Research

Using care pathways for cancer diagnosis in primary care: a qualitative study to understand family physicians' mental models

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Abstract

Background: Care pathways are tools that can help family physicians navigate the complexities of the cancer diagnostic process. Our objective was to examine the mental models associated with using care pathways for cancer diagnosis of a group of family physicians in Alberta.

Methods: We conducted a qualitative study using cognitive task analysis, with interviews in the primary care setting between February and March 2021. Family physicians whose practices were not heavily oriented toward patients with cancer and who did not work closely with specialized cancer clinics were recruited with the support of the Alberta Medical Association and leveraging our familiarity with Alberta's Primary Care Networks. We conducted simulation exercise interviews with 3 pathway examples over Zoom, and we analyzed data using both macrocognition theory and thematic analysis.

Results: Eight family physicians participated. Macrocognitive functions (and subthemes) related to mental models were sense-making and learning (confirmation and validation, guidance and support, and sense-giving to patients), care coordination and diagnostic decision-making (shared understanding). Themes related to the use of the pathways were limited use in diagnosis decisions, use in guiding and supporting referral, only relevant and easy-to-process information, and easily accessible.

Interpretation: Our findings suggest the importance of designing pathways intentionally for streamlined integration into family physicians' practices, highlighting the need for co-design approaches. Pathways were identified as a tool that, used in combination with other tools, may help gather information and support cancer diagnosis decisions, with the goals of improving patient outcomes and care experience.

In Canada, the process of obtaining a cancer diagnosis after first suspicion of a problem can be fraught with delay,[1–5] which has been associated with shorter survival, decreased quality of life posttreatment and suboptimal patient experience.[2,6] Delays may be caused by various factors related to the characteristics of cancer, the patient and the fragmented health care system.[5,7,8] There is a set of standard tests and steps required to get to diagnosis, and the coordination of these mostly rests in the hands of family physicians.[1,5,9]

Care pathways are evidence-based tools outlining a care plan that can help family physicians navigate the diagnostic process.[10,11] They are increasingly common[12] and mostly promoted by governments and health care authorities, given their potential to improve care coordination[11] and patient outcomes, and reduce health care spending.[13,14] In the primary care context, pathways are often developed by health care authorities, at times in collaboration with family physicians or specialists.[15–17] Whereas some studies in Alberta and Canada

suggest that family physicians are interested in and follow pathways in their practice,[15] others suggest important challenges related to how pathways might be adopted and used.[18] Some authors report low uptake due to pathway characteristics (format, content), availability and accessibility,[17,19,20] and family physicians' practice context.[17,20–23] However, there is little discussion about how family physicians think and make

decisions when presented with pathways, and how pathways fit into their working strategies. In this study, we intended to contribute to that discussion in the context of cancer diagnosis. The objective was to examine the mental models associated with using pathways for cancer diagnosis of a group of family physicians in Alberta, to inform future approaches to pathway design with the goal of promoting higher uptake and integration into practice. Mental models are an explanation of an individual's understanding about how something works in the real world.[24] They incorporate cognitive functions or mental processes known as "macrocognition" (Table 1) and are explained by macrocognition theory.[24–27]

Methods

We conducted a qualitative study using cognitive task analysis, an established method used to understand how experienced knowledge workers think and approach their work in real-world settings.[24,28] It uses specialized interviews to uncover tacit knowledge, the "subtle, cognitive aspects of task performance,"[29] by including specially trained interviewers and keeping the interviewee focused on a specific and recent case, probing and reprobing, for vivid recall of knowledge and skills based on lived experience. In our study, eliciting this knowledge was done using simulation exercises, where participants reviewed hands-on practice and followed a think-aloud process to talk through a particular scenario.[24] Think-aloud processes are often used to test health care tools (e.g., pathways), since they help gain insight into participants' thoughts when using these tools and reveal information needs and usability in their existing workflows.[30]

