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Health informatics interventions to minimize out-of-pocket medication costs for patients: what providers want

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ABSTRACT

Objective: To explore diverse provider perspectives on: strategies for addressing patient medication cost barriers; patient medication cost information gaps; current medication cost-related informatics tools; and design features for future tool development.

Materials and Methods: We conducted 38 semistructured interviews with providers (physicians, nurses, pharmacists, social workers, and administrators) in a Midwestern health system in the United States. We used 3 rounds of qualitative coding to identify themes.

Results: Providers lacked access to information about: patients' ability to pay for medications; true costs of full medication regimens; and cost impacts of patient insurance changes. Some providers said that while existing cost-related tools were helpful, they contained unclear insurance information and several questioned the information's quality. Cost-related information was not available to everyone who needed it and was not always available when needed. Fragmentation of information across sources made cost-alleviation information difficult to access. Providers desired future tools to compare medication costs more directly; provide quick references on costs to facilitate clinical conversations; streamline medication resource referrals; and provide centrally accessible visual summaries of patient affordability challenges.

Discussion: These findings can inform the next generation of informatics tools for minimizing patients' out-of-pocket costs. Future tools should support the work of a wider range of providers and situations and use cases than current tools do. Such tools would have the potential to improve prescribing decisions and better link patients to resources.

Conclusion: Results identified opportunities to fill multidisciplinary providers' information gaps and ways in which new tools could better support medication affordability for patients.

Key words: electronic prescribing, drug costs, information seeking behavior, insurance, health, social determinants of health

Lay Summary

Almost a quarter of Americans taking prescription medications have difficulty affording them. We asked 38 healthcare providers what they do to help patients get affordable medications. They try to reduce the number of medications that patients take, choose more affordable medication options, and connect them to free medications or financial help. But it is hard for providers to do these things because they don't always know which patients have financial challenges, and they may not know how much medications cost patients. Healthcare providers use digital tools like ordering systems to pick medications for patients, but they do not always have clear price information and they do not help outside of healthcare visits with prescribers. It is also hard for healthcare providers to get information about what patients have difficulty affording medications, and about resources to help them. Healthcare providers want new and improved digital tools to help them choose medications, and to be able to compare exact medication price differences. They also want a visual sign for patients with financial challenges, and centralized information about cost reduction resources. Finally, they desire tools to help them talk to patients about mediation prices, and medication price reports for patients themselves.

INTRODUCTION

Medication costs in the United States are among the world's highest.[1] Of medications purchased in the United States, 70% include patient out-of-pocket costs[2] and 24% of adults taking prescription drugs have difficulty affording them.[3] Higher out-of-pocket costs are associated with greater odds of prescription abandonment[4] and cost concerns contribute to lower adherence of people with chronic conditions.[5,6] It is estimated that 20–30% of diabetes- and hypertension-related prescriptions are never filled.[7,8] Not taking medications as prescribed can worsen chronic conditions[3,9] and increase emergency room visits and hospitalizations.[10,11] Low-income patients are disproportionately affected by costs, especially when uninsured or underinsured.[12–14] African American and Hispanic populations have consistently worse chronic disease outcomes than Whites[15] and are most affected by cost-related adherence barriers.[16–18]

Many prescribers report considering patients' out-of-pocket costs in making treatment decisions. One US study showed that 78% of physicians routinely consider costs when prescribing generic drugs; a more common practice for those with larger proportions of Medicaid-insured patients.[19] A survey of nurse practitioners (NPs) found that they considered costs in 58% of prescriptions.[20] Prescribers also consider attention to patient medication costs important. A physician survey found that most believed it was important to minimize out-of-pocket cost (94%) and total cost (94%) when equally safe and effective medications were available.[21] Similarly, 90.3% of NPs in a US survey thought cost should be considered when prescribing.[20] To address costs, physicians and NPs report using strategies such as switching to generic medications,[22,23] although they are not always more affordable.[24,25] Physicians may also reduce costs by discontinuing nonessential medicines,[22] especially for older adults.[26,27] Additionally, providers often adopt patient-by-patient approaches to affordability challenges via resources like discounts, drug coupons, and assistance programs.[28,29]

Despite such documented efforts, several known barriers limit provider access to information needed to address patient medication affordability issues. Physicians face information gaps concerning list prices and copayments[21]; this may make it difficult for physicians to respond to copayment changes unless these are large and widely adopted across insurers.[30] Physicians and NPs may also have difficulty estimating list prices.[28] Furthermore, while patients can provide information concerning their needs,[31] and may influence prescribing decisions,[32] not all disclose cost barriers.[2,33] Expanded social and economic risk screening[34] may make financial information more available at the point of care. Published screening instruments often ask about financial strain, including payment difficulties.[35–37] However, it is unclear whether providers consistently have access to such information when developing treatment plans or addressing affordability barriers. Furthermore, the number and complexity of cost alleviation resources may limit both patients' and providers' abilities to navigate them efficiently. For example, some pharmaceutical companies offer charitable assistance programs that provide free or low-cost medications to eligible patients,[38] usually based on income and insurance access. Other charitable programs may have related restrictions, such helping only insured individuals.[39]

