

COVID-19 Risk Index in the Peterborough Public Health Region: A Qualitative User Experience Study

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ABSTRACT

Background: The COVID-19 pandemic has required novel risk communication strategies, prompting Peterborough Public Health to launch the COVID-19 Community Risk Index in March 2022. The aim of this study was to identify areas of strength and opportunities for improvement of the Risk Index by conducting user experience (UX) testing.

Methods: We conducted 14 semi-structured interviews via Zoom during October and November 2022. Participants included those who care for someone at high risk of COVID-19 in the Peterborough Public Health region (healthcare workers, community organization employees, and family members) as well as local business owners. Our methods for UX testing were based on Morville's honeycomb model, which outlines seven dimensions (usefulness, usability, desirability, findability, accessibility, credibility, value) that contribute to a positive user experience. Analysis included thematic analysis of findings using Morville's model, which was done manually by indicating the frequency that responses occurred to determine themes within each dimension.

Results: Participants rated the Index highest in credibility and value, and lowest in usefulness and desirability. Key findings indicate that the Index can be improved by increasing findability, providing more context to each risk level, including more visuals, and incorporating other respiratory illnesses into the Index.

Interpretation: We identified necessary characteristics for effective COVID-19 risk communication. A key opportunity includes the incorporation of clear evidence and use of language to communicate risk and risk guidance. These results will be used to improve the Peterborough Public Health COVID-19 Risk Index, and offer insights to improvements in public health risk communication strategies broadly.

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INTRODUCTION

The ongoing COVID-19 pandemic has required novel risk communication strategies. Risk indices have been utilized in public and environmental health to communicate exposure risks to inform individual decision-making regarding preventive measures; an example includes the Air Quality Health Index (Stieb et al., 2008). As we continue the pandemic response, individuals are expected to assess their own risk and make decisions accordingly.

A challenge in risk communication has been the changing utility of case counts, originally the mainstay of pandemic risk, as a measure of pandemic burden. PCR-based testing has decreased in most provinces due to changing testing criteria rendering case counts less meaningful. Wastewater surveillance levels have increasingly informed assessments of community transmission of COVID-19 (Daughton, 2020). Wastewater surveillance does, however, present limitations at the present time both in its implementation (e.g. delays in testing/turnaround in some jurisdictions) and in its interpretation. Therefore, it is best interpreted in the context of other pandemic indicators. In Peterborough, other surveillance indicators such as rapid antigen testing (RAT) self-reporting have been utilized through a confidential RAT self-reporting survey launched in December 2021 with large public uptake (Rapid Antigen Testing uptake, 2021).

In March 2022, Peterborough Public Health (PPH) launched the Community COVID-19 Risk Index (Figure 1) to inform the community of current risk for COVID-19 transmission and provide corresponding guidance (Peterborough Public Health., n.d.). It aggregates all available indicators on COVID-19 transmission into one five-risk level scale (Very Low Risk, Low Risk, Moderate Risk, High Risk, Very High Risk). The Risk Index is updated weekly and is published on the PPH website. Information about the current risk level is also shared through PPH's social media channels, and when risk increases news releases are issued.

The novelty of a COVID-19 Risk Index warrants investigation into user perception and interaction. Peter Morville's honeycomb model for UX (Figure 2), includes seven dimensions of UX: usability, usefulness, desirability, findability, accessibility, credibility, and value. These can inform methods for investigating how users

experience public health tools such as the COVID-19 Risk Index. Each dimension can be defined as follows (Semantic Studios, n.d., Wesolko, 2022):

Usefulness: The product fulfills a need for the user.

Usability: The product is simple and easy to use.

Desirability: The visual aesthetics of the product are attractive.

Findability: Information is easy to find and navigate.

Accessibility: The product is designed so that users of all abilities have the same user experience.

Credibility: The product provides trustworthy information.

Valuable: The product provides benefit and value to the user.

The objective of this qualitative study was to investigate how users perceive and interact with the Peterborough Public Health COVID-19 Risk Index, using Morville's Honeycomb model as a guide for UX. The findings will be used to inform improvements to the Risk Index and its promotion. This project is unique as the first we are aware of to investigate user experience in the context of a community specific COVID-19 risk communication tool.

METHODS

Study Design

This study was conducted as a qualitative study with data collected via participant interviews and analyzed using thematic analysis. Grounded theory framework informed the lens of thematic analysis, as recurring ideas and concepts became apparent as the data collected was reviewed. This study has received ethics approval from Public Health Ontario.