Setting and participants

We used purposive sampling[31] to target family physicians in typical community practices, who represent real-world users and are most influential in uptake of pathways.[32] We avoided physicians with practices heavily oriented toward patients with cancer or who worked closely with specialized cancer clinics, as they may have advanced knowledge of the cancer diagnostic process and might not require pathways. Recruitment relied on notices in the provincial newsletters of the Alberta Medical Association (AMA) (Appendix 1, available at https://www.cmajopen.ca/content/11/3/E486/suppl/DC1), and sampling relied on our familiarity with Alberta's Primary Care Networks and confirmation of alignment with our target population by interested physicians. Our approach was to explore in depth each participant's input and macrocognition used, and consider commonalities. Based on previous work and experience using cognitive task analysis with physicians, 6 to 8 interviews were expected.[33,34] Using the expertise of the research team, and following the criteria for success in cognitive task analysis,[29] we stopped recruiting when we had enough valuable insights to describe participants' mental models and to inform future approaches to pathway design. Individual interviews took place virtually by Zoom, in February and March 2021, after informed consent was granted. No repeat interviews were conducted. Participants were offered a stipend, based on established provincial guidelines.[35]

Data sources and collection

Data sources were cognitive task analysis interviews from simulation exercises that used 3 similar algorithmic examples of cancer diagnosis pathways developed in Alberta: rectal bleeding,

Table 1: Macrocognition framework	
Function	Description
Sense-making and learning	• A deliberate attempt by an individual or team to develop coherent understanding of a situation or task • Evidence of an individual or team's attempt to modify or generate a new mental model — by gathering information, deliberate learning, asking questions, reconsidering thoughts, decisions, etc. • Includes sense-giving (the act of presenting an understanding to others to adopt)
Decision-making	• The act of making decisions in, or about, patient care and administrative processes
Planning and replanning	• Attempts of individuals or teams to shape and/or reshape patient care or administrative processes • Considering future scenarios and plausible events, and planning for such events and scenarios; and then revising or replacing the plan when things do not go as anticipated
Monitoring and problem detection	• Tracking the progress or outcomes of patient care or administrative processes — recognizing and identifying problems or issues • Monitoring and problem detection may be planned, ad hoc ("noticing"), formal (data collection) or informal
Managing the unknown, unclear, unexpected and irregular	• Demonstrated attempts to plan for or anticipate what might go wrong, what unexpected events might occur, and/or how to manage and predict uncertainty (planned or anticipatory — contingencies, fallbacks) • Attempts to evaluate and estimate risks • Ways of, and skills in, reacting to the unplanned — adaptation, "scrambling"
Coordinating	• Includes — but is broader than — communication • Any activity that helps synchronize 2 or more individuals in a patient care or administrative process, especially transmitting information or expectations among all those involved • Maintaining shared expectations, understanding and mental models of processes • Attempts to "be and stay on the same page" or keep "common ground" with all those involved

iron deficiency anemia and lymphoma (Appendices 2, 3 and 4, available at https://www.cmajopen.ca/content/11/3/E486/suppl/DC1). Each simulation asked the participant to choose 1 pathway based on a recent case where they could have used it. They were asked to recall that case and think aloud about how they would have cared for that patient using the pathway. We used an interview guide derived from macrocognition theory[25–27] to ensure that key information was elicited. We gathered information on how the proposed pathways affected any of participants' macrocognitive functions (Table 1) involved in the cancer diagnosis process (investigation, referral, diagnosis), the fit between participants' mental models of diagnostic processes and the proposed pathways, and their use of the pathways (Appendix 5, available at https://www.cmajopen.ca/content/11/3/E486/suppl/DC1). Interview guides were developed by the research team, which included a family physician and 2 allied health professionals, and based on practice expertise and previous work in the area.[1,18,33,34] In addition, we pilot-tested the interview guide with an external family physician. Interviews were conducted by an interviewer and a note-taker, both members of the AMA Accelerating Change Transformation Team (AMA-ACTT) trained in cognitive task analysis.[36] Transcripts were not returned to participants for comment or correction, as they rarely are in cognitive task analysis; however, participants were notified that they may be contacted with clarifying questions. A demographic questionnaire was also completed for each participant during the interview (Appendix 6, available at https://www.cmajopen.ca/content/11/3/E486/suppl/DC1).

Data analysis

All interviews were audio-recorded, transcribed verbatim, combined with field notes and imported into Excel for analysis. In Excel, transcripts were divided into sections. Each section was coded based on our understanding of the macrocognitive functions presented in cognitive task analysis (Table 1) and explored in our previous cognitive task analysis studies.[18,33,34] Additional themes were identified using thematic analysis.[37] Coding of each section was completed by 2 members of AMA-ACTT trained in cognitive task analysis. Members were assigned to sections so that the same 2 members did not code together each time. To ensure consistency and trustworthiness,[37] AMA-ACTT and research team members met to review and discuss the coding, resolving any disagreements by consensus. We then met to review all coded data, build a description of each participant's mental model of their cognitive approach to using clinical diagnostic pathways, and compile similarities and contrasts across participants.