Multiple strategies have been proposed to address some of these barriers, and more systematically address patients' medication cost-related challenges.[40] Notably, price transparency to influence clinical decisions is receiving increasing attention, including policy efforts to prevent "surprise billing,"[41] for out-of-network providers.[42,43] For prescribing decisions, the Centers for Medicare and Medicaid Services (CMS) issued a rule requiring Medicare Part D health plans to adopt real-time benefit tools (RTBT) that integrate with e-prescribing or electronic health record (EHR) systems by January 1, 2021. Such RTBTs should provide "complete, accurate, timely and clinically appropriate patient-specific real-time formulary and benefit…information (including cost, formulary alternatives, and utilization management requirements)."[44] Multiple e-prescribing and EHR systems have launched RTBTs with price transparency features.[45–47] Some scholars advocate for EHRs to display drug prices,[48] and surveys show that healthcare providers want information about out-of-pocket medication costs and lower-cost alternatives.[49] Some RTBTs add cost information to after-visit summaries (AVSs), which may help surface patients' costs concerns. However, researchers criticize the CMS rule due to the lack of RTBT interoperability standards,[50] and evidence that EHR-based price transparency influences medication costs has been inconsistent.[51–59]

Furthermore, although new tools such as RTBTs may address prescribers' desires for point-of-care tools to recommend alternatives,[60] there has been little attention to the needs and perspectives of a range of providers engaged with addressing patients' medication affordability challenges, such as pharmacists, nurses, social workers, and advanced practice providers, in designing such tools. Pharmacists assist patients in identifying cost-effective insurance plans[61,62] and selecting lower-cost medications.[63,64] Nurses assess healthcare resource access,[65,66] including medications.[67] Social workers connect patients to cost-alleviation resources.[68,69] Yet, we know little about the cost-related information gaps diverse providers face, how current informatics tools support their work, and their design preferences for future tools.

Research aims and objectives

We investigated diverse providers' perspectives on medication cost information gaps and how they address patients' cost barriers. Further, we investigated perceived strengths and weaknesses of current cost-related information tools and potential informatics features that might improve cost-reduction efforts.

MATERIALS AND METHODS

Setting and participants

We recruited healthcare providers from a US not-for-profit community-based hospital system that includes 850 physicians and advanced practice providers, 100 clinics, and 9 hospitals, serving over 1 million patients across 15 counties in 2 Midwestern states. The system provides a variety of informatics tools to help clinical teams identify and address medication cost-related issues. These include EHR-based social needs screening/documentation tools in 8 of 14 clinical settings represented in the sample. Affordability resources include sources listed on a Sharepoint site and cost-related applications such as GoodRx on providers' devices. An EHR-based real-time eligibility (RTE) system handles prescription pre-authorizations. In February 2020, the system launched an EHR-integrated RTBT; interviews were conducted between March and September 2020. Only ambulatory prescribers could use the RTBT directly (see Table 1 for details regarding participant RTBT access). The RTBT contained insurance information from all major payers, including data for 88–95% of patients. Uncovered patients included uninsured patients or those whose insurers had not contracted with the RTBT vendor. When ordering medications for insured patients, clickable alerts indicated availability of lower-cost medications. When clicked, these presented alternatives based on copayment tier as a tier number or copayment amount. Medications with lower tiers could be substituted. Prior authorization information was updated simultaneously. The system could only consider 1 medication and 1 payer at a time and required staff pharmacy benefits verification during patient rooming. It also added information on medications and out-of-pocket costs to AVSs provided to patients on paper afterwards. At system launch, RTBT use instructions were distributed via email to all clinical providers.

We purposively sampled providers in clinical areas pioneering efforts to screen for and address patient social determinants of health (SDOH; $n = 19$ participants from 7 clinical areas)—of which financial strain and inability to afford medications is an example. We also sampled providers from clinical areas that had not implemented SDOH screening ($n = 19$ participants from 7 clinical areas). We captured a diverse sample of clinical settings and professional roles, including 5 participants with independent prescribing privileges, and 3 pharmacists who could prescribe or change prescriptions under a collaborative practice agreement. We also included providers who deal with medication affordability challenges in other ways (eg, nurses, social workers). A researcher (SRW) within the health system led email recruitment. Of 67 providers invited, 38 agreed to interviews (57%). Most who did not participate did not respond (23/29, 79%); 4 declined (14%); 2 were unable (7%).

Data collection

We conducted semistructured telephone interviews from March to September 2020. Many participants retained clinical duties despite the coronavirus disease 2019 (COVID-19) pandemic. SRW collected demographic information via a preinterview survey. SRW called

Table 1. Characteristics of study participants ($n = 38$)