Participants

Participants for this project included anyone over the age of 18 who resides in Peterborough City or County and is a caregiver for someone who qualifies as being at high-risk for COVID-19 (unvaccinated, aged 60+, immunocompromised, children aged 0-4). Children under 5 are considered high risk due to low local vaccination rates for this demographic (Peterborough Public Health, n.d.); thus caregivers of children under age five were eligible. Further, those involved in a local business' COVID-19 related policies were also eligible to participate to provide feedback on new

features specifically designed for this sub-population.

Sampling and Recruitment

Participants were recruited using a combination of purposive sampling, random sampling, and participant-referred recruitment. All recruitment was conducted virtually via email invitation. For recruitment of long-term care home staff, congregate living staff, and those involved in COVID-19 policies for businesses, the PPH liaison staff for each population was consulted for the most appropriate organizations to recruit from. For example, organizations that regularly engage with the liaison staff were considered appropriate. For recruitment of childcare centre staff and parents of children under 5, a random sample was drawn from all childcare centres and children's organizations in the Peterborough region. Recruitment was also conducted via participant-referred sampling, as participants were asked to encourage eligible people they know to contact the researcher lead. Participants were recruited from each category until saturation of themes was reached, both within each category and overall.

Data Collection

We collected data via one-on-one semi-structured interviews via Zoom during October and November 2022; the interview duration ranged from 15-45 minutes each. The interview guide (Appendix 1) was developed based on previous studies that investigated User Experience using Morville's Honeycomb model (Khaled et al., 2019 & Rosenbaum et al., 2008) and was piloted and refined to ensure clarity and rigor. An introduction of the interviewer, explanation of study objectives, and obtaining verbal consent took place prior to starting the interview and the audio recording.

First, each participant was asked about their familiarity with the Index and demographic questions (specifically age and gender). Participants were then asked to perform tasks specific to the Index, which was facilitated by the interviewer (E.S.) sending a link to the Index in the Zoom chat during the interview. Each participant shared their screen showing the Index, allowing the interviewer to observe how the participant responded when asked to locate components of the Index. Finally, each participant was asked to rate (on a 5-point Likert scale) the Risk Index based on the seven facets of Morville's Honeycomb Tool, which were defined to them.

Each participant was then given the opportunity to offer any general feedback about their experiences using the Index.

Researcher Positionality

The interviews were conducted by a student from McMaster University completing a placement at PPH (E.S.). ES brings perspectives as a female, white, cis-gendered, Master's of Public Health student in Canada. She is knowledgeable on qualitative data collection and analysis from training as part of her Master's of Public Health and was supervised by a graduate trained expert in qualitative methods (T.P.). PPH staff members (J.H., C.P., K.B., M.K.) and PPH Medical Officer of Health and CEO (T.P.) have led the development and modifications of the Index and are involved in weekly updates to the risk level. While the author group strived to be reflexive on position and perspective in this analysis, their perspectives represent values regarding the Index which may influence the results and interpretation.

Data Analysis

All interviews were transcribed using Zoom, and transcripts were reviewed, cleaned and de-identified. Data were extracted from the transcripts into a table to organize findings. Quantitative analysis included calculation of the mean rating for each dimension and median time to find components of the Index. Qualitative analysis included thematic analysis of findings using the seven dimensions of Morville's honeycomb model for UX. This was done manually by first categorizing participant responses into each of the seven dimensions of Morville's honeycomb model, followed by indicating the frequency that responses occurred to determine the most common themes within each dimension. All transcripts were deleted one year after the interview date to ensure participant confidentiality.

Consultation with Indigenous Communities

As part of PPH's Health Protection and Promotion Act Section 50 governance arrangement with Curve Lake First Nation and Hiawatha First Nation, and serving other urban Indigenous populations, this study engaged the Indigenous Health Advisory Circle of the Board of Health for additional input from Indigenous perspectives on this study, and its findings.

RESULTS

Participants

14 participants completed an interview; Table 1 presents demographic information as well as frequency of Index use. Most participants were between the ages of 40-50 (50%) and female (76%). 35% of participants were staff at a congregate living setting or long-term care home, 21% were staff at a daycare or a parent of a child under the age of five, and 43% were business owners or those involved in the COVID-19 related policies and procedures at a business. 14% of participants had never seen the Index prior to the interview, 14% use the Index once a month, 50% use it once a week, 14% use it more than once a week, and 7% use it only when the risk level changes. Frequency of use was measured through all mediums, including the PPH website and social media viewing of risk level updates.