Ethics approval

Ethics approval was received from the Health Research Ethics Board of Alberta Cancer Committee (HREBA.CC-21-0003).

Results

Eight family physicians volunteered, and all volunteers were included (Table 2). Interviews lasted 45–60 minutes. Four physicians chose the rectal bleeding pathway, 3 the iron deficiency anemia pathway and 1 the lymphoma pathway. Two elected to also comment on pathways they did not choose (iron deficiency and lymphoma). The analysis identified the macrocognitive functions most used and physicians' mental models (with 4 subthemes), and the actual use of the pathways (4 themes). Illustrative quotations are provided in Table 3 and Table 4.

Macrocognitive functions and mental models

The pathways heavily influenced participants' sense-making and learning (Table 1). Participants used the pathways to gather information, confirm what they already knew or support what they were doing, or as a quick guide for what steps to take when unsure. This was particularly true for the rectal bleeding and iron deficiency anemia pathways. These are health issues regularly seen by physicians, and therefore, physicians had well-developed mental models of the diagnostic process and described using these pathways as a quick confirmation or validation tool (Table 3, subtheme 1). For the lymphoma pathway, a less commonly seen health issue, physicians did not have a well-developed mental model of the diagnostic process, and would use the pathway for guidance and support, and confidence or reinforcement in making decisions about the diagnostic and referral processes (Table 3, subtheme 2).

In some cases, participants stated they would use the pathways to help patients make sense of their situation, either to show them that a process exists and where they are within that process, or to provide information in patient handouts (Table 3, subtheme 3). Some participants noted that it would be useful to have an easy-to-find, printable patient version of the pathway, with information on procedures and adverse effects (Table 3, subtheme 3.1).

Participants suggested that the 3 pathways could help care coordination and decision-making. Participants perceived a lack of agreement among family physicians and specialists (and among specialists themselves) about what is considered a

Table 2: Demographic characteristics of participants (*n* = 8)	
Characteristic	No. (%)
Gender	
Woman	6 (75)
Man	2 (25)
Age, yr	
30–39	6 (75)
50–59	2 (25)
Years in practice	
6–10	6 (75)
29–33	2 (25)
Geographic location of practice*	
Southern Alberta, urban	6 (75)
Northern Alberta, urban	2 (25)
*Locations are classified based on Alberta Health Services and Alberta Health standard guidelines. Urban centres have a population of ≥ 25 000, and rural centres have a population of < 25 000.	

"high-risk" scenario, which determines whether referrals are "semiurgent" or "urgent." Pathways were intended to inform or validate decision-making regarding referral priority; however, with uncertainty about definitions of cancer risk, and without clarity about urgency of testing and referral, most participants stated they would simply "pick up the phone and call a specialist" to avoid a potential miss of cancer diagnosis (Table 3, subtheme 4).

Use of the pathways

Participants noted that the pathways presented in this study are not tools they would necessarily use for all patients. They explained that for common health issues, they had already developed an approach and relied on existing tools to inform care decisions, such as generally recommended clinical guidelines (e.g., Towards Optimized Practice guidelines [https://actt.albertadoctors.org/CPGs], addressing particular care gaps), or

