An exploration of primary care provider perspectives on mammography screening research and decision-making with average-risk women

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Abstract

Context: Growing evidence nuancing the benefits and harms of mammography screening has put systematic screening into question. Given the responsibility of primary care providers in counseling women in mammography decision-making, it is important to understand their thoughts on this process. Understanding primary care providers' perspectives on clinical research on mammography will also help inform future best practices as guidelines evolve.

Objective: 1) To explore the perspectives and approaches of primary care providers with respect to mammography decision-making with average-risk women, and 2) To explore physician perspectives on evidence-based research synopses on mammography for average-risk women and how they may apply this information in practice. **Design:** Critical interpretive review and dynamic cohort study. **Methods**: First, a critical interpretive review was conducted, using an interpretive descriptive analytical framework that drew on primary care providers' codes of ethics. Ovid MEDLINE®, Scopus, and PsycInfo databases were searched from 2002 to 2018. Following an inductive analysis of the data extracted from the included articles, resulting themes were subjected to an interpretative descriptive analysis. Second, the Essential Evidence Plus database was searched to identify POEMs (Patient Oriented Evidence that Matters™), clinical research summaries on mammography evidence. Using the Information Assessment Method (IAM), physician ratings and comments about mammography evidence were extracted from reflections on the POEMs. Quantitative data were assessed with descriptive statistics; qualitative data were summarized and assessed iteratively and thematically. Connections were sought between both sources of data. **Results**: This thesis revealed that physicians hold a wide range of perspectives and practice patterns and perspectives regarding mammography screening for average-risk women. Primary care providers greatly differed in terms of their beliefs in screening

effectiveness, their level of trust in screening guidelines, and their thoughts about the recommended age at which average-risk women should begin mammography screening. The critical interpretive review included nine articles that highlighted numerous factors influencing a primary care provider's decision to order mammography screening in addition to professional guidelines. These factors include: providers' beliefs on screening effectiveness, patients' anxiety and requests to be screened, physicians' colleagues' practice patterns, clinical time, and providers' feelings of potential regret about missing diagnoses. The POEMs analysis yielded four POEMs on mammography screening and the number of quantitative POEM ratings ranged from 1243 to 1351. Across all four POEMs, among the physician ratings about using the information for a patient, over 50% were about using it in a discussion with a patient or other healthcare provider. This study showed divergences in the ways in which physicians value and use clinical evidence on mammography screening. Overall, physicians' opinions on the quality of the research used to inform the POEM information and the worth of mammography screening greatly differed. Physicians were divided on the usefulness of POEMs in screening discussions with patients, due to patient, provider, and system-related factors. Physicians also pointed out that a strong screening culture affects both providers' and women's screening decision-making.

Conclusions: Primary care providers hold a diversity of perspectives and approaches with respect to mammography screening for average-risk women. The complexity of current evidence on the harms and benefits of screening, coupled with the uniqueness of each patient's values and preferences, warrant increasingly patient-centered approaches to mammography decision-making. Further research should continue to examine ways of optimizing screening decision-making for primary care providers and their patients.

Résumé

Contexte: De plus en plus, les données probantes nuancent les avantages et les inconvénients du dépistage par mammographie, et remettent ce dépistage en question. Les prestataires de soins primaires conseillent les femmes dans la prise de décision pour la mammographie; il est donc important de comprendre leurs pensées sur ce processus. Comprendre leurs perspectives sur la recherche clinique sur la mammographie aidera aussi à informer les futures directives. **Objectifs**: 1) Explorer les perspectives et approches de prestataires de soins primaires sur la prise de décision pour la mammographie avec les femmes à risque moyen 2) Explorer les perspectives de médecins sur des synthèses de recherche clinique sur la mammographie pour les femmes à risque moyen, et comment les médecins appliquent cette information en pratique. **Conception de Recherche:** Revue de la littérature critique d'interprétation et étude de cohorte dynamique. **Méthodes**: 1) Une revue de la littérature critique d'interprétation a été menée utilisant un modèle d'interprétation descriptive et analytique et des codes déontologiques médicaux. Les bases de données Ovid MEDLINE®, Scopus, and PsycInfo ont été cherchées de 2002 à 2018. Suivant l'analyse des données extraites des articles, les thèmes finaux ont été assujettis à une analyse d'interprétation descriptive. 2) La base de données Essential Evidence Plus a été cherchée pour identifier des POEMs (Patient Oriented Evidence that Matters™) sur la mammographie, des synthèses de recherche clinique crées à partir de données probantes. Utilisant l'Information Assessment Method (IAM), des évaluations et des commentaires de médecins sur ces données probantes ont été tirés de réflexions sur les POEMs. Les données quantitatives ont été évaluées avec des statistiques descriptives, et les données qualitatives ont été résumées thématiquement et itérativement. Des connections entre les deux sources de données ont été cherchées. **Résultats**: Les prestataires différaient en terme de leurs croyances en l'efficacité de la mammographie, leur

confiance dans les directives cliniques, et leurs pensées sur l'âge recommandé pour la mammographie. La revue de littérature critique a identifié 9 articles soulevant les facteurs influençant les prestataires de soins primaires à recommander la mammographie. Ces facteurs comprennent: les croyances du prestataire en l'efficacité du dépistage, leur regret potentiel lié au manque possible de diagnostic, la valeur donnée aux directives cliniques, la pratique de leurs collègues, l'anxiété et les demandes des patients pour être dépistés, et le temps disponible. L'analyse des POEMs a permis de retenir 4 POEMs pertinents et le nombre d'évaluations quantitatives des POEMs varie de 1243 à 1351. À travers les 4 POEMs, parmi les évaluations des médecins sur l'utilisation de l'information pour un patient, plus de 50% avaient rapport avec l'utilisation du POEM dans une discussion avec un patient ou un autre prestataire de soins. Les opinions des médecins sur la qualité de la recherche des POEMs et sur la valeur de la mammographie différaient sensiblement. Les médecins étaient divisés sur l'utilité des POEMs pour les discussions avec les patients à cause de facteurs liés au patient, au prestataire, et au système de santé. Les médecins ont aussi indiqué qu'une forte culture de dépistage affecte la prise de décision des femmes et celle des prestataires de soins. **Conclusions:** Les prestataires de soins primaires soutiennent une diversité de perspectives et d'approches envers la mammographie pour les femmes à risque moyen. La complexité des données probantes sur la mammographie ainsi que l'unicité des valeurs et des préférences de chaque patient nécessitent des approches à la prise de décision pour la mammographie d'avantage centrées sur le patient. La recherche future devrait continuer à examiner les façons d'optimiser la prise de décision pour la mammographie pour les prestataires de soins primaires et leurs patients.

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Abbreviations

CTFPHC: Canadian Task Force on Preventive Health Care

USPSTF: United States Preventive Services Task Force

CMA: Canadian Medical Association

POEM: Patient Oriented Evidence that Matters™

IAM: Information Assessment Method

Chapter I - Rethinking mammography screening: an introduction

Background

Diagnosed in more than 1.5 million women each year, breast cancer is the most common cancer among women. This disease causes the largest number of cancer-related deaths among women internationally [(1)]. In Canada, excluding non-melanoma skin cancer, breast cancer is the most frequent cancer among women, and is the second leading cause of death from cancer in this population [(2)]. It is estimated that 1 in 8 women will develop breast cancer throughout their lifetime, and 1 in 31 will die from it [(3)]. No single element causes breast cancer but several risk factors increase women's odds of developing this disease including older age, higher breast tissue density, family history of breast cancer, and later than average menopause [(3)]. These risk factors are unfortunately not preventable. An early age at the first full term pregnancy, however, is thought to decrease a women's risk of developing breast cancer [(4)]. When women do not present any genetic susceptibility, family history, previous breast neoplasia, or chest irradiation, they are considered at average risk of getting breast cancer [(5)]. Mammography represents the main mechanism currently in place for early detection of breast cancer in this group. Organized mammography screening programs have since been implemented as a means of systematically detecting breast cancer in asymptomatic average-risk women and reducing mortality from breast cancer in this population [(6)].

In high-income countries, population-based mammography screening programs have been in place since the late 20th century. In Canada, provincial governments control and monitor these public health surveillance initiatives [(7)]. Screening programs invite women to participate in routine screening after reaching a certain age, which varies depending on the province [(7)]. The World Health Organization supports and promotes the development of such programs in its breast cancer action plan [(8)]. Data from the National Cancer Institute on mammography screening

programs indicate that a total of 26 countries in the International Cancer Screening Network had running mammography programs in place in 2012 [9]. The targeted age group for mammography screening varied from country to country. The earliest recommended age to start screening was 40 years of age and the oldest age to stop screening was above 75. The participation rates of women ranged from 19% in Japan up to 87.5% in the Navarra region of Spain. As these screening programs continue to be evaluated, a growing number of researchers are questioning the value of systematic screening for asymptomatic average-risk women. Some countries have even proposed to scale back or terminate their mammography screening programs [10, 11].

In 2013, the Swiss Medical Board, an independent health technology assessment initiative, was mandated to conduct a review of mammography screening in Switzerland. An interdisciplinary expert panel of two medical ethicists, an epidemiologist, nurse scientist, clinical pharmacologist, oncologic surgeon, lawyer, and a health economist worked on this review [10]. The Board's concerns included (1) the use of data from outdated trials initiated between 1963 and 1991 in making judgments about harms and benefits of screening; (2) overestimation of the magnitude of the benefits of screening and underestimation of its harms; and (3) women's overly optimistic perceptions of the benefits of screening compared to the benefits that should be expected in reality. In addition, the panel referred to the follow-up of the Canadian National Breast Screening study to highlight the substantial number of women undergoing unnecessary treatment including surgical interventions, radiotherapy, chemotherapy, or combinations of these treatments [12]. Although not mentioned in the Board's report, a number of researchers have criticized this randomized two-armed trial follow-up study by Miller et al., since its start in 1980. Critics claim that the study had important methodological shortcomings including issues in the randomization process and outdated mammography technology used in the trial, subsequently

leading to an overestimation of the magnitude of overdiagnosis from the trial's findings [13, 14]. Overdiagnosis of breast cancer occurs when the mammography screening test detects cancer that will never cause any symptoms [15]. Overdiagnosis can lead to unnecessary treatment and thus also needless exposure to potentially harmful side effects and adverse events. Miller et al. refuted these claims in a series of response letters to the journal in which they initially published their trial.