Characteristics	Number	Percentage
Gender		
Male	6	16
Female	32	84
Age		
Mean/median	43/41	
Range	32–61	
Race		
White (non-Hispanic)	35	92
Black or African American	1	3
Multiracial	2	5
Clinical Area		
Cardiology	6	16
Family/Internal medicine	6	16
Population health	6	16
Community health/nursing	3	8
Women's and Children's	2	5
Home health	2	5
Inpatient care	2	5
Oncology	2	5
Outpatient surgery center	2	5
Pediatrics	2	5
Pharmacy	2	5
Endocrinology	1	3
Orthopedic/Neurology	1	3
Substance use/Mental health	1	3
Provider Profession		
Nurse	17	45
Social worker	6	16
Physician	5	13
Pharmacist	3	8
Medical assistant	3	8
Administration	2	5
Nurse practitioner	1	3
Pharmacy technician	1	3
Practice duration (years)		
Mean/median	15/14	
Range	1–38	
Length of employment at the health system (years)		
Mean/median	10/8.5	
Range	<1–38	
RTBT usage history		
Direct RTBT usage experience: Prescribers	4	11
Indirect RTBT usage and implementation experience: 1 prescriber and 2 nonprescribers	3	8
No RTBT usage: prescribers without RTBT access due to phased Implementation	3	8
No RTBT usage: prescribers with access who had not used	1	3
No RTBT usage: nonprescribers without RTBT access	27	71

interviewees, completed the consent process, administered the survey, and connected BEI and KAK for interviews. BEI (male, PhD candidate) conducted 45–60 minute interviews with KAK's assistance (female, PhD candidate). The research team collaboratively developed and pilot-tested the interview guide to ensure feasibility and clarity. Participants were aware of the research goal. Additionally, the team reviewed 7 social needs screening tools from interviewees' units.

In the initial 36 interviews, 2 participants were using the RTBT, 2 were not direct users but supported others using it, and 1 had been

involved in RTBT implementation but did not use it directly. To gain more focused information on the RTBT, the team used a supplemental interview guide to reinterview 1 provider involved in implementation and interview 2 new physicians about their RTBT experiences (see Table 1 for final details). Data saturation was reached when later interviewees' responses confirmed themes without contributing new content.[70]

Interviews were audio-recorded and professionally transcribed. BEI verified transcripts and them to NVivo for analysis. The team conducted open, in vivo, and structural coding in the first round, followed by second- and third-round focused coding to develop themes.[71] KAK was the main coder in the first and second rounds; BEI coded 20% to check inter-rater reliability. The kappa coefficient was 0.65, indicating "strong" agreement.[72] TCV was the main third-round coder, providing investigator triangulation and ensuring credibility.[73] TCV focused on refining themes and confirming evidence. For additional triangulation, other team members helped develop themes and evaluate evidence.[73] Codebooks were created for each round.

RESULTS

Participant characteristics

The average interviewee age was 43 (range 32–61); 84% were female (16% male), and 84% were non-Hispanic White (Table 1). Interviewees included nurses, social workers, pharmacists, administrators, and physicians, with an average of 15 years of clinical experience (range 1–38) and 10 years' experience at the health system. Seven participants (18%) had direct or indirect experience using the RTBT.

How providers report addressing medication cost barriers

When aware of barriers, most participants reported working toward reducing patients' costs. Three mentioned **reducing the amount of medication that a patient takes** (Table 2; main themes in the tables are bolded in the text) by deprescribing, or by improving patient health behaviors to reduce need. Another action was **prescribing comparable medication at lower cost**, reported by 14 participants, including physicians, pharmacists, nurses, and the NP. Prescribers learned about cost barriers directly from patients, or indirectly from other staff. They chose alternatives based on prior knowledge, recommendations from other providers such as pharmacists, or existing tools. Two physicians who used the RTBT indicated that it assisted; 1 stressed its value for surfacing insurance-related cost issues. Similarly, a pharmacist used the Medicare portal to identify lower-cost medications for Medicare-insured patients.

Sixteen providers attempted to **provide resources to help patients stay on current regimens**, including 7 prescribers (3 physicians, 3 pharmacists, and 1 NP). Prescribers have access to an in-system Medication Assistance Program (MAP) that provides prescription medications to patients who meet personal income criteria, and which is supported by the hospital foundation. The MAP was a key resource for 28 providers, but because some patients were ineligible, all mentioned other options. Community assistance through external organizations was available for select medications. Providers also used medication samples as shorter-term solutions.

Four participants—including 3 nurses—mentioned **resources to address other adherence barriers**, such as food assistance. Participants viewed transportation access as a significant barrier and con-

nected patients to transportation services or mail-order pharmacies. Two described physically delivering medication to patients' homes.

Medication cost-related information gaps

Fifteen informants—representing all included clinical roles—reported information gaps regarding **patients' financial resources and ability to pay**. Eight related learning about problems after patients refused to fill prescriptions, had endured financial burdens, or were not taking their medication. Useful information such as past-due healthcare bills or social needs screening information was not always available to certain people or units outside of where the screening took place. Some information was in narrative notes or otherwise difficult to locate within the EHR. Providers often relied upon patients for financial information. In areas without formal social needs screening, 4 reported regularly asking patients about cost; 7 stated that patients brought it up themselves (Table 2).

Seventeen providers, including 7 prescribers, reported lacking reliable, comprehensive, and/or timely information about the **true cost to patient, and for whole regimen** (see Table 2). Although the RTBT provided this when ordering and through the AVS, 2 prescribers did not yet have access to it due to phased implementation and 1 with access had not used it. Two who used it wanted greater coverage of insurers and patients; 2 others were uncertain of the information's quality (see below). Static resources such as Medicare reference guides were not tailored to patients' situations (although more recently released Medicare Part D tool provides tailored information). Pharmacies offered reliable information, but using them required phoning or placing advance orders. Finally, providers lacked information about the costs of patients' full regimens.