Table 3: Illustrative quotations from data generated by cognitive task analysis interviews with family physicians related to macrocognitive functions and mental models	
Macrocognitive function: subtheme	Quotation
1. Sense-making and learning: confirmation and validation (common health issues)	I'd probably, just given my experience, I would see the patient and probably open this up after just to glance through to see, have I thought of everything I should? Almost like a checklist to make sure I haven't missed anything. (FP7)
	I think what it would have done is just confirmed for me that I was doing the right thing. (FP3)
	All of the pathways, for me, it gives me a framework to go off of. How do I go through the process in my mind in terms of what's the differential? … . Just reminding myself what are the alarm features? When do I have to be really worried? … . It is good to have that framework. It gives us more reassurance. So much of family practice is uncertainty and dealing with uncertainty. And dealing with very big symptoms to start with. They don't come in and say, "Oh, I have rectal cancer." You are trying to sort through the symptoms. (FP1)
2. Sense-making and learning, decision-making: guidance and support (uncommon health issues)	I'd say all of it [use of lymphoma pathway], because I do struggle in this area. It's uncommon, so I don't have as much experience or comfort level with it, so I would [use it], especially the "clinical exam." (FP8)
	It [pathway] would make a difference … . I'll be seeing the patient next week. I'll be able to say, "Listen, I've sent this to the Lymphoma Diagnosis Program and they are going to call you." I know with confidence that I'm sending the patient to the right place. (FP2)
3. Sense-making and learning: sense-giving to patients	… if there is a patient that is insisting on seeing the specialist then I'll use the algorithm and say, "Actually, we have something that we follow. This is a pathway that we follow and the specialist won't see you until we follow through this pathway to the end where we need to go. And then, if something comes up, there are indications when I have to send you to the specialist, but we have to work through this together before we get to that point." (FP1)
	Handouts for patients are the best. … I definitely would still share this with them. You just have to spend the time to go through each thing with them and make notes and give it to them so they can refer back to it. (FP4)
3.1. Sense-making and learning: sense-giving to patients — patient version of pathways	… a tool that followed the algorithm that we were following, so they [patients] would know what steps we were going through and when it is a problem, when to reconnect. (FP1)
	Often patients will experience some side effects the first couple of weeks and they will go away, so that is good for them to know. I don't necessarily give them a handout about that, but could I? Absolutely I could. Maybe it would just make me feel better that they have absorbed and understood that information … I think information about procedures is probably harder to find, so I think that is good. When I order a specialized test, sometimes patients want to know a bit more about that. It helps alleviate their anxiety as well. (FP5)
	The patient handouts… it is hard to actually find the right ones. … . I think having handouts direct from AHS would be a great thing. Also, with instructions … "Your doctor has referred you to here and you should be hearing from this particular place" or something within this timeline. (FP6)
4. Coordinating, decision-making: shared understanding	… One is "urgent". One is "semiurgent." ... I think is a bit confusing, to be honest, because this is all the same thing in my opinion. Only because as primary care physicians, we don't really dictate when the person is going to be scoped or not, so "2 weeks" or "8 weeks" unless they are bleeding … if you are looking for "urgent" they should be picking up the phone and calling. (FP4)
	"Semiurgent criteria." Yes, that was pretty much what we fall into. I then just did the referral, although I marked it as urgent. Urgent, I suppose, when I mark a referral I'm just faxing through, I'm not expecting it to be necessarily quicker than that 2 months. If I'm thinking this needs to be seen in next week or 2, that's when I'm picking up the phone and speaking to someone. (FP3)
	Sometimes you have to go with your gut feeling though or refer them anyway, because it is better to rule out the cancer than to find out it was and it's too late … I may not fully always go to the "T", because if you think this is cancer, you should check it out, right? (FP8)
Note: AHS = Alberta Health Services, FP = family physician.	

more detailed and condition-specific clinical support tools (e.g., UpToDate [https://www.wolterskluwer.com/en/solutions/uptodate]). Participants reported that if they were to use the pathways presented in the study, they would use them only to complement tools they typically use (Table 4, theme 1).

Participants indicated that the most valuable use of the pathways was to support and guide the referral process. First, the pathways could act as a platform to build a shared understanding between family and specialist physicians of what "high risk" means and when to send a referral for "semiurgent"