Finding Information on the Index

In general, participants were able to locate various components of the Index without difficulty. Table 2 presents the time required and whether assistance was needed to find each component. The current overall risk level was found in a median time of 1 second. The following components required a longer time to find: current risk level for deaths (2 seconds), link to the page with risk guidance for the community (3 seconds), and guidance for the general population at a moderate risk level (6 seconds). Participants experienced the most difficulty finding the definition of a high-risk population (13 seconds) and 50% of participants required prompting from the interviewer on where this information was located.

In addition, the mean rating for each dimension of user experience was calculated, and is presented in Table 3. The highest rated dimensions were credible and valuable (rating of 4.9), while the lowest rated dimensions were useful and desirable (rating of 4.3).

The main findings for the qualitative data collected from participant interviews can be summarized by dimension of Morville's honeycomb model for User Experience, and are also presented using a visual format in Figure 3. Additional key quotes can be found in Appendix 2.

Useful

In terms of usefulness, most participants expressed that the Index provides great utility and that it helps to guide their behaviours and decisions:

"It's very applicable and relevant, if there wasn't a high or very high risk I wouldn't be masking right now."

In contrast, five participants expressed that the Index would have been more useful during earlier waves of the pandemic, or that its usefulness is hindered by feelings of "COVID-19 fatigue":

"It would have been great last year, but I don't need it [now], so it's not something that I need to use often."

In addition, two participants indicated that the utility of the Index would increase if it included other respiratory viruses, such as influenza and respiratory syncytial virus (RSV). This is particularly relevant given the early increase in cases of respiratory viruses that occurred in Ontario in October and November 2022 (9).

Usable

Three participants suggested framing transmission for each risk level in proportions. This could include providing information on how many people in the community out of 100 are likely to have COVID-19 at each risk level. Three participants expressed the need for increased usability when viewing the Index on a mobile phone; this is particularly important for those who provide direct client care and may not have the opportunity to view the Index from a computer.

Desirable

In terms of desirability, some participants expressed that although the Index is not particularly desirable or visually appealing, the functionality and usability of it is more important than the visual elements:

"The cleanliness of it is helpful. It's not particularly visually appealing, but I don't think it needs to be."

In contrast, participants also indicated that the overall desirability of the Index would increase with the addition of more visuals and images. For example, one participant expressed that the inclusion of symbols, similar to how the weather

forecast is displayed online, would increase the desirability of the Index.

Findable

In terms of findability, six participants expressed that there is too much clicking between pages and scrolling throughout a page; this hinders their ability to locate information on the Index:

"There is too much clicking and scrolling, you have to know what you are looking for and know it exists in the first place."

For example, the current layout of the Index presents the current risk level and guidance for each risk level on different pages; two participants expressed that it would be beneficial to have the risk guidance directly under the current risk level. In addition, four participants expressed that the Index was difficult to find from the PPH website, and that including a more direct link to the Index from the website homepage would increase findability.

Accessible

Four participants expressed that the Index required increased accessibility for specific populations such as those with low technological literacy skills, the elderly, and the visually impaired. Participants also mentioned that they feel the Index is text-heavy, and greater use of visuals could increase accessibility for some populations.

Credible

There was consensus among nearly all participants that the Index is a credible source of information that they trust:

"It's coming from the health unit, it's definitely credible information."

"I like the breakdown; that you can see that it's moderate risk, and these are all the indicators that they've used. To me that's what makes it credible."

Only two participants expressed concern about the credibility of the Index, namely over the validity of some indicators used in the Index due to changes in eligibility (i.e. PCR testing) and reporting. In addition, some participants indicated the need for the risk guidance to be linked to underlying evidence, particularly for marginalized groups such as Indigenous populations.

Valuable

Almost all participants indicated that the Index is a valuable tool:

"[The Index] has prevented me from attending certain gatherings, or perhaps doing something that I thought of doing... it has caused me to think more about whether [an activity] is worth it."

"We review it every week. I refer to it Wednesday evening when I get home, and if there are changes it becomes a point of discussion in our business the next day. We try to respond and react to it in a number of ways."

