ownership of choice	"The choice was mine at the end."
	Importance of cost	"I don't want this to be used as somebody's money."
	Avoiding negative side effects	"I will tell you right now, if I start to take the medication and I get those side effects, I'll stop taking it. Right now, I have no problems with my legs."
	Values having information to take away	
	Active involvement in decision making	"[I value] how much I am involved, decision-wise."
	Importance of preserving quality of life	
	Value of visuals	
	Values tracking health using technology	"[I use the online chart] a lot. . . it's great because everything is there, even the test results."
Physicians		
Concerns with technology	Concerns about technology taking doctor's attention away from the patient	
	Aversion for technological assistance for easy/quick decisions	"I feel like I remember enough to not need it. I turn to technology when it is something out of my experience, something I don't recall, or when it will be helpful to show the patient something."
	Role of technology in improving current workflow	"In the setting of actually seeing a patient, it [technology use] has to be efficient."
	Frustration with technology limitations	"Our current technology is not very good at tracking the status of things. . . When I place a referral, it is hard to know whether it is acted on or not, and why or why not."
	Challenging to incorporate existing technology	"There's a lot [of technology] out there, but it's [important] knowing how to use it and then having shared decision making with the patient."
	Cost burden of technology	"[I don't] get reimbursed for what I am doing at a higher quality."
Current methods used in decision making	Customizes options presented to patient	"Very commonly the comorbidities are giving me a preselection [of options, such as]. . . if someone has to do P.T. but they have bad knees and cannot go."
	Values clinical decision support	"I think one nice thing is sometimes now we prescribe a medication and it will remind you to check that certain labs have been checked and follow-ups are in place."
	Avoids using technology during encounter	"There could be the latest and best application that is life-saving and I wouldn't use it during the [initial] encounter."
Education and information gathering	Consulting experts or reference guidelines or evidence-based tools	"[I consult an] expert pharmacist who is a master of these medications [or use reference guidelines as a] framework for decision making."
	Values established evidence-based tools	"I would only go to websites like the Mayo or Cleveland Clinic or medical journals; the source that I choose is a source that I trust."
	Expanding knowledge through continuing education	
Existing decision challenges	Prioritization of patient values	"We decide together. I give them a couple of options and we discuss the pros and cons of each option. I tell them the best options and if the patient doesn't agree, then we can discuss it further until we are able to get to a resolution together."
	Balancing the amount of information presented	"It is always a delicate balance between the amount of information you present and how much is needed for a shared decision. The biggest thing

(continued)

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Table 3. continued

Domain	Theme	Quote
Patients		with our clinic is an asymmetry of information. . . when one party has a huge amount of information and one doesn't. Typically I'll present all of the options that I think are beneficial to their health, with always the option of not doing them, but preferring we do it."
	Reliance on memory or prior experience	
Existing use of technology	Comfort with using technology during an encounter	"I've definitely pulled up UpToDate during the encounter as well. . . even if they come in with something basic. I feel pretty comfortable with using it in the room. And most patients are pretty good about it too."
	Values patients using existing technologies	
	Extensive use of technology tools	
Frustration	Challenging to present accurate cost information	"Cost is a little tricky because the cost to the patient will be very variable depending on what insurance they have, copays, etc."
Patient understanding of decision	Using teach-back method for patient understanding	"[I] ask them to repeat [the decision] back to me in their own words so I can assess if they understood."
	Values resources to send home with patients	
	Enable patient autonomy	"I usually try to use shared decision-making principles which include letting the patient decide what option they would like."
Technology desires/wish list	Simplify workflow where possible	"I'd like to get the information with far fewer clicks. The other thing that would be useful is some sort of pop-up. If I order a test, has the status of anything changed since I last updated the patient's chart?"
	Values electronic validation tools	
	Desires easier access/use of technology tools	"I think we have [calculators] for the common things. . . but if you could just plug those things in to see what medication. . . that would be amazing. . . If we had easier access, definitely in this clinic we would all be using it."
	Physician desires increased patient engagement with technology	"In the perfect world, maybe there would be an interactive game or something to direct them to afterwards."
	Values technology to enhance knowledge or tasks	"I turn to technology when it is something out of my experience, something I don't recall, or when it will be helpful to show the patient something."
	Values visual presentation of data	"[I] would want something more visual and more accessible, both."
	Values simplified patient-facing tools	
	Desires to convey full list of medical options	"I tend to use a full spectrum of options available."