The Swiss Medical Board then looked at the most recent trials [12, 16, 17] to compare breast cancer mortality rates based on trial information with women's perceptions of breast cancer mortality rates. According to the Board's review, women thought that without biennial mammography screening in over a ten-year period, 160 women should die from breast cancer. Yet according to the evidence in the trials, only 5 women would die from breast cancer without screening over the ten-year period. In February 2014, the Board publicly announced the results of their review. They reported that for every 1000 women screened, approximately one death from breast cancer is prevented. In addition, they underscored the distress experienced by women caused by false positives. Following their thorough examination of the available evidence at the time of their review, they recommended that no new systematic screening programs be implemented in Switzerland. They also recommended that a time limit be placed on current screening programs. Yet prior to the official proposal of scaling back mammography screening in Switzerland, researchers had already begun examining and questioning the processes that allow for organized screening to be implemented in the first place.

In 1968, Wilson and Jungner at the World Health Organization established a set of ten criteria that must be met in order to justify the implementation of a population based screening program [18]. These criteria are presented in Table 1. Since the publication of these criteria,

however, researchers have not created any criteria for situations where the de-implementation of such screening programs may be warranted. As evidence that further nuances the benefits and identifies important harms of mammography continues to emerge, scientists, clinicians and policy-makers face complex clinical and ethical questions regarding mammography screening.

Table 1. Ten Criteria established by Wilson and Jungner to justify the implementation of screening programs [18]

1. The condition sought should be an important health problem.
2. There should be an accepted treatment for patients with recognized disease.
3. Facilities for diagnosis and treatment should be available.
4. There should be a recognizable latent or early symptomatic stage.
5. There should be a suitable test or examination.
6. The test should be acceptable to the population.
7. The natural history of the condition, including development from latent to declared disease, should be adequately understood.
8. There should be an agreed policy on whom to treat as patients.
9. The cost of case-finding (including diagnosis and treatment of patients diagnosed) should be economically balanced in relation to possible expenditure on medical care as a whole.
10. Case-finding should be a continuing process and not a "once and for all" project.

A group of four former United States Preventive Service Task Force (USPSTF) members critically evaluated Wilson and Jungner's criteria and proposed a modification with the "balance approach" [19]. Although more time-consuming, Harris et al.'s approach offers policy-makers a thorough step-by-step procedure to follow when deciding to implement a population-based screening program. Their proposed process to evaluate a screening program takes into account evidence for three distinct issues in addition to the consideration of the unique preferences of an informed population to be screened. These three elements are: the magnitude of the health

benefits, the magnitude of the harms, and the availability of the resources required to implement and monitor such a screening program.

Their approach highlights the importance of focusing on appropriate health outcomes [19]. As such, they suggest using the term "predictors of poor health" to more precisely specify the target of screening. In the case of mammography screening, asymptomatic breast cancer and ductal carcinoma in situ would be considered predictors of poor health; however, the degree to which ductal carcinoma in situ predicts invasive breast cancer, an adverse health outcome, is still uncertain. Harris et al. therefore caution that ideally, screening tests should not be targeting uncertain predictors of poor health. The treatment of uncertain predictors of poor health that uses the same level of aggressiveness as the treatment of strong predictors of poor health may lead to more harm to individuals than benefits. In discussing limitations of the balance approach, the authors acknowledge that it still relies on judgment of the certainty of evidence and on the trade-offs between the magnitude of benefits and harms of screening programs. Not only have uncertainties about the value of systematic mammography screening prompted responses from clinicians and researchers, but they have also become the focus of critical analyses in ethics.

Following the release of the 2009 updated USPSTF recommendations for mammography screening for breast cancer [20], Plutynski wrote an article providing an overview of the ethical issues in cancer screening and prevention [21]. The main issue that Plutynski points to in her discussion revolves around the variability in which different cancers progress, warranting the need to carefully select appropriate treatment strategies, and to consider watchful waiting in some cases. Furthermore, according to Plutynski, safeguards should be implemented so that screening recommendations may be followed consistently with respect for individuals' autonomy and beneficence. Mammography screening presents risks to patients. Some health care providers

may be less willing to acknowledge the limitations of this screening test, but patients should have the right to know these risks when given the option of undergoing the test in order to make informed decisions. Exercising autonomy requires that patients be able to know and communicate which risks they are willing to accept. Of these risks, overdiagnosis represents a principal one that continues to spark debate in both the realms of medicine and ethics. The way one conceptualizes the phenomenon of overdiagnosis is important to consider when proposing solutions to minimize harms ensuing from it.

Carter, a health ethicist at the University of Sydney, describes the problems that come with solely understanding and addressing overdiagnosis from a utilitarian perspective [(22)]. Utilitarianism refers to a group of consequentialist theories where what is considered morally right or morally wrong depends on the consequences that follow from an act or rule [(23)]. In addition, if given the choice to act two different ways, a utilitarian thinker would choose the act that produces the largest benefit for the overall population. Utilitarianism considers important the effect of an action on the overall population, and therefore may justify the suffering experienced of some individuals as a result of an action, for the greater benefit of the whole group. In contrast, deontological thinkers do not believe in basing their decisions on outcomes [(24)]. According to deontological theories, other ethical considerations such as personal rights, duties, autonomy, or dignity weigh more in moral reasoning and decision-making processes.

In her essay, Carter describes how utilitarian philosophy introduces several problems when it comes to conceptualizing overdiagnosis. In illustrating overdiagnosis in breast cancer for instance, she explains that communicating deaths prevented from mammography screening versus the number of women overdiagnosed equates to presenting overdiagnosis as a “trolley problem”. Trolley problem scenarios are hypothetical thought experiments, which typically

include the “switch” and “bridge” problem. The “switch” problem refers to a situation in which an individual is faced with a difficult choice to either let an uncontrollable trolley kill five workers stuck on a track, or take action and switch the trolley to a side track, only killing one worker instead of five. The “bridge” problem refers to a similar situation with an uncontrollable trolley, however in this case, if the person pushes a heavy person off of a bridge onto the track, they will stop the trolley and save the five workers. Even if pushing the person off the bridge and changing the switch result in the same outcome, one person’s death and five lives saved, studies show that most individuals would prefer to change the switch than push the person off the bridge, indicating the weakness of the utilitarian reasoning. Indeed, factors other than outcomes seem to matter to individuals’ decision-making. For example, Carter explains that an individual’s knowledge of a close friend or relative’s personal experience with breast cancer may increase the emotional salience of breast cancer for that individual and allow them to accept risking overdiagnosis. With regards to efforts focused on overdiagnosis reduction, Carter also cautions that a utilitarian approach involving healthcare system changes should not overlook the experience of the individuals who would suffer from the de-implementation of a screening program. At the time of implementation of public health interventions, policy makers and institutions should inform the public about the drawbacks of screening programs and that some individuals will inevitably be overdiagnosed. Similarly, when it is decided that such a program should be scaled back, the public should be made aware that some individuals may suffer consequences from the program being stopped but will receive the needed support and resources to cope with such situations. In light of these limitations of utilitarian thinking, Carter points out that research gathering insight into the public’s perception of overdiagnosis as an ethical concern of population-based screening will elicit different moral responses depending on the way

researchers frame overdiagnosis in their study design. Taking into account these highlighted ethical considerations, beginning routine mammography screening may no longer be a straightforward decision for all women. Focusing on primary care providers' role in mammography screening decisions will therefore be important to examine.

As part of their preventive scope of practice, primary care providers engage in discussions and decision-making with patients about screening tests such as mammography, for early detection of breast cancer. In Canada, family physicians may refer women to mammography screening once they reach a certain age. This referral can then become an automated routine health test that continues to be ordered regularly during a number of subsequent years. In addition to family and primary care physicians, nurses and nurse practitioners are also health professionals who are qualified to offer counseling to average-risk women making decisions about mammography screening [(25)]. However, in Canada, after a certain age, women at average-risk of getting breast cancer in most provinces may enter mammography screening programs without a referral from their primary care provider. Women at average risk of getting breast cancer between the ages of 40 and 74 are of particular interest to this thesis because most guidelines precisely target this group of women and they represent the majority of women in the population.

Most women in Canada are at average risk of getting breast cancer. Indeed, only a small minority of Canadian women, 1 to 2%, are at high risk of developing breast cancer over their lifetime [(26)]. A woman who has a 25% chance of getting breast cancer during her life is said to have a high-risk profile. Women's risk of developing breast cancer may be determined using risk assessment methods. Risk prediction tools exist for both asymptomatic and symptomatic individuals [(27)]. Seventeen different breast cancer risk prediction models have been evaluated and

validated in different populations [28]. However, this thesis will solely focus on average risk women for the reasons detailed above.

For average-risk women who have access to a primary care provider, the opportunity of discussing mammography screening together encourages informed decision-making and promotes patient autonomy. A study conducted in Geneva about women's decision-making preferences regarding mammography screening showed that the majority of women either wanted their doctor to be the primary decision-maker, or intervene on an equal basis [29]. Given that physicians influence the decision of women to undergo mammography screening, it will be important to examining the perspectives of these primary care providers about their experiences in counseling women.

General Research Objectives

The purpose of this thesis is first to explore and review the perspectives and approaches of primary care providers regarding mammography screening decision-making with average-risk women. The second objective will be to empirically study physicians' perspectives on clinical information from research synopses regarding mammography screening for average-risk women and the extent to which they use this information in their clinical practice.

Chapter II - Mammography screening and decision-making: a literature review

1. Evolving evidence of the benefits and harms of screening

1.1 Benefits

Based on their 2011 systematic review of studies that led to their official mammography guidelines [30], The Canadian Task Force on Preventive Health Care (CTFPHC) reported that regular screening reduces the absolute risk of dying from breast cancer by 0.05%, 0.13%, and 0.22%, in women between the ages of 40 to 49, 50 to 69, and 70 to 74, respectively. The number needed to screen (NNS), defined as the number of women who would need to be screened every 2 years for a median of 11 years in order to prevent one death from breast cancer, further illustrates this age-based difference in risk reduction. Based on this same systematic review, the CTFPHC found that the NNS for women between the aged 40-49, 50-69 years, and 70-74, are respectively 2108, 721, and 451.