The only concerns over the value of the Index were that some community members are feeling "COVID-19 fatigue" and that it may have been more inclined to use it and find value from it if launched earlier in the pandemic.

Additional Input from Indigenous Health Advisory Circle

We were privileged to engage the Indigenous Health Advisory Circle (IHAC) of the Board of Health in gathering feedback on the Index. Similar to other participants, IHAC members had trouble finding the Index from the PPH website and noted that it would benefit from increased findability. Members also suggested including a short questionnaire on the landing page of the Index to determine if the user is at high risk for COVID-19. For example, the province of Alberta has implemented a screening tool that includes questions such as age and vaccination status to determine if one is at high risk (Alberta Government, 2022); IHAC members suggested a similar tool as part of the PPH Index. Finally, it was suggested that a separate risk level be shown for those at high risk for COVID-19 rather than showing one risk level for all populations and providing guidance based on risk.

DISCUSSION

From our analysis, we found that participants rated the Index highest in credibility and value, and lowest in usability and desirability. Most components of the Index that participants were asked to locate were found in under 6 seconds. Findings from our thematic analysis indicate the following key areas of improvement: the utility of the Index would increase if other respiratory

illnesses were included, more context is needed for each risk level, the usability of the Index would improve if it was more mobile-friendly, the Index should be easier to access from the PPH website, there is too much clicking and scrolling to find information on the Index, and more visuals are needed on the Index. Nearly all participants agreed that the Index is a credible source of information and provided overall value to the community.

Our results show that in general, those who care for someone at high risk of severe COVID-19 have positive feelings about the PPH COVID-19 Risk Index. Most participants rated all seven facets of Morville's UX a four or five out of five; indicating a favourable user experience. However, participants also identified room for improvement.

PPH has collected user feedback on the Index in the past, albeit in a passive method using a voluntary online survey. This feedback has been used to inform three earlier iterations of the Index; the most recent version was launched on December 8, 2022 and included a renaming of the product to "COVID-19 & Respiratory Virus Risk Index". PPH will use the feedback gathered from this study to further improve the Index with a focus on increasing usefulness, usability, desirability, and findability.

A key opportunity for improvement identified in this work includes linking underlying guidance to evidence-based recommendations. The e-COVID RecMap project synthesizes global guidance on COVID-19 interventions and response onto a quality appraised platform for policy-makers, clinicians and the public (Hajizadeh et al., 2021, Lofti et al., 2021, Lofti et al., 2023). RecMaps have been demonstrated to offer superior communication of recommendations (Hajizadeh et al., 2021, Lofti et al., 2021, Lofti et al., 2023). We are currently working to link risk guidance that is recommended in the PPH Risk Index to corresponding recommendations, in particular those that have been written in clear plain language recommendation format, so that evidence underlying recommendations can be clear to Risk Index users.

In comparing our results to existing literature, similar studies have utilized Morville's honeycomb model to evaluate online resources for health professionals and care providers. Rosenbaum et al. (2008) conducted UX testing of The Cochrane Library and found that participants experienced

challenges locating the site and its contents, expressed that there was too much information, and many were frustrated at the difficulty of performing different tasks on the site. Heen et al. (2021) used an adapted version of Morville's honeycomb model to assess the utility of a decision aid intended to support health care professionals and patients in clinical encounters. The authors used their honeycomb model for user experience to inform four iterations of the decision aid, each with increased readability, understandability, usability, and ways to cope with information overload. Similar to existing health sciences UX studies, we found that participants experienced challenges locating the Index and its contents. In addition, participants in our study expressed the need for simplicity and presentation of information in a way that is easy to understand.

Knowledge Gaps and Future Directions in the Area of Study

The PPH COVID-19 Risk Index is under continual improvement. The Index may benefit from follow-up UX testing once the identified changes have been implemented. For follow-up, research participant eligibility could be drawn from the general population or from other settings to improve external validity of findings. Another future direction could be to investigate whether the Index promotes behaviour changes related to COVID-19 and other respiratory illnesses; this could be done by conducting a randomized control trial to determine if those who consult the Index on a regular basis engage in safer behaviours (i.e. increased mask wearing) than those who do not consult the Index regularly.