Theme	Quotation
Table 4: Illustrative quotations from data generated by cognitive task analysis interviews with family physicians related to the use of pathways	
1. Limited use in diagnosis decisions (common health issues)	A lot of it is stuff you just intrinsically think about. … when you are doing your history and physical for the patient, you will always ask, if someone is coming in with anemia … "Any major sources of bleeding? How are your bowel habits? What do they look like? How many times a day do you go? How is your appetite? How is the shape of your stool?" There is just a fire of questions that you ask that I guess is intrinsic. (FP7)
	Like I said before, rectal bleeding is a very common patient complaint. … I don't think it [pathway] would have informed my practice … . This is what we would be doing. What we think are red flags concerning colorectal cancer. This kind of stuff, to be honest, most GPs should know it and have it in the back of mind or the back of their hand. (FP5)
	For the rectal bleeding, one of my main go-tos is going to be UpToDate. The resource there. That is still the one I would refer to, but I guess from provincial guidelines, I still find that for this particular, these types of cases, it is still the TOP guidelines. … I think this pathway is pretty closely aligned with the current one from TOP guidelines. I don't think having this one in particular would necessarily change a lot of what would have been done for this patient already. (FP6)
	I was just going to say it is really good that you have the Specialist Link number there. I usually have it on a sticky on my monitor and sometimes it falls off, so this is really good. (FP4)
2. Use in guiding and supporting referral	… referring to a GI [gastrointestinal] specialist, well, it's complicated. If you kind of put it that if some of these investigations come back a certain way, if CBC is up, or if this is down or the other one is up, refer to GI. If this is up and this is down, if not refer to hematology. And different tests you could do and add in there. (FP4)
	I think it is really helpful just to have these community-specific pathways. Especially for people who practise in multiple communities. For people who are new to a certain community if they moved here and just don't know where to refer. … If you refer to the wrong people, they tend to reject it. That can cause delays in diagnosis. I think that community-specific piece is really what I'm really looking for within these pathways. (FP5)
	They [surgeons/specialists] are not easily approachable people. … I find that I am always in an awkward position. I am the low man on the pole … . Surgeons don't want to talk to me. I don't want to waste the radiologist's time. And I also don't want to send the patient down the wrong path … . (FP2)
	I think the pathway would be good … just having it take one extra step … where you check off you meet this, this, and this criteria and just sending that sheet off. And referral done. (FP3)
	I think there is not a lot of standardization in terms of, in general, what happens with referrals. Some specialists send the thing back to us and say, "You contact the patient and tell them about the appointment." Another one will say, "We will take care of it." I think most of the time patients have no idea when to expect a call or what to do if they haven't heard or how long to wait. It would be nice if everyone was standardized. But instructions on a paper would be great. (FP6)
3. Just relevant, easy-to-process information	This [pathway] is 9 pages long. You don't want that when you are trying to quickly access something to jog your memory or trying to determine if someone is high risk or low risk for an investigation. (FP7)
	Yes, what I am looking for. I say I am a family doctor and I work from "rules of thumbs" and I have 2, so I don't want a long list of 20 thumbs. I want 2 thumbs. What do I look for and if this happens, send them to emerg. (FP2)
	We just really don't have the time, so making it super simple and easy to follow would be really, really helpful. One page. High-level information of what is going to change outcomes and what is going to help outcomes and help people be seen sooner. (FP4)
4. Easily accessible	I want it all in 1 spot. … it has to be just sort of in 1 spot and we know where to look for it. (FP1)
	I think if they are easy to access that people would use them. If you have to search within a website too far, if it gets too cumbersome to get to, then people will give up because they will forget to bookmark it or how to get there. (FP8)
	I would want them all together. I think it would be easy enough if it was just set up as a bookmark or something that opened in easy access. … I'm going to say I still probably prefer something within my EMR that would allow me to — Just because sometimes navigating away, … it is not very quick. Often, I end up reverting to my phone to show patients things on the Internet, because it is so much quicker than trying to do it on my computer. So, having it, again, just being able to access it and at least click a link through my EMR would probably be quicker than me trying to open everything else up. (FP3)

Note: CBC = complete blood count, EMR = electronic medical record, FP = family physician, GP = general practitioner, TOP = Towards Optimized Practice.

or "urgent" treatment. Second, the pathways could provide steps to guide the referral process, including criteria, requirements, and when and to whom to refer. Some participants proposed the pathways could be part of the referral process itself by including a clickable referral form that could be submitted. Participants indicated this may help improve time to diagnosis, and communication and care coordination with specialists (Table 4, theme 2).

Although the pathways were presented to participants as algorithms, participants demonstrated that they would not use them algorithmically in clinical practice. In the time-pressured primary care setting, participants emphasized their need to access and process information quickly. They walked us through how they would rapidly review the pathways to identify recognizable patterns or the minimum information necessary to make decisions, confirm knowledge, guide what steps to take when unsure, or build new patterns to drive a satisfactory decision. The participants emphasized they typically would only access the first page, which should present the most valuable information in a concise and user-friendly way (Table 4, theme 3). Lastly, most participants stated that the pathways needed to be located on the same webpage and easy to find. A few participants noted that having access to the pathways through their electronic medical records would be ideal (Table 4, theme 4).

Interpretation

In this cognitive task analysis, the pathways presented to participating family physicians had little effect on their diagnostic process for the 3 conditions (rectal bleeding, iron deficiency anemia and lymphoma) beyond sense-making and learning, some diagnostic decision-making, and potentially care coordination. The pathways did not conflict with participants' mental models, meaning that they could fit within their diagnostic and referral processes. Findings indicated that participants would use the pathways to gather information, confirm or validate what they already know, locate steps to take when unsure, and complement tools they already use.