The USPSTF also examined the benefits of regular mammography screening but used different measures and calculations than those of the CTFPHC. The USPSTF conducted a meta-analysis to determine the absolute rates of breast cancer mortality reduction per 10 000 women screened during a ten-year period. Their study revealed that the number of deaths reduced was 2.9 (CI, – 0.6 to 8.9) for women aged 39 to 49 years, 7.7 (CI, 1.6 to 17.2) for women aged 50 to 59 years; 21.3 (CI, 10.7 to 31.7) for those aged 60 to 69 years; and 12.5 (CI, –17.2 to 32.1) for those aged 70 to 74 years. The absolute reduction for the combined group of women aged 50 to 69 years was 12.5 (CI, 5.9 to 19.5). The different calculations and reporting methods used by both American and Canadian agencies make direct comparisons between both sets of data difficult.

1.2 Harms

Myers et al. [5] found that more frequent screening and longer duration of screening was associated with an increase in the cumulative probabilities of false-positive mammogram results leading to unnecessary biopsy. A systematic review of studies found that the experience of having a false positive after a mammogram could lead to breast cancer-specific psychological distress that endures up to 3 years [31]. In this same review, women who obtained false-positive mammograms were also less likely to return to their next round of screening. The impact of such false-positive mammograms on women's emotional health has been evaluated in the literature.

A research team in Denmark led a cohort study [32] that recruited 454 women in order to measure their psychosocial outcomes following breast cancer screening. Six months after receiving a diagnosis of a false positive, women experienced changes in existential values and inner calmness that were as intense as those reported by women who were diagnosed with breast cancer, 6 months after their diagnosis. Participants with false-positive findings continued to report greater negative psychosocial outcomes three years after being declared free of cancer, compared with participants who had normal findings. In addition to false-positives, researchers have focused on quantifying overdiagnosis, another important mammography screening concern.

In Gøtzsche and Jørgensen's Cochrane systematic review of studies [17], mammography screening led to 30% overdiagnosis and overtreatment of breast cancer, or a 0.5% absolute increase in risk. For every 2000 women invited for screening during ten years, ten healthy women would be treated unnecessarily for a cancer that would not have been diagnosed had they not undergone mammography screening. In another review, Morris et al. [33] reported that current estimates of breast cancer overdiagnosis in the United States ranged from 0% to 30%. To them, this wide range indicates the complexity of calculating rates of overdiagnosis, and they speculate

that these calculations are based on studies with methodological flaws such as the inability of performing statistical adjustments for the effect of lead time [34, 35]. They therefore argue that that more attention should be placed on over-treatment, the most harmful consequence of overdiagnosis. This approach would translate into spending more research effort on developing better treatment decision tools, rather than on reducing rates of overdiagnosis. Puliti et al. conducted a review of observational studies that reported on estimates of breast cancer overdiagnosis in European population-based mammography screening programs in seven different countries [34]. They found unadjusted estimates of overdiagnosis varied from 0% to 54% in the 13 included studies. However, when they adjusted for breast cancer risk and lead time, the estimates respectively became 1.0% in Italy, 2.8% in the Netherlands, 3.3% in Wales, 4.6% in the Netherlands, 7.0% in Denmark, and 10% in England. According to Puliti et al., higher reported breast cancer overdiagnosis estimates in the literature are a result of lack of adjustment for disease risk and lead time. Lastly, Carter, Coletti, Harris, and Russell systematically reviewed optimal methods for quantifying and monitoring overdiagnosis in several types of cancer screening over time including mammography screening [36]. These authors found that although follow-ups of randomized trials present strong internal validity, they may lack external validity and also require extended periods of time. Overall, they found that well conducted ecological and cohort studies appeared to be the most appropriate means of quantifying overdiagnosis. The estimates of overdiagnosis in 18 breast cancer screening ecological and cohort studies ranged from 1% to 52%. These types of studies scored the best in terms of Carter et al.'s criteria such as risk of bias, time frame, and general analysis.

2. Discordant screening recommendations

Ebell et al. conducted a review to compare mammography guidelines among 21 high-

income countries with the highest per capita spending on healthcare [37]. Their results showed that commonalities exist between the various guidelines with the general consensus that average-risk women between 50 and 69 or 70 should be screened biennially. However, this review showed that some specialty societies' guidelines in the United States such as the American College of Radiology differed from other guidelines in that they recommended more intensive and frequent screening. Ebell et al. therefore advise that in the creation of recommendations for a specific population and setting, independent interprofessional expert panels should be responsible for the creation of screening recommendations, based on a comprehensive examination of benefits, harms, and context-specific available resources in that particular setting.

The CTFPHC is currently in the process of updating its mammography guidelines, and expects to release this summary update for clinicians and policy-makers later in 2018 [38]. New from the 2011 recommendations, this latest report will examine new evidence syntheses and assess the quality of evidence on the benefits and harms of screening deemed critical for decision-making by the CTFPHC. Furthermore, this report will systematically look at women's willingness to be screened and screening uptake based on the way women value the benefits and harms of mammography screening.

Jørgensen et al. [39] sought to understand the reasons why organizations' breast cancer mammography guidelines differ by closely assessing the various studies used to inform these clinical guidelines. They summarized the methods, results, and recommendations of seven recent guidelines from North America and Europe, critically assessing their strengths and weaknesses. They found that all guidelines quantifying breast cancer overdiagnosis reported higher numbers of overdiagnosed cases than deaths from breast cancer avoided. According to Jørgensen et al., lack of rigorous evaluation of the methodology of the randomized trials used to inform

guidelines has likely led to overestimates of screening benefits and underestimates of overdiagnosis. Until researchers reach consensus about estimates of harms and benefits of screening, they advise that efforts should be focused on optimizing breast cancer treatment for women. In addition to understanding the medical evidence about screening and the guidelines informed by this research, it is important to review the experiences and perspectives of women regarding screening, since women's health outcomes are at the center of this discussion.

2. Summary of women's perspectives on mammography screening

2.1 Perceptions of women on mammography screening practices

In order to try to better inform the decision-making process between clinicians and women considering breast cancer screening, one study [40] examined women's views on breast cancer and screening practices. Phone interviews were conducted with 41 participants. Some women believed that any detected abnormality ought to be treated, even if it was not malignant. Participants recognized that mammography did not work perfectly, yet almost all participants thought that abstaining from mammography put women at risk for early and preventable death. A strong belief in early detection was noted in the participants, so much so that all repeated the message that "early detection saves lives". In their conclusions, the authors remarked that the perceived danger associated with the failure to be screened with mammography may result in women blaming themselves for a breast cancer diagnosis.

Dubenske et al. [41] compared the mammography screening decision-making experiences of women and physicians in a study involving two patient focus groups and 17 physician interviews. The authors found that while women and physicians generally shared similar views on shared decision-making, several areas of discordance between both groups clearly emerged. Women for instance reported trusting their physician's ability to guide the decision-making

process yet some physicians felt ill-prepared to direct their patients appropriately in this process and felt challenged by current contradictory guidelines. Both women and physicians found it important to prepare women for screening outcomes. Physicians stated they did hold discussions with women to prepare them for the potential outcomes. In contrast, women unanimously reported receiving limited or no information about the screening process or how to make sense of results and next steps.

Henriksen et al. conducted a qualitative study to evaluate women's preconceptions about mammography screening in Denmark and their knowledge of overdiagnosis [42]. Specifically, they wished to understand how framing information in certain ways has an influence on women's decision to participate in screening programs. In addition, they looked at the influence of women's prior knowledge of screening on their understanding of benefits and harms of screening. They individually interviewed six women who would soon be receiving their first invitation to join the Danish organized breast screening program. At the time of the interview, the participating women had already received the official screening program information leaflet for one week. Their findings revealed that the attitudes of their friends and acquaintances played a dominant role in screening decision-making, as compared to the information from the official leaflet. Participants seemed to disregard any information that conflicted with their prior beliefs and were unaware of the existence of overdiagnosis.

Other studies have specifically focused on this exact issue of women's awareness and beliefs about overdiagnosis.

2.2 Perceptions of women on breast cancer overdiagnosis

Hersch et al. qualitatively explored the views of women with no personal history of breast cancer about overdiagnosis in mammography screening, and how these may affect

screening attitudes and intentions [43]. This study involved focus groups and guided group discussions during which women were presented with information on varying overdiagnosis estimates and the mortality benefit of screening. Through this study, Hersch et al. found that most women were surprised to learn about overdiagnosis, but understood the concept over time. Women's information preferences varied. Many women believed in the importance of considering the existence of overdiagnosis to make informed choices about whether to have screening. However, many women still wanted to be encouraged to be screened. When presented with the 50% estimate of overdiagnosis, some women perceived the need for more careful and personalized screening decision-making. Otherwise, the lower estimates had little influence on women's attitudes and intentions regarding screening. In general, the information raised concerns for some women, especially regarding the decision to either treat screening-detected cancer or consider alternative management approaches such as watchful waiting.

Using computer assisted telephone interviews with a sample of 500 Australians, Moynihan et al. [44] aimed to measure public perceptions about overdiagnosis including overdiagnosis in mammography screening. Participating individuals were asked whether they had been informed about overdiagnosis, and their opinions on informing people about overdiagnosis. Only 10% (95% CI 8%–13%) of participants reported their doctor informing them about overdiagnosis. Out of the women who reported having mammography screening, only 10% (95% CI 6%–15%) said they were told about overdiagnosis. Overall, 93% (95% CI 90%–95%) of participants agreed that people should be informed about overdiagnosis as well as screening benefits.

There is no clear consensus about whether or not and how exactly overdiagnosis should be brought up in a discussion about screening between a primary care provider and a patient at

average-risk of getting breast cancer. Research is increasingly focusing on these communication challenges.

3. Mammography screening communication

One qualitative study [45] engaged experts in Australia to examine their rationale for their stance on guidance and information provision to women regarding breast screening. Experts included epidemiologists, surgeons, oncologists, radiologists, advocacy leaders, and administrators. The most frequently expressed reasons for the provision of information on overdiagnosis included: the right for people to know what they are signing up for when they participate in screening and the idea that providing information enables informed decision-making which is particularly important for breast cancer screening given its downsides. Maximized screening participation represented the most commonly expressed rationale for limiting information on overdiagnosis. However, those experts did not view their preference for limiting overdiagnosis information as contrary to informed decision-making. Rather, they challenged the concept of overdiagnosis as a harm and also thought that increased participation in screening would enhance patient choice later on, given the importance of early detection of breast cancer in future treatment decisions. This study highlights the important ethical issues around breast cancer screening communication. It showed that experts disagreed on what values to prioritize when considering communication strategies in the context of breast cancer screening and had different views on what it meant to respect values such as autonomy.