Five providers highlighted information gaps regarding the **impact of changes in patient insurance status on cost**, including whether patients had reached their deductibles or were in the Medicare "donut hole," (a known coverage gap).[74] Annual changes in formularies and deductibles also affected coverage and costs. Although the RTBT indicated copayments for patients in the donut hole when ordering, such information was not easily accessed if pricing changed afterwards due to patient insurance status changes.

Strengths and weaknesses of current tools

Five providers found some **cost-related information unclear**. Copayment tiers displayed via the RTBT and external websites caused the most confusion; actual dollar values were not standardized across insurers (Table 3; main themes bolded, subthemes italicized in the text). Display decisions were controlled by insurance companies, not the health system.

Seven providers were **uncertain about the quality of cost-related information** to which they had access. Uncertainty was expressed about external information sources, the RTE system, and the RTBT. Three RTBT users expressed *uncertainty about quality* related to insurance information currency, with 2 providers questioning why the pricing information button appeared when it did. They questioned whether the system worked. However, 3 expressed *confidence in the quality of information* displayed in the RTBT and AVS.

According to 8 participants, **cost-related information is not getting to all of the people who may need it**; this primarily concerned the "true cost to the patient." According to 4 prescribers, the *separation of decision-making and order entry* meant that decision-makers did not see the RTBT. This occurred in office visits and occasionally after patients visited the pharmacy. Ten participants noted that *nonprescribers need cost information for work with patients* when an-

Table 2. How providers report addressing medication cost barriers and information gaps

Topic	Theme	Quotes from Provider Interviews
How providers report addressing medication cost barriers		
	Reducing the amount of medication that a patient takes	"It could be they can [no] longer afford it. They've changed insurance and their copay is unreasonable now. They may have fallen into…that donut hole and they can't temporarily afford [medications]…I do a comprehensive medication review…streamline that list for medications that may no longer be necessary." (P33, Pharmacist)
		"…doctors are adamant about helping them eat healthy…so that they can…taper off…medications…they can't afford" (P1, Social Worker)
How providers report addressing medication cost barriers	Prescribing a comparable medication at lower cost	Prescriber roles:
		"I… see if we can change them from more expensive medication…to a less expensive medication that would work similarly." (P27, Physician)
		"[about the RTBT] The cost information that is specific to that insurance, it frequently impacts my ordering… I always tell patients…these three medicines are all very similar and I will prescribe the one that is least expensive for you…But I don't know which one your insurance covers…" (P37, Physician)
		Nonprescriber roles:
		"…you can make this recommendation earlier on for the physician, say 'I'd love to have this patient on Entresto, but maybe we really ought to consider just putting them on an ARB instead because they're not going to be able to afford the Entresto." (P34, Pharmacist)
		"[H]e was initially started on Brilinta, which was too expensive for him so we switched him over to Plavix and gave him coupons…it is asking for a physician to review and place the new order." (P31, Nurse)
	Provide additional resources to stay on current regimen	"…I'll tell them to ask their provider for samples …Or we do GoodRx and see if it is cheaper…" (P4, Nurse)
		"We communicate with the Medication Assistance Program…one of my patients, we got free samples of Humalog…" (P3, Nurse)
		"Dad's just been laid off, I tried generic form [of asthma medication] and dad called and it was over $200 for an inhaler so I was able to call the pulmonologist who had the sample…" (P11, Physician)
	Resources to address other adherence barriers	"… they'll tell you, 'Well, you know, I didn't get it refilled yet.' 'And why is that?'…You don't have transportation to get to the pharmacy? … There are mail-order pharmacies… I've…picked up meds for a patient and taken them to their home every month." (P8, Nurse)
		"…community health workers…help…with budgeting…[they] might be able to say, 'Hey, if I can help you get diapers from this organization and additional food from this food bank, would you be able to save $10, so that you would be able to afford your medication?'" (P13, Nurse)
Medication cost-related information gaps reported medication cost-related information gaps	Patient's financial resources and ability to pay	"[I will ask] If I have concerns about their compliance….it was pretty obvious…they weren't taking the medicine that I had prescribed so we talked about it….it was hundreds of dollars a month." (P11, Physician)
		"…everybody has different securities in what they can see…front desk people, they are able to see that this patient…clinical staff don't have the capability to look at the financial side." (P21, Nurse)
		"The patient would have to divulge that information [about difficulty paying for medications]." (P31, Nurse)
	True cost to patient, and for whole regimen	"I have no idea [how to find out patient out of pocket costs]…I wish I did…We don't know…until they go to the pharmacy." (P11, Physician)

(continued)

Table 2. continued

Topic	Theme	Quotes from Provider Interviews
	Impact of changes in patient insurance status on cost	"[The RTBT] works 50% of the time…when you click on the estimation, the dollar sign that comes up, it'll show the price of it. Others, it's just a blank." (P38, Physician) "…88%…that was our anticipated coverage rate…They may be on no insurance plan…[also] let's say the patient has Medicare and Medicaid? I can only ping one of them with this tool…So, it's not going to be accurate for that patient." (P33, Pharmacist) "..how much is this patient spending on all of their medications, which might be helpful from the primary care perspective…" (P27, Physician) "…with [the] Medicare donut hole…a brand name anticoagulant may start off at \$40 a month…but then they hit the [donut hole] halfway through the year and …[it's] \$300 a month… websites aren't going to tell you where in the benefit they are that year." (P36, Pharmacist) "…with insurances [cost] also needs to be looked at, at the beginning of each year as you meet your deductible…" (P26, Administrative)

swering patient questions, resolving affordability challenges, or caring for the patient at other units.