Limitations

A main limitation in our study is that participants were recruited from organizations that PPH has existing connections with, therefore they likely had a positive relationship with PPH before completing the interview. This could have introduced bias by indicating more favourable results than if we were to recruit from the general population. Recruiting from the general population is a next step that could produce less biased results. Another limitation in our study is the response bias that may have been present from direct observation from the interviewer. This may have influenced participants to rate the Index higher than they would have if we had used an anonymous form of data collection. Direct observation may have also influenced the time it took to locate components of the Index. For

FIGURES AND TABLES

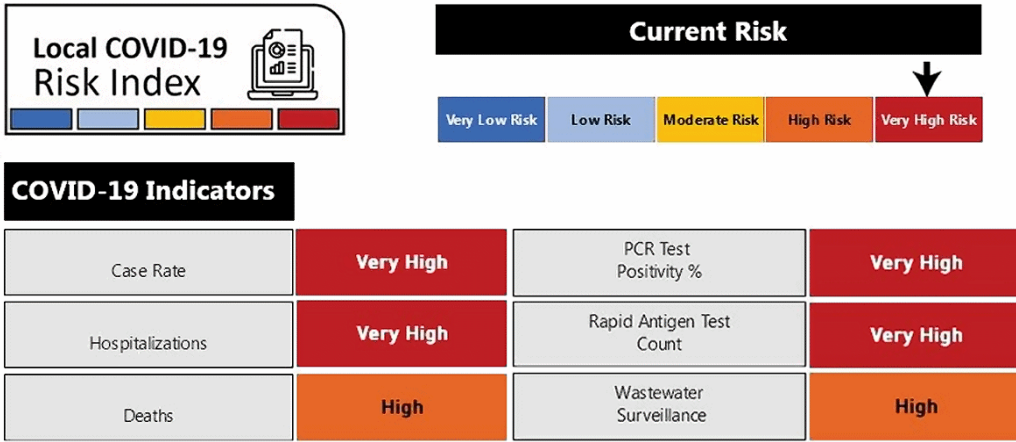


Figure 1. Peterborough Public Health COVID-19 Community Health Risk Index (as of Nov. 30, 2022)



Figure 2. Morville's honeycomb model for UX

Table 1. Patient characteristics

Characteristic	Participants (n=14) no. (%)^a
Age group	
<40 yr	5 (35%)
40-49 yr	7 (50%)
≥50 yr	2 (15%)
Gender	
Female	11 (79%)
Male	3 (21%)
Other	0
Type of organization	
Congregate living setting/long-term care home	5 (35%)
Daycare staff/parent of child(ren) under age 5	3 (21%)
Business/business organization	6 (43%)
Frequency of Index Use^b	
Never	2 (14%)
Once a month	2 (14%)
Once a week	7 (50%)
More than once a week	2 (14%)
When the risk level changes	1 (7%)

^aTotals may not equal 100% due to rounding

^bIncludes use through all mediums such as website use, social media viewing of risk level update, email updates

Table 2. Findability of Risk Index Components

Risk Index Component	Number of participants who located component without difficulty^a	Number of participants who needed assistance to find (i.e. prompting, hints)	Time to locate Risk Index component (seconds), median (IQR)
Current overall risk level	13	0	1 (1)
Current risk level for deaths	11	2	2 (4.75)
Risk guidance for the community	10	3	3 (5)
Guidance for general population at a moderate risk level	12	1	6 (2)
Definition of a high-risk population	6	7	13 (17)

^aThis information was only gathered for those who completed the interview on a computer; responses from 13 participants are included for these variables as one participant completed the interview from a phone.

Table 3. Ratings of User Experience Dimensions

Dimension of User Experience	Rating (mean \pm SD)
Useful	4.3 \pm 0.72
Usable	4.5 \pm 0.76
Desirable	4.3 \pm 0.91
Findable	4.4 \pm 0.94
Accessible	4.4 \pm 0.84
Credible	4.9 \pm 0.27
Valuable	4.9 \pm 0.36



Figure 3. Key findings organized by Morville’s honeycomb model

APPENDICES

APPENDIX A: INTERVIEW GUIDE

- Introductions, thanking participant for their time
- Explanation of the interview process
- They will be asked 17 questions and will have the opportunity to elaborate on their answers
- The first five questions will be introductory/background questions, the following five questions will prompt them to interact with the Index, and the final seven questions will ask them about specific characteristics of the Index
- Interview will last approximately 30 minutes and will be recorded
- Seek final informed consent
- Remind that they can choose to end the interview at any time or choose to not answer specific questions
- Confirm their wish whether to receive findings and if email is the best way to do this

Background/Opening Questions:

1. What is your age? If you do not feel comfortable disclosing an exact number, a decade range (i.e. 50-60) is ok too.
 2. What is your gender?
 3. What is your role at the organization?
 4. How often do you use the PPH COVID-19 Risk Index (monthly, weekly, daily?)
- Proceed to take the participant through the Risk Index, showing the main page with current risk level and indicators as well as the risk guidance page. Send the link to the Risk Index in the Zoom chat so that the participant can view and interact with the Index from their screen.