Our findings align well with and help explain previous studies reporting low uptake of pathways in primary care, even though family physicians may see them as highly relevant.[38] Evidence on successful pathway implementation and uptake is not abundant,[21] and mostly refers to barriers and facilitators related to the contextual factors linked to patients (e.g., epidemiologic, socioeconomic and ethical aspects), health care providers (knowledge, attitudes and behaviour) and work environment (e.g., inadequate staffing and time pressure).[23] Our results elaborate on factors related to family physicians and suggest that uptake will be less successful than anticipated if pathways conflict with physicians' cognitive work strategies. The pathways in the study were presented as algorithms, but participants used pattern recognition and satisficing approaches[39] to quickly find the minimum information necessary to make a satisfactory decision, or to confirm that their decision was appropriate. It is crucial that future design of primary care pathways takes into account the cognitive implications of the primary care time-pressured context, in which family physicians, in order to quickly work through the issue at hand, are heavily dependent on fast, automatic and instinctive thinking strategies.[40] Future pathway design considerations might include simple checklists or providing key information upfront and very succinctly.

In Alberta, pathways have been identified by the Strategic Clinical Networks (networks of clinicians and patients with knowledge about a specific health area) at Alberta Health Services as a preferred strategy to improve the quality of care provided to Albertans.[16,41] Findings from our study provide 2 relevant considerations related to this. First, they suggest that pathways should be co-designed with the intended physician end-users, and include explicit examination of their cognitive work patterns to fulfill their information needs, thereby increasing the likelihood of incorporation into their workflow. Postimplementation solutions to promote pathway uptake and use, such as dissemination strategies,[42] training activities[43–45] or additional materials like explanatory handbooks,[46] may not be enough to support successful implementation. Second, findings suggest that pathways may need to be complemented by other tools. Pathways in cancer care are identified as key to support enhanced cancer diagnosis,[47] yet participants reported that they would refer their patients to a specialist when there was any — even minimal — chance of cancer, and mentioned the lack of shared understanding and communication with specialists. In alignment with current discussions on suboptimal care continuity and inconsistent collaboration between family physicians or specialists,[5,9,48,49] our findings emphasize the importance of pathways, while also suggesting the need for additional improved supports for family physicians. A previous study by this team[1] reported that family physicians and cancer specialists supported the implementation of a centralized service where primary and specialist physicians converge in their roles. Pathways, low-risk guides and other initiatives, such as rapid access clinics[50,51] and specialty teleconsultation systems,[15] could be considered.

Limitations

Interviewers and participants might have had previous interaction through other work, and this may have led to social desirability and response bias by participants. Experts often provide learned theoretical responses to questions, or may consider their reputations when answering, which can lead to response bias. The cognitive task analysis method of using specialized interviews to ground experts in an actual case in a real-world setting was deliberately designed to address these biases. Not all groups of potential participants were represented in the study. For example, just 2 physicians practising in northern Alberta participated, and as such, the findings may not reflect the experiences of physicians in northern rural and remote communities of the province, who, given the characteristics of these populations and lower access to specialist care, may use pathways differently.

Conclusion

We found that family physicians might use pathways developed for primary care, but not necessarily in the manner intended. Although pathways are designed to algorithmically guide the care process, our findings suggest that pathways might be used to quickly gather information, confirm decisions or provide information to patients. Our findings highlight the need to use co-design approaches to develop pathways, ensuring information needs, cognitive strategies and workflows of family physicians are accounted for. Our findings also underline the need to think about cancer diagnosis pathways not as "the tool" to guarantee improved cancer diagnosis, but as "one tool" that may be used in combination with others to help enhance cancer diagnosis. Future studies should explore and rigorously assess existing and innovative approaches to develop pathways and additional supports that can be easily integrated into family physicians' practices.