Six providers said cost-related information was **not always available when needed**. True cost *information is needed at different points in the medication ordering process*. One physician wanted to be able to look up costs before ordering. Two wanted access when reviewing already-prescribed medications to address affordability challenges. One nurse identified challenges with the AVS print-outs provided to patients after their visit was over. Nevertheless, 5 providers—including 3 prescribers—said information provided when ordering *is available when needed*, at least sometimes. However, they all wanted information to be available at other points, too.

Finally, 8 providers in diverse roles found some information **difficult to access**. Four mentioned *fragmented information* about ability to pay, often located in narrative notes—indeed, 9 at sites without SDOH screening said they documented affordability challenges in notes. Four said information about resources for patients was fragmented, except for the MAP. A related issue for 4 providers was *nonintegration of resources into existing systems*, particularly concerning external applications and websites on costs and cost-alleviation resources. In contrast, providers appreciated RTE and RTBT integration into the EHR.

Provider ideas for future medication cost tools

Thirteen participants—including 9 prescribers—wanted **expanded support for choosing medications** (see Table 4). Four wanted *wider coverage of patients and insurers* so they could use the RTBT's patient-specific cost information in more clinical circumstances, including settings where Medicare Part B prescriptions were common. Two wanted a system to present *a listing of available options* in a drug class rather than in the current one-by-one display. Five wanted a display that allowed providers to *compare costs and see exact price differences*. One wanted cost comparisons integrated with clinical information about medications. One NP suggested that a system *include varied payment options*, including those covered by insurance and those from pharmacies like those advertised in GoodRx.

There was also interest in **user control over interaction**. Five providers wanted user-initiated interactions with cost information, such as inquiry buttons. Additionally, there was a desire for flagging

options to which users could respond. Providers imagined patients using the tool in conversation with patients.

Eight providers—including 5 nurses—wanted **quick-reference sources to facilitate discussions about costs**. Primarily, this was envisioned as allowing *searches for patient-specific cost information within current workflows*, but often for nonprescribers or outside of medication-ordering workflows. These could be used to answer patient questions at discharge planning and would eliminate steps such as asking colleagues, calling pharmacies, or making referrals to insurance pre-authorization departments. Two providers wanted *links and lookups to use for more general cost information* when preparing for discussions with patients or answering colleagues' queries. Six recommended personalized *patient-facing reports of medication costs and coverage* that would inform them about costs before prescriptions were filled; provide records of expenses to date; and provide updates on formulary coverage. Four providers found providing cost information to patients via the AVS helpful; one recommended incorporating this information into the patient portal; another recommended providing a spreadsheet.

Six providers, including 4 social workers, wanted tools for **streamlining medication resource referrals**. Four felt this could involve *centralization and standardization of affordability resource information*. Two social workers wanted an *assessment of medication needs and available resources* to make it easier to understand size and duration of problems and possible actions. Four providers wanted similar *patient-facing cost-alleviation resource information* for their independent use.

Six providers advocated a tool to identify **patient status** related to costs, including 3 nurses, 2 administrators, and 1 pharmacist. They thought a *centrally accessible visual summary of patient out-of-pocket costs* could keep affordability issues in view through a snapshot, summary, or demographic page.

DISCUSSION

Study findings identified themes regarding how providers seek to address medication cost barriers, how current informatics tools do or do not serve those activities, and desired features of future tools. Participants reported 3 strategies for reducing patient medication