From the healthcare provider perspective, the needs were more varied as evidenced by the increased number of domains and themes identified. Ruiz Morilla et al.[41] found that "The ease-of-use of the electronic devices was of particular concern as was the need for incentives to use the technology," which was also consistent with the concerns about technology and the desires/wish-list domains raised by physicians in our study. Physicians also differed widely in their use of technology currently from preferring to avoid it during some situations but relying on it during others. This highlights the need for technology to meet physicians' and patients' actual needs (as reported here) and to fulfill specific use-cases rather than as a generalized solution. Other domains and themes revealed a focus on education or communication needs, which is appropriate given that the use of technology during encounters has been described as a barrier to effective communication.[42]

The role of new technologies in health care is increasingly accepted. The findings of this study provide a guide to SDM tool developers to address the lingering gap between existing technologies and the user experience for both patients and physicians. For patients, physicians, researchers, entrepreneurs, policy makers, and software designers seeking to increase communication and SDM in primary care practice, we recommend the following considerations based on our study.

1. Patients' preferences for technological platforms can vary widely and are often individualized. It is important that multiple tools are available for patients and providers to draw from in an encounter. Furthermore, physicians should actively elicit patient preference for a given platform.
2. The utility of an SDM tool is incumbent upon the patient and provider sharing a mutual interest in making a decision together. As such, it is important to evaluate the patient's preferred level of involvement prior to using a given tool.
3. Often, patients may prefer to defer decisions for which SDM is indicated for a variety of reasons. As such, SDM tools should provide an opportunity to defer a decision.

CONCLUSION

These findings are valuable for clinicians, patients, researchers, entrepreneurs, policy makers, and software designers seeking to increase communication and SDM in primary care practice. For those interested in pursuing IT interventions to address this common, yet complex, healthcare topic, an analysis of OPTION scale data identified three key areas to prioritize: (1) checking the patient's preferred information format, (2) asking the patient's preferred level of involvement in decision making, and (3) providing an opportunity for

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deferring a decision. These priorities all reflect a desire for increased engagement with decision making and should be incorporated into provider workflows. In its best use, IT can be a powerful tool to standardize and simplify these workflows and is particularly well suited to addressing these priorities. However, IT interventions may not be as desirable for the more personal aspects of medicine such as trust building, as patients feel that a provider is paying undue attention to the technology and not the patient. During interviews, patients expressed views on IT use in relation to potential effects on the patient–provider relationship. Further research is needed to assess the impact of adoption of technology on patient satisfaction with their provider. Physician interviews revealed that physicians desired new technologies to improve communication with patients or simplify their workflow, but they expressed hesitancy to incorporate new technologies. Our results are novel in that they suggest a change in approach for the development of SDM tools to begin placing a heightened emphasis on addressing barriers to their successful implementation into routine primary care. Additionally, this highlights the need for tools to standardize common parts of SDM across decisions and demographics to capture patient preferences that are critical to a successful shared decision. Entrepreneurs and software developers should consider these priorities and needs when designing products to maximize their adoption. We believe that when new technologies are implemented that consider these factors, they can positively address current deficiencies in SDM.

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AUTHOR CONTRIBUTIONS

All authors contributed to the study design. A.M. and S.O. were responsible for data collection. Qualitative analysis was conducted by S.O., A.G., and S.K. Quantitative analysis was conducted by A.M. All authors participated in drafting and revising the manuscript, and approved the final version of the manuscript.

SUPPLEMENTARY MATERIAL

Supplementary material is available at *Journal of the American Medical Informatics Association* online.

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CONFLICT OF INTEREST STATEMENT

None declared.

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