References

1. Pujadas Botey A, GermAnn K, Robson PJ, et al. Physician perspectives on delays in cancer diagnosis in Alberta: a qualitative study. *CMAJ Open* 2021;9:E1120-7.
2. Brousselle A, Breton M, Benhadj L, et al. Explaining time elapsed prior to cancer diagnosis: patients' perspectives. *BMC Health Serv Res* 2017;17:448.
3. Yuan Y, Li M, Yang J, et al. Factors related to breast cancer detection mode and time to diagnosis in Alberta, Canada: a population-based retrospective cohort study. *BMC Health Serv Res* 2016;16:65.
4. Sikdar KC, Dickinson J, Winget M. Factors associated with mode of colorectal cancer detection and time to diagnosis: a population level study. *BMC Health Serv Res* 2017;17:7.
5. Grunfeld E. The two solitudes of primary care and cancer specialist care: Is there a bridge? *Curr Oncol* 2017;24:69-70.
6. Neal RD, Tharmanathan P, France B, et al. Is increased time to diagnosis and treatment in symptomatic cancer associated with poorer outcomes? Systematic review. *Br J Cancer* 2015;112(Suppl 1):S92-107.
7. Scott SE, Walter FM, Webster A, et al. The model of pathways to treatment: conceptualization and integration with existing theory. *Br J Health Psychol* 2013; 18:45-65.
8. Walter F, Webster A, Scott S, et al. The Andersen Model of Total Patient Delay: a systematic review of its application in cancer diagnosis. *J Health Serv Res Policy* 2012;17:110-8.
9. Easley J, Miedema B, O'Brien MA, et al.; Canadian Team to Improve Community-Based Cancer Care Along the Continuum. The role of family physicians in cancer care: perspectives of primary and specialty care providers. *Curr Oncol* 2017;24:75-80.
10. Kinsman L, Rotter T, James E, et al. What is a clinical pathway? Development of a definition to inform the debate. *BMC Med* 2010;8:31.
11. Vanhaecht K, De Witte K, Panella M, et al. Do pathways lead to better organized care processes? *J Eval Clin Pract* 2009;15:782-8.
12. Vanhaecht K, Bollmann M, Bower K, et al. Prevalence and use of clinical pathways in 23 countries: an international survey by the European Pathway Association. *J Integr Care Pathw* 2006;10:28-34.
13. Scott SD, Grimshaw J, Klassen TP, et al. Understanding implementation processes of clinical pathways and clinical practice guidelines in pediatric contexts: a study protocol. *Implement Sci* 2011;6:133.
14. Rotter T, Kinsman L, James E, et al. Clinical pathways: effects on professional practice, patient outcomes, length of stay and hospital costs. *Cochrane Database Syst Rev* 2010;CD006632.
15. Arain M, Rostami M, Zaami M, et al. Specialist LINK and primary care network clinical pathways: a new approach to patient referral: a cross-sectional survey of awareness, utilization and usability among family physicians in Calgary. *BMC Fam Pract* 2020;21:86.
16. Wasylak T, Strilchuk A, Manns B. Strategic Clinical Networks: from pilot to practice change to planning for the future. *CMAJ* 2019;191(Suppl):S54-6.
17. Groot G, Ollegasagrem S, Khakpour M, et al. Facilitators and barriers to clinical pathway uptake and utilization among primary care providers in Saskatchewan: a qualitative study. *Clin Invest Med* 2022;45:E1-9.
18. Wagner KK, Austin J, Toon L, et al. Differences in team mental models associated with medical home transformation success. *Ann Fam Med* 2019; 17(Suppl 1):S50-6.
19. Donald M, McBrien K, Jackson W, et al. Development and implementation of an online clinical pathway for adult chronic kidney disease in primary care: a mixed methods study. *BMC Med Inform Decis Mak* 2016;16:109.
20. Evans-Lacko S, Jarrett M, McCrone P, et al. Facilitators and barriers to implementing clinical care pathways. *BMC Health Serv Res* 2010;10:182.
21. Elliott MJ, Gil S, Hemmelgarn BR, et al. A scoping review of adult chronic kidney disease clinical pathways for primary care. *Nephrol Dial Transplant* 2017;32:838-46.
22. Ford E, Edelman N, Somers L, et al. Barriers and facilitators to the adoption of electronic clinical decision support systems: a qualitative interview study with UK general practitioners. *BMC Med Inform Decis Mak* 2021;21:193.
23. Seckler E, Regauer V, Rotter T, et al. Barriers to and facilitators of the implementation of multi-disciplinary care pathways in primary care: a systematic review. *BMC Fam Pract* 2020;21:113.
24. Crandall B, Klein GA, Hoffman RR. *Working minds: a practitioner's guide to cognitive task analysis*. MIT Press; 2006.