Table 3. Strengths and weaknesses of current tools

Theme	Subtheme	Quotes from Provider Interviews
Strengths and weaknesses of current tools	Providers find some cost-related information unclear	"…some patients…when the provider puts in the medication, they can see that this is a tier 1, tier 2, tier 3 medication…some [ask], What does tier 1 mean? What does tier 2 mean? " (P21, Nurse)
		"…it would be interesting if prices could be in there… If it's covered, what the co-pay is or what that actually means." (P7, Physician)
		"Q1Medicare.com. I can enter the patient's Medicare plan and it will give me the patient's medication list and associated copay tiers…I may not know the copay amount …" (P33, Pharmacist)
	Some providers are uncertain about the quality of cost-related information	Uncertainty about quality:
		"…a lot of times, the stuff that pops up you can't trust at all, you know? … You don't know that it's… consistent with what their insurance is really going to cover.….I don't know if it's related to certain insurance companies… I do see [the RTBT]… a handful of times a month…it tends to be with the diuretics. Why?" (P35, Nurse Practitioner)
		"…[the RTBT is] not always accurate because at times insurance formularies are not up to date or the insurance coverage is not up to date, so it is not always possible to get that information." (P27, Physician)
		"…those formularies…PDF files are sent to me … Those are less accurate because they're only sent to me annually." (P33, Pharmacist)
		Confidence in the quality of information:
		"I would assume that it's accurate because I haven't had patients call to state that they aren't able to afford a medication that was previously told to them that it would be X amount of cost." (P38, Physician)
		"…they're not perfect, but they're usually good at the front desk making sure [insurance is] updated…before we see the patient. So that was my argument that we have to trust the [AVS]." (P31, Nurse)
	Cost-related information is not getting to all of the people who may need it	Separation of decision making and order entry:
		"… the majority of our providers…do not put their own orders in, so you're going to have a medical assistant [or nurse] having that [RTBT] popup…they're just going to bypass that…" (P35, Nurse Practitioner)
		"When I'm with a patient…we do our own order entry, but…[when] orders come through as 'patient called'… we tell the nurse this is the order…and they order it…- They would get that same [RTBT] popup… they might be just clicking through it…" (P37, Physician)
		Nonprescribers need cost information for work with patients:
		"I want my care coordinators to know [costs]. A patient gets a new prescription but they did not have that conversation in the office and so they're asking me how much their copay is going to be…There are thousands of insurance plans, I have no idea." (P33, Pharmacist)
		"It would help if we did have some of that [insurance or financial] information ahead of time…when they are coming into the emergency room, we're trying to gather it right away." (P6, Social Worker)
	Not always available when needed	Information is needed at different points in the ordering process:
		"We don't want to be …'it's just another popup that's getting in my way of finishing this order'… you end up not paying attention…if I could have a way to access that [RTBT] information outside of the patient visit…or, if

(continued)

Table 3. continued

Theme	Subtheme	Quotes from Provider Interviews
		I'm talking to the patient…if I could look it up…" (P37, Physician)
		"I would like it to not be so restrictive to an order function, because I want to use it…even though I don't have order capability, I want to identify alternatives and how much this is going to be." (P33, Pharmacist)
		"…based on the patient's insurance, [the After-Visit Summary] gave that patient an estimate on their meds…if the physician ordered, say Plavix and you sent it to Walgreens, it would give the patient an estimated cost of what they were going to pay at their pharmacy … the providers thought it was going to make their visits last longer, that they were going to have to revisit…and I'm like…'At least I know now, here, and then we're not finding out an hour later [by phone].'" (P31, Nurse)
		<u>Is available when needed:</u>
		"…when we order a medication…[HER] will show us whether the drug is on a preferred list, if it's covered by insurance… so that triggers it right away for us to look at that." (P20, Clinical Manager)
		"Having access to the information at the time of prescribing is a game-changer for them… the delay in the patient receiving the care that they need is eliminated." (P33, Pharmacist)
	Difficult to access	<u>Fragmented information:</u>
		"… it would nice if the health system all had one place that they looked at to see where the gaps [in patients' social needs] are…right now…we might identify these three [financial] needs and we might document it…but then if the [other provider] will never see that…" (P23, Nurse)
		"Just a simple tab would be wonderful!… so we will know where to go to get that information if it is in regards to client medications…we could go to for patient discounted rates or something like that…" (P14, Nurse)
		<u>Nonintegration of resources into existing systems:</u>
		"…there are resources out there…but the fact that they're not…integrated into our system makes it' harder to use them…Fingertip Formulary…you have to go to a different system…it's going to take a lot of time and it's not going to become something that I can use while the patient's sitting there." (P34, Pharmacist)
		"[Medication cost apps are]… so user-dependent…that's going to be at the forefront for some providers and…not for others." (P7, Physician)

costs: reducing the number of prescriptions taken, prescribing less expensive but comparable medications, and connecting patients to cost-alleviation resources. Providers in settings without SDOH screening lacked information about ability to pay; even with screening, this information could be difficult to locate within the EHR. Sometimes, providers discovered financial barriers only after clinical encounters. Notably, fixing such problems is not typically reimbursed. Providers also reported difficulty with gauging medication regimens' true costs. Prescription information available through the RTBT was not always available when needed. Cost clarity was lacking when insurance situations changed, and due to tier-based copayment information. Quality questions emerged regarding external resources and uncertainty about how existing tools such as the RTBT functioned; this might be improved by offering provider training in future implementations. Nevertheless, cost-related infor-

mation was not available to everyone who needed it due to workflow/system mismatches and permissions based on prescribing privileges. Although the RTBT integration into the ordering process was valued, cost-related information was also desired during other workflow phases. Fragmentation and lack of EHR integration impeded access to need and referral information. Providers described desired use cases for future tools.

Study results aligned with prior findings concerning prescribing providers' strategies for addressing affordability, such as prescribing comparably effective, less costly medications.[22,23] Our findings extend prior research by documenting involvement of providers from multiple disciplines in each strategy. Moreover, results point to gaps in support for technology support for members of these other disciplines. For example, because prescribers may not enter their own orders, the RTBT may not always be used by relevant decision-