Han et al. (13) similarly discuss the challenges in communicating clinical uncertainty. Their review underscores the ethical difficulty in determining whether communicating this uncertainty enhances or diminishes patient autonomy and offers net benefits or harms on patient experiences with care. Han et al. describe the burden faced by both patients and clinicians when

it comes to discussing uncertainty in practice. According to these authors, acknowledging the value of medical evidence with its inevitable limitations and accepting the discomfort of making decisions in situations of uncertainty will continue to challenge both patients and providers. They recommend that research efforts be focused on strategies to increase patient's tolerance of uncertainty while providing support to them, while also helping providers tolerate the uncertainty experienced in the required communication task. Given primary care providers' role in referring women to screening programs, and in light of the challenges of communicating uncertainties and screening harms previously described, the ethical values and responsibilities of these providers should be explored.

4. Ethical and professional obligations of primary care providers

Family physicians influence women's decisions to start mammography screening [(29)]. Given the ongoing discussion about the magnitude of the harms and benefits of mammography screening and the ensuing ethical concerns regarding the worth of screening programs, it is important to understand primary care provider's perspectives on these issues.

Selby et al. describe the unique position in which these health professionals find themselves to support individualized cancer screening including mammography screening. [(46)]. Guideline recommendations are increasingly tailoring screening decisions to match individual patients' preferences and values. Ensuring appropriate access to personalized screening decision-making requires that primary care providers play an active role in promoting evidence-based, informed, and ethical screening decision-making.

The ability to care for and counsel patients regarding such decisions is rooted in providers' professional and ethical responsibilities. Codes of ethics describing physicians' duties towards their patients list these responsibilities. Several statements from two official codes of

ethics in Canada hold a particular relevance to this discussion regarding physicians' responsibilities in counseling women regarding mammography decision-making. The Canadian Medical Association (CMA) Code of Ethics and the Code of Ethics of Physicians Practicing in Quebec were selected to reveal distinctions between national and provincial codes of ethics. A summary of these articles is shown in Table 2.

Table 2. Professional and Ethical Responsibilities of Physicians according to the CMA Code of Ethics and Code of Ethics of Physicians practicing in Quebec

Ethical Considerations for mammography screening decisions	**Relevant Articles in Two Canadian Codes of Ethics**	
	CMA Code of Ethics [47]	Code of Ethics of Physicians Practicing in Quebec [48]
Decision-making and Consent	**21**. Provide your patients with the information they need to make informed decisions about their medical care, and answer their questions to the best of your ability. **22**. Make every reasonable effort to communicate with your patients in such a way that information exchanged is understood.	**29**. A physician must ensure that the patient or his legal representative receives explanations pertinent to his understanding of the nature, purpose and possible consequences of the examination, investigation, treatment or research which he plans to carry out. He must facilitate the patient's decision-making and respect it.
Responsibility to Society	**23**. Recommend only those diagnostic and therapeutic services that you consider to be beneficial to your patient or to others. **44**. Use health care resources prudently.	**3**. A physician's paramount duty is to protect and promote the health and well-being of the persons he attends to, both individually and collectively.
Value of Science	N.A	**6.** A physician must practice his profession in accordance with scientific principles.

The articles in Table 2 deemed relevant to this thesis correspond to the themes of decision-making and consent, responsibility to society, and the value of science. Both codes emphasize the importance of physicians in facilitating the decision-making processes with patients, and in providing appropriate information to patients in order for them to make a decision. Article 22 of the CMA Code of Ethics makes explicit the duty of the physician in ensuring that such information is not only given but also understood by the patient. Regarding physicians' responsibility to society, only the CMA discusses resource allocation in health care settings by stating that health care resources should be used prudently (Article 44). The Code of Ethics of Physicians practicing in Quebec is unique in highlighting physician's dual responsibility to the individual patient and to the greater collectivity. Last, in terms of the value of science in physicians' practice, only the Code of Ethics of physicians practicing in Quebec mentions that physicians must practice their profession according to scientific principles. Although the codes of ethics do not explicitly address issues of overdiagnosis, or unnecessary testing and treatment, key organizations within the medical community expressed their concerns and created initiatives to tackle this problem within the healthcare system.

The American Board of Internal Medicine launched *The Choosing Wisely* campaign to promote discussions between clinicians and patients with the goal of helping patients choose evidence-based health care and ultimately reduce unnecessary medical testing and treatment within the American healthcare system [(49)].

Since its inception in 2012, *Choosing Wisely* has grown to become a worldwide movement. Since 2014, *Choosing Wisely Canada* recommends to "not routinely do screening mammography for average risk women aged 40 – 49. Individual assessment of each woman's preference and risk should guide the discussion and decision regarding mammography screening

in this age group" [50]. The College of Family Physicians of Canada included this recommendation in the *Choosing Wisely* list of thirteen things physicians and patients should question.

In April 2014, the Quebec Medical Association organized the first Quebec Symposium on Overdiagnosis [51]. This association partnered with *Choosing Wisely Canada* to run a provincial chapter dedicated to the same goals as the national campaign: reducing and preventing overdiagnosis and the promotion of wiser health care decisions.

5. Overview

This chapter (II) summarizes the peer-review literature on key issues framing the focus of this thesis. It highlights the variability in the evidence on mammography screening harms and benefits, including uncertainties around the magnitude of overdiagnosis, as well as challenges in determining the extent to which screening reduces mortality from breast cancer. An overview of mammography screening guidelines and the issue of discordance among these guidelines is discussed. Furthermore, ethical issues arising from screening and a summary of women's perspectives on mammography screening including screening communication are explored. Using two codes of ethics of physicians practicing in Canada, the ethical and professional obligations of physicians towards women making decisions about screening are discussed. Specific attention is placed on articles in the codes related to consent, decision-making, and the joint duties held by physicians to the individual and to the population. Finally, this chapter addresses institutional efforts to address unnecessary testing and treatment.

6. Specific Research Objectives

Little is known about primary care providers' thoughts on this growing body of evidence nuancing the benefits and identifying the harms of mammography screening. Given that a

decision to undergo mammography screening often takes place in a primary care setting, it will be crucial to understand the thoughts and beliefs of primary care providers regarding this decision-making process. In addition, since physicians are key end-users of evidence-based practice guidelines for mammography screening, it will be useful to explore what they think of clinical research that is used to inform such guidelines, and how they may apply this information in practice.

Each of the following two chapters (III and IV) will therefore address the research objectives established at the end of Chapter I. First, a critical interpretive review will aim to critically review the literature on primary care providers' perspectives on mammography screening and screening decision-making with average-risk women. This review answers the research question: What are the perspectives and approaches of primary care providers with respect to mammography screening decision-making with average-risk women?
Following this review, the second objective of this thesis will be to empirically explore physician's perspectives and experiences about mammography screening evidence-based research synopses, and the extent to which they apply this clinical research in their practice. This second manuscript answers the following question: What are the perspectives of physicians on mammography screening clinical research synopses and the ways they use this research information in their practice?

Chapter III - Scrutinizing screening: exploring the perspectives of primary care providers on mammography decision-making with patients

Preface to first manuscript

This study, a critical interpretive review, uses McDougall's approach due to its relevance for bioethics research [52]. Specifically in this review, the question of what are the perspectives of primary care providers with respect to mammography screening decision-making with average-risk women is examined. Additionally, with respect to screening discussions with average-risk women, the factors guiding primary care providers in their practice, the ways primary care providers understand and manage clinical uncertainty, and their experiences supporting patient decision-making are explored. Drawing on Sally Thorne's interpretive descriptive framework [53], the results emerging from this critical interpretive review are assessed against Canadian codes of ethics of primary care providers. This process helps relate the findings from the review to the ethical and professional standards guiding providers' practice.

The manuscript that follows has been published in a peer-review open access journal, *Public Health Reviews*, targeting current and emerging public health concerns and promoting public health knowledge and best practices. The manuscript appears in a special issue entitled "Contemporary Issues in Screening".

Contribution of authors

Scrutinizing screening: exploring the perspectives of primary care providers on mammography decision-making with patients

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SS, CE, and GB contributed to the conception and design of the work. SS performed the data

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Abstract:

Context: A decision to undertake screening for breast cancer often takes place within the primary care setting, but current controversies such as overdiagnosis and inconsistent screening recommendations based on evolving evidence render this a challenging process, particularly for average-risk women. Given the responsibility of primary care providers in counseling women in this decision-making process, it is important to understand their thoughts on these controversies, and how they manage uncertainty in their practice. **Objective**: To review the perspectives and approaches of primary care providers regarding mammography decision-making with average-risk women. **Design and methods**: A critical interpretive review of peer-review literature that reports primary care provider perspectives on mammography screening decision-making. Ovid MEDLINE®, Ovid PsycInfo and Scopus databases were searched with dates from 2002 to 2018 using search terms related to: mammography screening, uncertainty, counseling, decision-making, and primary health care providers. **Results**: Nine articles were included following a review process involving the three authors. Using an inductive and iterative approach, data were grouped into four thematic categories: 1) perceptions on the effectiveness of screening, screening initiation age and screening frequency; 2) factors guiding primary care providers in the screening decision-making process, including both provider and patient-related factors; 3) uncertainty faced by primary care providers regarding guidelines and screening discussions with their patients; and, 4) informed decision-making with average-risk women, including factors that facilitate and hinder this process. **Discussion** of results addresses several factors about the

diversity of perspectives and practices of physicians counseling average-risk women regarding breast cancer screening. These have implications for the challenge of understanding and explaining evidence, what should be shared with average-risk women considering screening, the forms of knowledge that physicians value to guide screening decision-making, and the consent process for population-based screening initiatives. Within the data, there was little attention placed on how physicians coped with uncertainty in practice. Given the dual responsibility of physicians in caring for both individuals and the larger population, further research should probe more deeply into how they balance their duties to individual patients with those to the larger population they serve.

Keywords: mammography screening, ethics, primary care physician, perspectives, decision-making

Background

Organized mammography screening programs have been implemented in most high-income countries since the end of the 20th century to promote the early detection of breast cancer and reduce mortality rates from this disease. Yet over the last two decades, the utility of these population-based programs are increasingly being questioned due to growing evidence on the uncertain benefits and potentially substantial harms of screening for average-risk asymptomatic women [1]. Since the introduction of widespread breast cancer screening in the 1980s, the incidence of invasive breast cancers has increased but the incidence of metastatic breast cancer has remained stable [2].