User Experience Questions:

- First, I will be asking you to perform a few tasks involving the Risk Index. These tasks will require you to locate specific pieces of information on the Risk Index. You can perform these tasks on your own computer as I am able to see your screen.
1. Can you tell me from looking at the Index what the current risk level is?
 2. Can you tell me what the current risk level is for deaths?
 3. Can you find the page that provides risk guidance for the community?
 4. Can you find the guidance for the general population at a moderate risk level?
 5. Can you find the location on the page that defines what a high-risk population is?
- Next the participant will be asked to rank each of the seven facets of User Experience on a scale from 1-5 (with 5 indicating the best score). A definition of each characteristic will be provided to the participant. The opportunity will be given for participants to elaborate on why a specific rating was chosen, as well as what changes could be made to the Index in order to improve their rating.
1. Useful: Usefulness can be described as the degree to which a tool fulfills a specific need. On a scale of 1-5, how useful is the PPH Risk Index?
 2. Usable: On a scale of 1-5, how easy is the Index to use?
 3. Desirable: This characteristic describes how appealing the visual elements of a tool are. On a scale of 1-5, how visually appealing is the Index?
 4. Findable: Findability describes the ability to locate and navigate content on the tool. On a scale of 1-5, how easy is it to locate and navigate information on the Index?
 5. Accessible: A tool is accessible when it can be found easily by anyone. On a scale of 1-5, how accessible is the Index?
 6. Credible: A tool is credible when you trust and believe the information that the Index provides. On a scale of 1-5, how credible is the Index?

7. Valuable: A tool is valuable when it provides an overall benefit to community members. On a scale of 1-5, how valuable is the Index?

Ask participant to elaborate on their rating, for example “You gave the characteristic of (#1-7 above) a rating of X; what characteristics would you like to see to provide a rating of X+1?”

Concluding Questions:

1. Is there anything else that you would like to add about your experiences using the PPH COVID-19 Risk Index?
- Thank participant for their time

APPENDIX B: KEY QUOTES

"I think the content should include all the different influenzas and whatnot that are going around. Certainly a key theme would be COVID, but I think it would be good to know about the influenza going around and other infectious diseases. We might get more people using the index if it included other infectious diseases."

"It's just the usage. It's good for me, but I feel like there's only a certain amount of people who are actually using this index. I wish people would use it more. I think it's really good information, but I think people are done (with covid), I think poeple are just over it."

"In general I think it is very user-friendly...would be helpful if the current risk was a little bigger. Some people may look at the current risk level but not the guidance".

"I wouldn't question the credibility, we follow other messages from public health."

"I don't use it a lot, but I think it's pretty good, I really liked it. At work you hear about (the risk level) but at home I never use it, I just hear things from the news and stuff like that. I will definitely be showing this to my parents."

"I think it gives you some hard evidence on where to go to make your decisions. It's tricky because at the end of the day you're still left making your own decision, but it still gives you that guidance."

"It has great utility but it's not user friendly. The way that information is presented feels very full-on, and not that many people are detail oriented and would ready through. Instead of it being a long scroll through, I think it should be a quadrant or something. So when you click on low medium high, it expands out, and it's more pictorial."

"It needs to be user friendly, I'm thinking for my own parents who may not be savvy on the computer."

"I think it could be prettier, but then it detracts from it. It's very straightforward, nice, easy, simple to follow."

"I keep it saved on my phone, so I haven't tried to navigate it from the public health website, but I feel like the public health website in general is not easy to navigate. I rely on Instagram a lot to see the updates."

"There's value there for sure. A year and a half ago it would have been amazing to have."

"Peterborough Public Health is credible, I like the fact that it's credible information that I don't have to cross-reference. So if I'm going to use your resources, I don't have to worry [about credibility] because it's coming from Peterborough Public Health."