Table 4. Provider ideas for future medication cost tools

Theme	Subtheme	Quotes from provider interviews
Support for Choosing Medications	Medication comparison features	<u>Wider coverage of patients and insurers:</u> "I would like [the RTBT] on **every patient.**" (P21, Nurse) "[The RTBT] covers [Medicare] Part D meds. I want a tool that does the same thing for [Medicare] Part B meds. I want to know what my chemo copay is going to be…my IV antibiotics…" (P33, Pharmacist) <u>Listing of available options:</u> "I could click on this and say… these are the other options for the same…drug class and this is going to be much less expensive for the patient…I would do that…" (P35, Nurse Practitioner) <u>Compare costs and see exact price differences:</u> "…a comparison of the cost of similar medications, otherwise you have to put in the order…see what the cost would be and then do that again for another medication…if there was some way to compare across medications in the same class easily… It's difficult to figure out what that difference in cost would be… (P27, Physician) "…a tool to help us know how to [consider costs] while accomplishing other things we want to do; it would be nice to put them on the class of drug that also helps them lose weight…or lower their cardiovascular risk…" (P37, Physician) <u>Include varied payment options:</u> "…a tab…[to] click on; as I'm thinking about prescribing it, and it shows what the insurance would cover for a particular medication and what the alternatives through would be. And then… GoodRx, these are the closest pharmacies…you need our coupon…And these are the prices even without insurance." (P35, Nurse Practitioner)
	User control over interaction	"…a tab…that popup is so random. If I could count on every time I click on this I could see…[cost] information…I could say, this is going to be best for the patient." (P35, Nurse Practitioner) "…so I could plug it in and click an inquiry button before I click submit and the computer would run that medicine through that pharmacy and it has some comparisons too…" (P11, Physician)
Quick-reference sources to facilitate discussions about costs	Searches for patient-specific cost information available within current workflows	"… within [EHR], if you would have a search field… type in, cost of whatever med you want…it could then plop out based on this patient and what insurance they have and their co-pay…" (P10, Nurse) "…a link in the [EHR] navigator… be able to put in that medication…to find out what the cost is…[staff] end up calling the pharmacy. I could see [some patients] using [it]…" (P12, Nurse) "…patients calling and saying, 'this medication is too expensive for me.'…it's like, 'Okay, well how much was it?'…they're like, 'I don't remember.'…if you had the ability to see how much a medication would cost for that patient outside of an order…" (P36, Pharmacist)
	Links and lookups to use for more general cost information	"….well for cost of medication…on the med list like, Lyrica is $200 bucks…that would be nice, so then I could at a glance…if it was right on the med list that said the approximate cost …it would definitely help in my med review…" I would say, "Whew, that Lyrica is expensive, how do you afford that?" (P4, Nurse) "I'll have caseworkers that…ask questions about medications…I could explain what it's for and why…and the pricing…" (P8, Nurse)
	Patient-facing reports of medication costs and coverage	"…as their plan changes if they could get into [patient portal] and say, 'my insurance must have changed'…I can't take Humalog, now I have to take NovoLog…a quick step to their formulary." (P21, Nurse) "…it would be wonderful to be able to give [patients a] financial spreadsheet … their treatment plan or the financials or the supportive services…so that they have a copy of it." (P26, Administrative)

Table 4. continued

Theme	Subtheme	Quotes from provider interviews
		"…we enjoyed [the After-Visit Summary] because our patients could see right then what they were going to be paying…" (P32, Nurse)
Streamlining medication resource referrals	Centralization and standardization of affordability resources information	"All in one place! It would be nice if there was a link that we could go to or even just within [EHR]…if I identify…certain medication that a patient just can't afford… try to find the medication at a lower rate for them…" (P5, Social Worker)
		"All manufacturers. All insurances. Everybody did everything the same and so you knew exactly what to look at, where to look, to figure out what co-pay was, what deductible was….straightforward to be able to determine [needs]…" (P30, Pharmacy Technician)
	Assessment of medication needs and available resources	"How can we help…the duration, the amount, the diagnosis, the insurance or lack of insurance… 'they only need three units or they need a weeks' supply.' that's different than somebody who might need three months or a lifetime." (P15, Social Worker)
		"I'd want to know…the needs and the available resources …insurance…income supports…ability to pay." (P9, Social Worker)
	Patient-facing cost-alleviation resource information	"…a simple tab that we could go to for patient discounted rates… It could be on…[t]he patient's access to the [Health System] site. There are some patients…they could search…" (P14, Nurse)
		"…when that issue arose that we could then use that tool or that information to communicate with the adult, parents, whatever about what their options are." (P18, Social Worker)
Patient status	Centrally accessible visual summary of patient out-of-pocket costs	"[I would want information on the patient's out of pocket costs presented] …in [EHR] …you want it in the same place every time…There's like a snapshot screen …That's probably what people look at the most. So I would say there." (P24, Clinical Manager)
		"I would put [patient cost information] in bullet points and I would put it right on the summary page of my patient's chart so I can see it….That would be a point of reference, for every time we're changing therapy or ordering tests or scheduling procedures …" (P32, Nurse)
		"…to have easy visual to see which patients are most at risk [for affordability issues]… makes use of the banner…" (P34, Pharmacist)

makers. These findings suggest the importance of ensuring that cost tools support all providers involved in reducing costs. This is especially important given how large physicians' patient panels can be, and the limited time which they may have available to address cost issues with individual patients. In facilitating the work of a wider range of providers, future tools should also support a wider range of use cases. Such use cases involve prescribing decisions made when providers are not placing orders, facilitating changes made by ancillary staff, and links to relevant cost-reduction resources.