A decision to undertake screening for breast cancer often takes place in the primary care setting, but current controversies such as inconsistent recommendations based on available evidence on the harms and benefits of screening render this decision-making process challenging for primary care providers and their patients. One Cochrane review of 7 trials involving 600 000 women assessed the effect of breast cancer screening with mammography on mortality and morbidity [3]. It revealed that screening likely reduces mortality but the magnitude is uncertain because of methodological shortcomings of the included trials. The authors of this same review concluded that mammography screening does not clearly do more good than harm, thus underlining important ethical implications for medical practice. According to the Canadian Task Force on Preventive Health Care (CTFPHC) [4], which bases its recommendations on a systematic review of studies, regular screening only reduces the absolute risk of dying from breast cancer by 0.05%, 0.13%, and 0.22%, in women between the ages of 40 to 49, 50 to 69, and 70 to 74, respectively. In contrast, the United States Preventive Services Task Force (USPSTF) found higher absolute risk reductions than those of the CTFPHC. The USPSTF

conducted a meta-analysis to determine the absolute rates of breast cancer mortality reduction per 10 000 women screened during a ten-year period. Their study revealed that the number of deaths reduced was 2.9 (CI, – 0.6 to 8.9) for women aged 39 to 49 years, 7.7 (CI, 1.6 to 17.2) for women aged 50 to 59 years; 21.3 (CI, 10.7 to 31.7) for those aged 60 to 69 years; and 12.5 (CI, – 17.2 to 32.1) for those aged 70 to 74 years. The absolute reduction for the combined group of women aged 50 to 69 years was 12.5 (CI, 5.9 to 19.5). Furthermore, another systematic review found that having a false positive after a mammogram could lead to lasting psychological distress [5].

Another concern is overdiagnosis, causing women to undergo unnecessary testing and treatment of cancers that would not have harmed them during their lifetime [6]. One investigation in the United States [7] found that current estimates of breast cancer overdiagnosis from screening mammography ranged from 0% to 30%. According to the authors of that study, this wide range indicates the complexity of calculating rates of overdiagnosis. They also speculate that overdiagnosis calculations may be based on studies with methodological flaws. Studies tend to use various methods to calculate overdiagnosis and the rates measuring it differ widely. Quantifying the magnitude of the harm caused by overdiagnosis will be difficult until there is better agreement in the evidence. Despite the serious harms that some researchers have attributed to overdiagnosis using population-level data, this topic also remains challenging to assess in the context of a patient-provider relationship. In one qualitative investigation in Australia [8], researchers and policy-makers disagreed on what information should be provided to women considering screening, and whether or not discussing overdiagnosis enabled or hindered informed decision-making. This study highlighted the important ethical issues around breast cancer screening communication. Another article [9] similarly discusses the challenges in

communicating clinical uncertainty, and the ethical problem of knowing whether communicating this uncertainty enhances or diminishes patient autonomy and offers net benefits or harms on patient experiences with care.

Basing its recommendations on best available evidence [4, 10], in 2014, *Choosing Wisely Canad*a, a clinician and researcher-led campaign aiming to reduce unnecessary medical tests and treatments, recommended to not perform routine screening mammography for average-risk women aged 40 to 49. In contrast, the American Cancer Society [11] and The American College of Radiology [12] continue to support screening in average-risk women in this age group. The Canadian Association of Radiologists also recommend that asymptomatic average-risk women aged 40 and over should undergo screening mammography every one to two years [13]. Norris et al. studied the relationship between screening guideline panel members, their conflicts of interest and screening recommendations for asymptomatic average-risk women aged 40 to 49 [14]. They found that five of the eight guidelines recommending screening had a radiologist member, but none of the four guidelines recommending against routine screening had a radiologist member. They also found that the proportion of primary care physicians on guidelines panels recommending non-routine screening was significantly lower than that of panels recommending routine screening.

In light of these inconsistencies in guidelines available to primary care providers, and the increasing evidence on the harms of overdiagnosis, the decision of whether or when to screen is no longer clinically or ethically obvious for average-risk women. Little is known about how primary care providers deal with these challenges in their clinical practice despite their important role in the promotion of preventive health services such as mammography screening [15]. Since

primary care providers are known to influence the decision-making process of women considering screening programs [16], it is crucial to understand their perspectives regarding mammography screening, and how they manage this decision-making in practice. Furthermore, codes of ethics and professional standards make clear a primary care providers' duty to support and counsel patients in an informed consent process [17] prior to undergoing a test such as mammography screening. Thus it is important to gain a better understanding of their views, giving consideration to ethical standards of practice.

The primary aim of our review is to explore the perspectives and approaches of primary care providers regarding mammography screening decision-making with average-risk women. Specifically in this paper, the question of what are the perspectives of primary care providers with respect to mammography screening decision-making with average-risk women will be explored.

Additionally, with respect to screening discussions with average-risk women, this review will seek information on what factors guide primary care providers in their practice, how primary care providers understand and manage clinical uncertainty, including their experiences with support of patient decision-making. To date, no review of primary care providers' perspectives on mammography screening and decision-making with their patients has yet been published.

Methods

A critical interpretive review of peer-review literature regarding primary care provider perspectives on mammography screening decision-making was conducted. This type of review was specifically developed for bioethics research, which typically requires the exploration of a wide range of interdisciplinary sources. The flexibility needed to conduct this review cannot function within the rigid approach of a systematic review. Instead, critical interpretive reviews

offer a thorough and rigorous approach to scan literature in an effort to identify 'key ideas' in a particular area of study, and theorize around this knowledge, in order to answer a specific research question [18].

A search strategy was developed to identify articles capturing the perspectives of primary care providers on mammography screening recommendations and decision-making with average-risk women. In this study, the term "perspective" was broadly defined as a thought, viewpoint, or belief. Specifically, articles that examined qualitatively or quantitatively these perspectives of primary care providers about any aspect of mammography screening or mammography screening decision-making were included. Articles that discussed elements that influenced primary care providers when making screening decisions with their patients were therefore also selected. Inclusion criteria for articles were: being published in English and discussing mammography screening in healthcare systems of high-income countries (Europe, North America, Australia, and New Zealand) because similar population-based screening programs have been implemented in these settings. We wished to focus the scope of this study to current perspectives based on current evidence. Since numerous mammography-screening guidelines from various professional organizations and cancer societies have been published since 2002 [4, 19-21], as well as systematic reviews on harms and benefits of screening [22, 23], all articles that were published in 2002 and later were included. In the United States, Family Medicine, Internal Medicine, and Obstetrics and Gynecology physicians all belong to the category of Primary Care Physicians. Since physicians in these three sub-specialties can refer women to mammography screening, articles involving any of these Primary Care Physicians were included. We then excluded articles that exclusively discussed screening for women at a higher risk of getting breast cancer, or women outside of the 40 to 74 age range.

Further, since this study aimed to capture primary care provider perspectives and approaches to screening average-risk women without a priori expectations of appropriate practice, we excluded articles measuring physicians' adherence to mammography guidelines or those measuring their performance according to quality measures. Additionally, since this research sought to gather perspectives of primary care providers, secondary analyses of data reporting only on changes in mammography referral rates were excluded. Although it is relevant to understand the perceptions of women towards screening, since this study focused on the viewpoints of primary care providers, articles that solely presented women's perceptions on screening were excluded. Additionally, articles reporting the perspectives of professionals in medical specialties other than primary care such as radiology were excluded, because they do not operate in a preventive medicine context. Viewpoints stemming from empirical evidence were prioritized over those arising from anecdotal evidence. Although critical analyses, editorials, and commentaries from primary care providers were included in order to scan for relevant references of empirical data on the perceptions of primary care providers, no new references were obtained this way, thus these articles were ultimately excluded.

Search strategies

The databases Ovid MEDLINE ®, PsycInfo, and Scopus were scanned from 2002 to 2018 on 23 February 2018 using categories of search terms relating to: mammography screening, counseling, decision-making, overdiagnosis, consent, and those covering primary health care provider terms. All combinations of terms were covered, and mappings to headings were made wherever possible. The Cochrane Library search engine was also used to attempt to identify potentially relevant articles, but this search did not return any Cochrane reviews on primary care

provider perspectives on breast cancer screening or mammography. The specific search strategies for the three databases were as follows:

Ovid MEDLINE ® Search 2002-Present: Mammography/ or mammogr* or breast cancer screening AND mass screening or early detection of cancer; OR screen*; AND Counseling or counsel* or (overdiagnos* or over diagnos*) or practice patterns, physicians'/ or decision-making or decid* or informed decision-making or informed consent or consent* or Uncertainty/ or uncertain* AND (family or physician$).af. or practice$.mp. or primary care.af. or exp Primary Health Care/ or primary.mp. or general pract$.af. or gp.tw. or gps.tw. or nurses/ or nursing/ or nurs*.

Ovid PsycInfo Search 2002-Present: Mammography/ or mammogr* or breast cancer screening AND Cancer screening or screening or screen* AND Counseling or counsel* or (overdiagnos* or over diagnos*) or decision-making/ or decid* or informed decision-making or informed consent/ or consent* or Uncertainty/ or uncertain* AND (family or physician$).af. or practice$.mp. or primary care.af. or exp Primary Health Care/ or primary.mp. or general pract$.af. or gp.tw. or gps.tw. or nurses/ or nursing/ or nurs*.

Scopus search 2002-Present: TITLE-ABS-KEY(mammogr* OR "breast cancer") AND TITLE-ABS-KEY(screen*) AND TITLE-ABS-KEY
(counsel* OR decid* OR decision* OR uncertain* OR consent* OR
overdiagnosis) AND TITLE-ABS-KEY("family physician" OR "family doctor" OR "primary care*" OR "primary health*" OR "general pract*" OR nurse OR "nurse pract*").

Following an in-depth reading of the results sections of all included articles, data were organized into sections that sub-divided the main objective of the review. The thematic development in critical interpretive reviews requires an inductive and iterative analytical

approach. Through this process, the analysis was revised and refined until all relevant elements from the articles were appropriately captured into three final sections. Drawing on Sally Thorne's interpretive descriptive framework [24], content from the included articles were then interrogated against professional and ethical codes of practice such as the Canadian Medical Association Code of Ethics [17] and Code of ethics of physicians in Quebec [25].