25. Klein G, Wright C. Macrocognition: from theory to toolbox. *Front Psychol* 2016;7:54.
26. Klein G, Ross KG, Moon BM, et al. Macrocognition. *IEEE Intell Syst* 2003;18:81-5.
27. Patterson ES, Miller JE. *Macrocognition metrics and scenarios: design and evaluation for real-world teams*. Boca Raton (FL): CRC Press; 2010.
28. Potworowski G, Green L. *Cognitive task analysis: methods to improve patient-centered medical home models by understanding and leveraging its knowledge work*. AHRQ Publication no 13-0023-EF. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ); 2013.
29. Klein G, Militello L. Some guidelines for conducting a cognitive task analysis. In: Salas E, editor. *Advances in Human Performance and Cognitive Engineering Research*. Bingley (UK): Emerald Group Publishing Limited; 2001: 163-99.
30. Jaspers MWM, Steen T, van den Bos C, et al. The think aloud method: a guide to user interface design. *Int J Med Inform* 2004;73:781-95.
31. Given LM, editor. *The SAGE encyclopedia of qualitative methods*. Thousand Oaks (CA): SAGE Publications; 2008.
32. Rogers EM. *Diffusion of innovations, fifth edition*. New York: Free Press; 2003.
33. Barber T, Sharif B, Teare S, et al. Qualitative study to elicit patients' and primary care physicians' perspectives on the use of a self-management mobile health application for knee osteoarthritis. *BMJ Open* 2019;9: e024016.
34. Barber T, Toon L, Tandon P, et al. Eliciting and understanding primary care and specialist mental models of cirrhosis care: a cognitive task analysis study. *Can J Gastroenterol Hepatol* 2021;2021:5582297.
35. Alberta Health Services. 2013. Medical staff remuneration for AHS committee and project participation. Chief Medical Office Policy. CMO 01-02.
36. Potworowski G, Green LA. Training Change Agents in CTA to bring health care transformation to scale:the case of primary care practice facilitators. *J Cogn Eng Decis Mak* 2016;10:328-49.
37. Miles MB, Huberman AM, Saldana J. *Qualitative data analysis: a methods sourcebook*. 3rd ed. Thousand Oaks (CA): SAGE Publications; 2015.
38. Toy JM, Drechsler A, Waters RC. Clinical pathways for primary care: current use, interest and perceived usability. *J Am Med Inform Assoc* 2018;25: 901-6.
39. Marewski JN, Gigerenzer G. Heuristic decision making in medicine. *Dialogues Clin Neurosci* 2012;14:77-89.
40. Kahneman D. Thinking, fast and slow. 1st ed. New York: Farrar, Straus and Giroux; 2013.
41. *Alberta Health Services: strategic clinical networks — a primer and working document (August 7, 2012 — V5)*. Edmonton: Alberta Health Services; 2012.
42. Grol R, Grimshaw J. From best evidence to best practice: effective implementation of change in patients' care. *Lancet* 2003;362:1225-30.
43. Bleijenberg N, Ten Dam VH, Steunenberg B, et al. Exploring the expectations, needs and experiences of general practitioners and nurses towards a proactive and structured care programme for frail older patients: a mixed-methods study. *J Adv Nurs* 2013;69:2262-73.
44. van Bruggen R, Gorter KJ, Stolk RP, et al. Implementation of locally adapted guidelines on type 2 diabetes. *Fam Pract* 2008;25:430-7.
45. Donald M, Smekal MD, Elliott MJ, et al. Online clinical pathway for chronic kidney disease management in primary care: a retrospective cohort study. *BMC Nephrol* 2021;22:332.

46. Melis RJF, van Eijken MIJ, Teerenstra S, et al. A randomized study of a multidisciplinary program to intervene on geriatric syndromes in vulnerable older people who live at home (Dutch EASYcare Study). *J Gerontol A Biol Sci Med Sci* 2008;63:283-90.

47. *Leading practices to create a seamless patient experience for the pre-diagnosis phase of care: an environmental scan*. Toronto: Canadian Partnership Against Cancer 2018.

48. Brouwers MC, Vukmirovic M, Tomasone JR, et al. Documenting coordination of cancer care between primary care providers and oncology specialists in Canada. *Can Fam Physician* 2016;62:e616-25.

49. Continuity of patient care study. Edmonton: Health Quality Council of Alberta; 2013.

50. Brouwers M, Oliver TK, Crawford J, et al. Cancer diagnostic assessment programs: Standards for the organization of care in Ontario. *Curr Oncol* 2009; 16:29-41.

51. Vos LJ, Ho CK, Donnelly BJ, et al. A population-based study examining the influence of a specialized rapid-access cancer clinic on initial treatment choice in localized prostate cancer. *Can Urol Assoc J* 2018;12:E314-7.

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