Our findings are also consistent with prior work suggesting true out-of-pocket medication cost information is not easily accessible.[21] In our study, information gaps persisted even in the RTBT context. This may partly be because only 4 participants had used the RTBT directly, whereas 3 had used the RTBT indirectly or been involved in its implementation. Yet, RTBT users' experiences revealed gaps related to missing insurers and insurance coverage information. Missing insurance data is a long-standing problem with real-time pharmacy benefits information.[75] This suggests ongoing needs to incorporate up-to-date, comprehensive coverage information into RTBTs; one solution is continued expansion of contracts between insurers and RTBT vendors. Furthermore, reliance on confirming insurance at the beginning of a visit may

have led to more missing data. Thus, similar to other interventions in which patients helped improve the accuracy of their medication documentation,[76] new tools might address data quality concerns by enabling coverage confirmation during a portal-based check-in.

Others also have found that providers may question the quality of insurance information in RTBT-type systems.[77] In our study, RTBT quality concerns were partly linked to a lack of understanding of the RTBT's logic, including reasons for clinical alerts and the source of information behind the information included in RTBT features like the AVS. Design approaches such as providing references and rationales for alerts or recommendations[78,79] and collecting local validation data on RTBTs' cost information may increase trust.[77] A further quality issue emerged due to the dynamic nature of insurance information, which could undermine data currency. Accordingly, providers wanted tools to account for total expenditures over the course of a year or after insurance changes regarding medication coverage. Tools to support workflows to correct this, such as a reviewing annual benefit updates and revisiting prescriptions as necessary might also help systematically address these concerns.

Findings also pointed to providers' knowledge gaps regarding patient's ability to pay and difficulties in relying on patients to disclose

challenges. Prior research has shown that patients may not disclose barriers due to embarrassment or doubt that providers can help.[80,81] Patients may not discuss cost unless asked,[82] such as when providers note adherence problems.[23,60] Similarly, we found that information about challenges might be elicited only after prescriptions went unfilled. However, some providers reported surfacing cost barriers by routinely asking about cost concerns, particularly those working in the 8 clinical settings that had implemented SDOH screening programs. In related work, we have also shown that some patients are willing to disclose more detailed information about their abilities to pay for medications if this can lead to them being prescribed more affordable medications.[83] However, as described elsewhere,[31] access to patient-reported SDOH data can be limited by security permissions and omission from structured EHR fields. To improve access to information about patients' abilities to pay, this study recommends using clear visual summaries in easily accessible EHR locations. Making AVS cost summaries available during visits, rather than just after, could facilitate cost-related conversations between providers and patients.[84–89] Patient-facing reports and materials advocated by participants may assist here, although health literacy concerns suggest that special care should be taken to ensure that their design follows relevant communication guidelines, such as use of plain language or pictographs. Recent work[88,90,91] highlights opportunities to expand cost-related content in patient decision aids; our findings suggest the need for exact dollar values rather than tier numbers.

As in previous work,[60] we found that physicians, NPs, and pharmacists refer patients to discount services such as GoodRx and $4 generics and physicians refer them to assistance programs.[22] Findings newly highlight how some providers tackle medication barriers by addressing other needs, such as transportation. This reveals the value of integrating information about medication referrals and resources into general community resource referral platforms that have databases of social service agencies, suggest referrals based on screening, send referrals, track outcomes, and integrate with EHR systems.[92] While such platforms may include some medication access resources, there is likely a need to expand to include cost resources currently used by our participants, such as GoodRx. However, as discussed elsewhere,[93] human assistance in choosing and facilitating connections to referral sources will still be needed.

Our study included several limitations. It was conducted in 1 region in the Midwest, at 1 health system with 1 EHR system. While this may limit the generalizability of the results, a strength is that we interviewed providers in 8 different professional roles to gather a variety of viewpoints. A unique characteristic of the health system was the MAP, which other systems may not have. This study's providers may have thus been more aware of medication assistance needs due to this resource. This may also be a strength, as informants were already aware of at least 1 relevant resource. The health system's RTBT was intended for prescribers only; only 4 prescribing providers had used it directly, and 1 implementer and 2 secondary users discussed its use. The study took place during the COVID-19 pandemic; although many participants retained clinical duties, they may have had limited bandwidth to learn about new tools. Therefore, our findings should be confirmed in future studies. It is important to emphasize, however, that the novel features that informants prioritized are not currently available in the health system's RTBT.

CONCLUSION

Providers lacked information to support medication affordability for patients; they wanted data on actual patient costs for all pre-

scribed medications, patients' ability to pay, and less fragmented affordability resources. There is a clear role for informatics tools to provide such information to facilitate medication affordability. Our findings should contribute to developing stronger tools, ideally using processes that engage diverse, multidisciplinary providers in their design, implementation, and use.

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AUTHOR CONTRIBUTIONS

TCV, BEI, TRT, JAP, and LMG designed the study. SRW recruited participants. BEI and KAK conducted interviews. BEI, KAK, and TCV coded and analyzed data. KAK and TCV drafted the article. All authors provided critical feedback on the article, and approved the final version.

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CONFLICT OF INTEREST STATEMENT

None declared.

DATA AVAILABILITY

The data underlying this article cannot be shared to protect the privacy of individuals that participated in the study, as they could be identifiable from the qualitative interview transcripts generated in this research.

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