Results

The database searches resulted in 1423 articles. After removal of duplicates, the three database searches yielded a total of 761 articles. One team member (SS) then reviewed the titles and abstracts of these articles and retained those that seemed to address the aim of this study. This search strategy identified 50 articles. Two team members (SS and CE) then independently reviewed these 50 articles in more depth and met in person to discuss which of these should be included based on our criteria. We also reviewed the reference lists of these retained articles to identify any other relevant articles that were not captured through our database searches. When needed, a third team member (GB) was consulted to reach consensus on whether an article should be included. Following this process, we identified a total of 9 empirical studies [26-34].

Since all participants in the included articles were physicians working in primary care, for simplicity we report the results and following using the term "primary care physicians" (PCP), and in some places "physicians". The analysis of data in the nine articles resulted in a grouping of results into four thematic categories. The first grouping includes general clinical perspectives and approaches from physicians on screening such as their perceptions on the effectiveness of screening, and at what age they initiated screening with average-risk women. The second group includes data on the multiple factors guiding physicians in the screening decision-making process. This category was the richest in data, and findings touched on physician and patient-

related factors, the influence of best practice guidelines and physicians' sub-specialty organizations, as well as non-medical factors such as physicians' colleagues' influence on their practice. The third category of results reports on data relating to the uncertainty faced by physicians with regards to guidelines and screening discussions with their patients. The last thematic grouping includes all data discussing decision-making approaches. Physicians' thoughts on their willingness to support women in informed decision-making, and the factors facilitating and hindering the informed decision-making for average-risk women are presented.

Table 1 presents the key characteristics of the included articles.

Table 1. Key characteristics of included articles

Article [a]	Objective	Setting	Year and method of data collection	Relevant outcome measures[b]
Tudiver 2002	To determine perceptions of family physicians on unclear or conflicting guidelines including mammography for women aged 40-49, and what factors influence their decision to order these tests	Canada	1999, National mailed survey with case vignettes	Agreement with guideline statements; decision to order screening test; factors that influence this decision
Haggerty 2005	To compare the influence of family physicians' recommendations and patients' anxiety or expectations on the decision to order screening tests for which guidelines are conflicting, including mammography for women 40 to 49	Canada	1999, Secondary analysis of the survey from Tudiver 2002 with clinical case vignettes	Decision to order screening test; perceptions of mammography recommendations; physician perception of patients' anxiety about cancer expectations to be tested
Meissner 2011	To explore the mammography screening beliefs, recommendations, and practices of primary care physicians in family medicine, general practice, internal medicine, and obstetrics/gynecology, for average-risk women aged 40-49 and over 50	United States	September 2006 to May 2007, Nationally representative survey of PCP	Influence of guidelines in clinical practice of PCP; beliefs about the effectiveness of 4 breast cancer screening tests in reducing breast cancer mortality in average-risk women; mammography recommendations to asymptomatic average-risk women; recommended frequency of mammography for women aged 40-49 years and aged > 50 years; age at which PCP no longer recommended screening for healthy women
Smith 2012	To determine family medicine residents' fellows' and staff physicians' attitudes and behaviours toward breast cancer screening in average-risk women aged 40 to 49	Canada, Two academic family practice health centres	No date reported[c], Cross-sectional survey	Screening initiation and frequency; reasons for offering and not offering screening; physicians' perceptions of patients' needs and understanding regarding mammography screening
Miller 2014	To examine family medicine, internal medicine, and obstetrics and gynecology physicians' beliefs about the effectiveness of different tests for cancer screening in women 40 to 49 and 50-69	United States, Private practice and hospital	November 2008 to January 2009, survey with data from *Women's Health Survey* sent to a nationally representative sample of physicians	Level of agreement with statements that tests were effective in screening for breast cancer; professional organizations influencing physicians' cancer screening recommendations
Kiyang 2015	To assess the intention of family physicians to support women aged 50	Canada	2010, Questionnaire based on the Theory of Planned	Physicians' intentions to support women in making informed decisions about

	to 69 (targeted by the QBCSP[c]) in making informed decisions about mammography, the determinants of this intention, and the factors that influence family physicians' adoption of this supporting behavior.		Behaviour post-attendance to a lecture on informed decision-making	mammography screening; determinants of this intention and the barriers and facilitators to adopting this supportive attitude.
DuBenske 2017	To compare women's and primary care physicians' (Family medicine, Internal medicine, obstetrics and gynecology) experiences of mammography screening shared decision-making with average-risk women aged 40 to 49.	United States, Academic health centre and clinics	2013, Patient focus groups with women aged 40 to 49 and interviews with primary care physicians	Primary Care Physicians' and patients' experiences in mammography screening decision-making
Radhrakrishnan 2017	To assess the associations between screening recommendations and 1) physician specialty and 2) organizational trust	United States	2016, National survey of primary care physicians	Physicians' screening recommendations; physicians' most trusted screening guidelines
Radhakrishnan 2018[d]	To investigate a broad range of attitudes and beliefs towards mammography screening, using factor analysis to group them into underlying themes	United States	2016, National survey of primary care physicians	Physician attitudes towards younger (45-49 years) and older (75+ years) women; recommendations for routine mammography

[a] First author and year of publication
[b] Only the outcome measures relevant to the aims of this critical review are provided in this table
[c] Quebec Breast Cancer Screening Program
[d] Only data concerning the younger group of women aged 45-49 were considered in this review
[e] No date reported in article. The first author was contacted by email October 26, 2017 but no reply was received by date of submission to journal.

Although all included articles are empirical, a variety of different outcomes were assessed. Authors measured the initiation and frequency of screening, the decision to order screening, the level of agreement of PCPs with different guidelines and if they were perceived as unclear, the influence of guidelines and non-medical factors in the decision to recommend screening or not, and the perceived effectiveness of mammography in reducing breast cancer mortality. They additionally measured the perceptions of physicians on patient anxiety and patient needs. Most articles used surveys to collect data quantitatively but one article [32] qualitatively explored the experience of physicians counseling patients and patients' views on this decision-making process using interviews and focus groups. Data in these nine articles were collected between 1999 and 2016 in Canada or the United States.

Table 2 summarizes the mammography screening recommendations of organizations cited in the included articles. Since the studies report on the perspectives of PCPs from 1999 to 2013, this table is shown to highlight the guidelines that were available to the participants in the included studies at the time of data collection.

Table 2. Summary of mammography screening recommendations in effect during data collection periods for the included articles

	Mammography screening recommendations for average-risk women[1]		
Guideline	Aged 40 to 49	Aged 50 to 69	Aged 70 to 74
Canadian Task Force on Preventive Health Care [4] [35]	**2011:** No routine screening (weak recommendation; moderate quality evidence). **2001:** No recommendation (Grade C). Screening should be an individual's decision	**2011:** Routine screening every 2 to 3 years (weak recommendation; moderate quality evidence) **2001:** Routine screening every 1 to 2 years	**2011:** Routine screening every 2 to 3 years (weak recommendation; low quality evidence) **2001:** Routine screening every 1 to 2 years
United States Preventive Services Task Force [19, 21, 36]	**2016**[2]: The decision to start screening mammography in women prior to age 50 years should be an individual one. Women who place a higher value on the potential benefit than the potential harms may	**2016**[2]: Biennial screening (Grade B) **2009**: Biennial screening (Grade B) **2002**: Screening every 1 to 2 years (Grade B)	**2016**[2]: Biennial screening (Grade B) **2009:** Biennial screening (Grade B) **2002**: Screening every 1 to 2 years (Grade B)

	choose to begin biennial screening between the ages of 40 and 49 years (Grade C) **2009:** The decision to start biennial screening before age 50 should be an individual one and take patient context into account, including the patient's values regarding specific benefits and harms (Grade C) **2002**: Screening every 1 to 2 years (Grade B)
American Cancer Society [11]	**Since 2003:** Women should begin annual mammography at age 45 and should be able to start at age 40 if they would like.
American Congress of Obstetricians and Gynecologists [37]	**Since 2003:** Annual mammography screening should be offered to women 40 years and older
American Academy of Family Physicians [38] and American College of Physicians [39]	**After 2009**: Biennial screening for women 50 to 74 **Before 2009**: Screening starting at age 40 every 1 to 2 years

[1]When reported, the rating for the quality of the evidence is listed with the GRADE score [4, 40]
[2] Guidelines that have been updated since the included studies' publications have been listed [21]

In two articles [28, 30], physician participants were asked to rate the influence of the USPSTF guidelines, and in two others [33, 34], these physicians rated their level of trust in different organizations including the USPSTF. Physicians were also asked about the CTFPHC in two articles [26, 27] and this guideline was cited in one other article [29]. Moreover, the five American studies [28, 30, 32-34] made reference to PCPs' sub-specialties' guidelines, so mammography recommendations for the American College of Obstetricians and Gynecologists (ACOC), the American Academy of Family Physicians (AAFP), and the American College of Physicians (ACP) are listed. The two North American task force organizations currently recommend routine screening in average-risk women between the ages of 50 to 74. For women in the 40 to 49 age range, the CTFPHC recommends against screening since 2011 and as of 2009, the USPSTF gives no recommendation and views screening as an individual's decision.

The AAFP' recommendations align with the USPSTF' 2016 updated guideline, but ACOG still recommends that screening should be provided to women starting at age 40. The ACP recommends that screening start at 45, an earlier screening starting age than the AAFP and USPSTF's starting age of 50.

Data reporting on the general perspectives and approaches of PCPs regarding mammography screening for average-risk women are shown in **Table 3**.

Table 3. Primary Care Physician beliefs on screening effectiveness and practice behaviours

Article	
Tudiver 2002	N.A[a]
Haggerty 2005	• Approximately 25% of the participating physicians thought that routine mammography screening was recommended for women 40-49.
Meissner 2011	• 99% of all PCPs reported that for average-risk women 50 years and older, mammography was effective in reducing cancer mortality. • 96 % thought that mammography was at least somewhat effective for women ages 40 to 49 years. • Over 70% of all physicians who recommended mammography to women ages 40 to 49 years recommended it on an annual basis (69.5% of family medicine/general practitioners, 74.5% of internal medicine specialists, and 79.3% of obstetrician/gynecologists). • More than 90% of all physicians recommended annual mammography to women aged > 50 years. Family medicine/general practitioners and internal medicine specialists who recommended mammography were more likely to stop recommending screening at a certain age (30.2% and 37.8%, respectively) than obstetrician/gynecologists (14%). • The age at which MDs no longer recommended screening varied, but less than 10 percent of physicians of any specialty specified an age that was smaller than 70 years.
Smith 2012	• 46% of family physicians offered routine mammography screening to average-risk women aged 40-49. • Among physicians who offered screening: 77% reported starting at age 40, while 14% started at age 45. Of these, 44% offered yearly screening, followed by 26% who offered biennial screening. The remainder of physicians offered either annual or biennial screening based on joint physician-patient decisions (17%).
Miller 2014	• 50% of physicians strongly agreed that mammography is an effective test for women aged 40–49 years. • 81.7% of physicians strongly agreed that mammography is an effective screening test for women aged 50–69 years.
Kiyang 2015	N.A
DuBenske 2017	N.A
Radhakrishnan 2017	• 81% of physicians recommended screening to women aged 40 to 44. • Gynecologists were more likely than family medicine/internal medicine physicians to recommend screening for women in general.
Radhakrishnan 2018	• 88% of physicians recommended screening mammography to women aged 45-49 • Of those physicians, approximately 67% recommended yearly screening for that group of women.

[a]NA: Not Applicable

The participating physicians in three articles found mammography guidelines unclear or conflicting [26, 27, 32]. At least 45% of the participating physicians in two studies [28, 29] routinely recommended and offered screening to women between the ages of 40 and 49. In another study [27], a smaller proportion of physicians, less than 30%, thought that routine mammography was recommended for women in this age range.

Table 4 presents the various factors guiding PCPs with respect to mammography screening decision-making with average-risk women.

Table 4. Factors guiding primary care physicians in the decision-making process regarding mammography screening with average-risk women

Article	
Tudiver 2002	• Patient anxiety, patient expectations of being tested, and a positive family history of breast cancer all significantly increased the chances that a mammogram would be ordered. • MDs' beliefs that mammography was not recommended or causes more harm than good, and a good patient-doctor relationship decreased the odds of screening. • The sensitivity of MDs to their colleagues' practice increased the odds of screening.
Haggerty 2005	• The physicians who believed routine screening was recommended ordered the test in most cases regardless of patient characteristics. • Physician beliefs about screening strongly predicted test ordering, but only when patients had no anxiety or expectations. If a physician thought that mammography for women aged 40 to 49 was not recommended or was unclear, then a patient's expectation of having mammography tripled the probability that mammography would be ordered. • If a physician perceived that routine mammography was recommended, however, then a patient's expectation did not alter significantly the already high likelihood that a physician would order the mammography test. • Family physicians agreed that numerous non-medical factors influenced their usual test-ordering behaviour. • 89.6% of physicians stated they would order a screening test that they would not usually recommend if the specialists with whom they work recommended the test • 88.1% would order the test if a patient requested the test and insisted on having it done. • 87% would order it if a patient was anxious about having the disease. • 59.2 %, 57.2%, and 54.7% of physicians would order the test if it was easy to administer, easily accessible, and inexpensive, respectively. • If their colleagues were recommending the test to their own patients, 37% of physicians said they would order the test. • Approximately 30% of physicians said they would order the test if it would take less time than convincing patients that they do not need it.
Meissner 2011	• Most physicians identified at least 1 breast cancer screening guideline as being very influential in their practice. • The ACS guidelines were most frequently cited as influential (56%), followed by the ACOG (47%), USPSTF (42%), AAFP (32%), and ACP (25%) guidelines.
Smith 2012	• 40% of physicians did not think breast cancer screening was necessary for women aged 40 to 49, but 62% said they would order the test if their patients requested it. • Reasons to not offer screening: - No evidence of decreasing breast cancer related deaths (63%)

	- Grade A recommendation to screening at age 50 and not 40 (25%) - Harms of screening outweighing benefits (19%) • Reasons to offer screening: - Patient request (55%) - Personal practice or mentor recommendation (27%) - Guideline recommendation (18%) - Other reasons to offer screening included emerging evidence of a modest decrease in breast cancer mortality, detection of early-stage breast cancer, and improvement in imaging for detecting benign versus malignant lumps.
Miller 2014	• The majority of physicians ranked their respective specialty professional organization as one of the top organizations that influenced their cancer screening recommendations. • Across all three specialties, the majority of physicians reported the ACS as a top influential organization. • More than 50% of Family Medicine and Internal Medicine physicians reported the USPSTF, as their top influential organizations. • Almost 50% of the Obstetrics and Gynecology physicians ranked the National Institutes of Health/National Cancer Institute as one of their top influential organizations. • Physicians who listed the ACS as one of their top influential organization were significantly more likely to believe that mammography was effective for women 40-49. • In contrast, physicians who listed the USPSTF as their top influential guideline were less likely to believe that mammography was effective for women age 40-49. • Physicians who reported a personal cancer experience were less likely to believe that mammography is effective for women aged 50–69 years.
Kiyang 2015	N.A[a]
DuBenske 2017	• Physicians report concerns for time constraints and desire for efficiency in decision-making discussions. • Women identify the need for physicians to take time to listen to their concerns and answer questions (reported as a discordance with the finding from the physician interviews).
Radhakrishnan 2017	Physicians who trusted ACS and ACOG were significantly more likely to recommend screening to younger women compared with those who trusted USPSTF guidelines.
Radhakrishnan 2018	• 26% of physicians trusted ACOG guidelines the most, 23.7% ACS, and 22.9% UPSTF. • The most trusted guidelines for gynecologists, family medicine/general practitioners, and internists were respectively those by ACOG, USPSTF, and ACS. Factors leading to physicians recommending screening: 1) Physicians had feelings of potential regret from not ordering mammograms: - higher risk for malpractice liability - fear or missing potentially lethal cancers - patient's expectations about mammograms 2) Concerns with and leading to overuse of screening.

[a]NA: Not Applicable

Three of the included studies [28-30] collected data on the influence of practice guidelines on physicians' ordering of mammography screening. In two of the American studies [28, 30], the American Cancer Society was identified as the most influential screening guideline. One of these studies, however, showed that PCPs in the United States were most influenced by their sub-specialty cancer screening guidelines [30]. In one other American study, physicians who trusted the USPSTF the most were significantly less likely to recommend mammography screening to women aged 40-49 than those who most trusted other organizations [33]. Furthermore, three of the studies revealed that physicians would recommend screening if their colleagues recommended this test [26, 27, 29]. As many as 89.6% of physicians in one study [27] stated they would order a screening test that they would not usually recommend if the specialists with whom they worked recommended the test. In addition, patient anxiety about having cancer and patient expectations to have mammography increased the likelihood that a physician would order a screening test [26, 27, 29, 34]. In one particular case [29], 40% of physicians did not think breast cancer screening was necessary for women aged 40 to 49, but 62% of those physicians said they would order the test if their patients requested it. Of the physicians who did not offer screening to women 40 to 49 [29], the most commonly expressed reason for not screening was the absence of evidence of decreasing breast cancer related deaths with screening. In the same study, approximately 20% of physicians in that study said they did not offer mammography screening because they thought the risk of harms such as increased anxiety, unnecessary radiation exposure, high false positive rates, unnecessary biopsies, and overtreatment of benign results outweighed any benefits of screening. In a second article [27], if a physician thought that mammography for women aged 40 to 49 was not recommended or was unclear, then a patient's expectation of having mammography tripled the probability that

mammography would be ordered. Only one article [26] reported on the patient-doctor relationship as a factor influencing a physician's decision to order a screening test. In this study, a good quality patient-doctor relationship significantly decreased the odds that physicians would order mammography screening for women aged 40 to 49.

Three of the articles [26, 27, 32] reported on uncertainty in the area of mammography screening and these data are shown in **Table 5**.

Table 5. Primary Care Physician Perspectives on Uncertainty in Mammography Screening

Article	
Tudiver 2002	• Over 65% of physicians found mammography screening guidelines conflicting.
Haggerty 2005	• About 30% of physicians found mammography screening guidelines unclear.
Meissner 2011	N.A
Smith 2012	N.A
Miller 2014	N.A
Kiyang 2015	N.A
DuBenske 2017	• Physicians are not always aware of all risk factors or using all risk factors in their discussions. • Physicians identified ambiguity in the guidelines. • Physicians reported less confidence in their ability to know or consider all risk factors for an individual's risk calculation as well as difficulty making sense of ambiguous, contradictory or changing guidelines. • One physician stated he did not feel adept to discuss screening.
Radhakrishnan 2017	N.A
Radhakrishnan 2018	• The difficulty of reconciling divergent organizational guidelines was strongly associated with recommending screening to women aged 45-49. Physicians who trusted the USPSTF guidelines the most had lower potential regret.

[a]NA: Not Applicable

In these studies, physicians found mammography guidelines unclear, contradictory, and changing. One study showed that the difficulty of reconciling divergent organizational guidelines was strongly associated with recommending screening to women aged 45-49 [34]. The study involving interviews with physicians [32] revealed that physicians did not feel confidently prepared to have a discussion with their patients about mammography screening and struggled with this uncertainty.

Lastly, the physicians' perspectives on the mammography decision-making process between physicians and patients are found in **Table 6**.

Table 6. The decision-making process about mammography screening including influencing factors

Article	
Tudiver 2002	N.A
Haggerty 2005	• Approximately 30% of physicians said they would order the test if it would take less time than convincing patients that they do not need it.
Meissner 2011	N.A
Smith 2012	• 94% of physicians found patients often or always thought that breast cancer was a serious threat, were aware of screening and wanted to discuss screening mammography. • Overall approximately 75% of physicians said that lack of time was never or rarely an issue in discussing breast cancer screening with patients aged 40-49. • 55% of physicians said they discussed the risks and benefits of screening with their patients, and allowed them to decide when screening mammography should be initiated.
Miller 2014	N.A
Kiyang 2015	• 63% of MDs showed strong or very strong intentions to support women in making informed breast cancer screening decisions. • Perceived behavioural control was most strongly associated with intention to support, followed by attitude, and then social normal. • Physicians most frequently reported time constraints as a barrier to supporting women, followed by women's awareness of relevant information. • The most frequently reported facilitator of supporting women was the availability of decision support tools for physicians and their patients. • The next most reported facilitators were specific characteristics of targeted women and the physicians' own knowledge about informed decision-making.
DuBenske 2017	• Physicians reported struggling to discuss screening mammography. • Four elements had a critical impact on communication between family physicians with patients on the shared decision-making process: (a) Time constraints; (b) Risk (lack of adequate knowledge of risks and ability to communicate risk in an effective format); (c) Guidelines (confusion related to conflicting and changing guidelines); and (d) personal preferences (addressing patient preferences that contradict guidelines and addressing physician's own biases). • Physicians reported a concern for time constraints, and noted they act as a barrier on being able to thoroughly consider all risk factors and offer individual recommendations. They also desired efficiency in the screening discussion. • Physicians report that they do have brief conversations about potential outcomes of screening, yet women in this study reported receiving limited or no information about them. • Both identify and support patient preference for varying degrees of involvement in decision-making. Both desire women to understand their risks. Both see the value in preparing women for potential call-backs and next steps, however, women report this does not happen whereas many physicians reported that they do discuss this. • Many women trust their physicians understand guidelines and use them in directing their decision; physicians identify ambiguity in the available guidelines.
Radhakrishnan 2017	N.A
Radhakrishnan 2018	N.A

[a]NA: Not Applicable

Four of the articles highlighted time as a factor affecting the screening decision-making process [27, 29, 31, 32]. In two of these studies [31, 32], physicians reported lack of time as a barrier to supporting women making informed decisions and a desire for efficient discussions. Approximately 30% of the physicians in a third study [27] stated they would order mammography if it would take less time than convincing patients that they do not need it. In contrast, the majority of the physicians in a fourth study [29] said that time was never or rarely an issue in mammography screening discussions. An overwhelming proportion of the physicians in this same study also perceived that women wanted to discuss screening mammography yet only 50% of the physicians claimed to discuss the risks and benefits of screening with their patients.

Discussion

The reviewed literature offers an overview of the current mammography screening landscape from the perspective of PCPs. These physicians approach mammography screening with average-risk women in different ways and hold diverse views with respect to screening decision-making with their patients, based on differing beliefs and varying factors influencing their practice. This research is useful to further understand what guides physicians when clinical guidelines are unclear and conflicting, and sheds light on the extent to which other factors consequently play a role in decision-making. By narrowing in on the patient-PCP relationship, this research illustrates what actually occurs in physicians' offices, regardless of public health messages or population-based mammography program goals. It can inform next steps on identifying what physicians need to improve the mammography screening decision-making process with average-risk women in order to respect ethical and professional obligations towards their patients.

The PCP data revealed that more than 50% of physicians in three of the nine included studies found mammography guidelines unclear, conflicting, or ambiguous. We expected studies to report on this clinical uncertainty in the recommendations, but interestingly, the physician data did not extensively elaborate on the ways in which these health care providers coped with clinical uncertainty in mammography decisions. Only one article [32] revealed that physicians reported less confidence in their capabilities of engaging in screening discussions with patients due to ambiguous guidelines. We had also anticipated capturing some data on ethical tensions experienced by physicians due to this lack of clarity in practice guidelines and to controversies about overdiagnosis. These tensions could include the willingness to justly inform women about the benefits and risks of mammography screening without causing undue distress by discussing screening drawbacks such as overdiagnosis, and uncertainties around the magnitude of this problem. Tensions between ethical principles in the decision-making process may not have come through our search because we did not include the keyword ethics. Or, the absence of data on ethical tensions could be due to a low likelihood of empirical studies measuring outcomes related to ethical or moral tensions.

Data from two studies [28, 30] showed that physicians clearly believed in the effectiveness of mammography screening in reducing breast cancer mortality, despite evidence in a systematic review showing the limited effectiveness of this screening test [4]. Since the effectiveness of mammography in preventing death from breast cancer and the rates of false positives and overdiagnosis vary by age group, sharing these numbers with women might improve screening discussions between providers and patients [41]. Despite this variability in screening effectiveness across age groups, the numbers of women needed to be screened in order to prevent one death from breast cancer remain substantial. In one systematic review [4], the

authors conclude that 2108 and 721 women would need to be screened every 2 years for a median of 11 years in order to prevent one death from breast cancer in women between the ages of 40-49 and 50-69 years, respectively. Yet despite this low absolute risk reduction associated with regular screening for average-risk women, up to 50% of the physicians in one study [28] strongly agreed that mammography is an effective test for women aged 40 to 49. Some PCPs may hold this belief because they are unaware of evidence on numbers needed to screen, or, because of a misunderstanding in the evidence they access to inform their clinical practice. In their work on the ethics of screening [42], Juth and Munthe note that some researchers express reductions in mortality from breast cancer using relative risk, while expressing rates of overdiagnosis and overscreening with absolute risk. They point out that presenting data in this way is conducive to biases favoring screening by "playing down the negative effects and emphasizing the positive ones". Framing the benefits and harms of screening tests such as mammography using different types of risk may be confusing to clinicians and work against efforts to promote informed consent and patient autonomy.

PCPs have discussed this issue of presenting evidence on risk reductions associated with tests or interventions as absolute versus relative risk, and how this difference has an impact on the capability of women to make informed choices. Woloshin and Schwartz [43] affirm that in a world where selling screening is much easier than selling informed choice, women needed to be reminded that ''screening is a genuine choice''. These physicians acknowledge the disagreement in the evidence despite the substantial amount of research that has been conducted on mammography harms and benefits. In counseling patients, they propose using screening fact tables that convey as clearly the possible the order of magnitude of the effects of regularly mammography screening.

Yet even if providers are equipped with the necessary information to share with women considering screening, disagreements on what exactly should be shared with women remains a problem. For instance, in Parker et al.'s work on breast cancer screening communication [8], the most frequently expressed reasons for the provision of information on overdiagnosis included: the right for people to know what they are signing up for when they participate in screening, and the idea that providing information enables informed decision-making which is particularly important for breast cancer screening given the drawbacks. In contrast, the most commonly expressed rationale to limit information on overdiagnosis was that doing so maximized screening participation. The participants in this study, however, were not asked about their beliefs regarding screening effectiveness in reducing breast cancer mortality, which would be important to look at if they hold the belief that maximizing screening is important. The participants who advocated for limiting information on overdiagnosis challenged the concept of overdiagnosis as a harm. They thought that increased participation in screening would enhance patient choice later on, given the importance of early detection of breast cancer in treatment decisions.

Regardless of what specific information is presented to patients, using evidence to guide practice requires proper knowledge and understanding of statistics on the provider's part to distinguish between relevant and irrelevant data. In a survey of over 400 PCPs in the United States [44], nearly half of the physicians mistakenly thought that a higher incidence of cancer in a screened population versus an unscreened group meant that the screening test saved lives. Although this data on statistics illiteracy is limited by the authors' use of hypothetical scenarios, these findings are concerning. Providers are expected to practice medicine according to evidence and should be able to explain their reasoning behind recommending a test or not, by understanding the numbers supporting their stance. Yet even with a thorough understanding of

statistics, the findings in our review suggest that some physicians may value some forms of knowledge more than others. In one of our included studies [27], if a physician thought that mammography for women aged 40 to 49 was not recommended or was unclear, then a patient's expectation of having mammography tripled the probability that mammography would be ordered for that patient. Our review generally showed that many factors other than clinical guidelines influence physicians in their decision-making with patients, including their colleague's recommendations [26, 27, 29]. Physicians may at times be as influenced by anecdotal, clinical, and personal experience as they are by evidence generated from conventional sources such as systematic reviews. However, as stated in article 6 of the Code of Ethics of Physicians in Quebec [25], 'a physician must practice his profession in accordance with scientific principles'. Moreover, our review did not capture data on system-level factors that may influence the screening perspectives and practices of primary care providers. These factors include quality assurance and performance measurement activities. Mammography screening belongs to the list of performance measures established by the Health Effectiveness Data and Information Set in the United States healthcare system [45].

While this research addresses screening from the perspective of PCPs, it is relevant to consider that in high-income countries, many women are invited to enter mammography screening programs through government-based initiatives. Provincial mammography screening programs across Canada do not offer or advise women to seek counseling prior to entering their programs. In Quebec, at the age of 50, women receive an invitation to enroll in the province's official screening program. Although the Quebec program offers psychosocial support to women once registered in the program, there is limited access to pre-screening counseling. Once women register in these programs, their physicians typically receive alerts for subsequent mammograms,

which are ordered automatically. Few opportunities may exist for women to revisit an initial decision to start screening. For women who discuss screening with their PCP, uncertainty around what information to present to inform decisions remains an important issue. Yet in the Canadian Medical Association Code of Ethics [17], articles 21 and 22 clearly indicate the ethical obligation of physicians to enable patients in making informed decisions by providing appropriate information and ensuring it is understood. Article 29 in the Code of Ethics of Physicians in Quebec [25] echoes this same responsibility of providers towards their patients.

When balancing the benefits and trade-offs of a screening test becomes less clear, such as in breast cancer screening, primary care experts are increasingly recommending shared decision-making [46]. Throughout this collaborative approach to decision-making, the patient's personal preferences, values, and beliefs are carefully explored and taken into account. The health provider and patient then deliberate to determine the best option for the patient. Additionally, the patient' self-efficacy to follow through with a plan and follow-up meetings are critical elements of this decision-making model. Whether or not an actual decision is made, patients' decisional needs become more evident through this process. Providers and patients can then effectively work together to assess these needs in order to progress in the decision-making [47]. Decision-making support tools such as the SURE Test (Sure of myself, Understand information, Risk-benefit ratio, Encouragement) [48] are useful for practitioners and patients when facing decisional conflict.

Lastly, our review revealed that physicians may have strong intentions to support women in making informed decisions about mammography screening [31], but some physicians may not be engaging in discussions about screening at the time their patients would like [29].

Limitations

Our study captures articles using diverse methodologies and methods and various outcome measures, resulting in a difficult harmonization of findings. Although all 9 included articles are empirical, comparing results of these studies that measure different outcomes becomes somewhat difficult. Our use of a Critical Interpretive approach [18] allows for a rich set of data that would not have necessarily been included in a more rigid search strategy such as those used in systematic reviews. Yet the conclusions that can be established from our study are perhaps limited and less clear than those that can be made from a systematic review.
Our search strategy may have also left out articles relevant to our review, but the McDougall approach [18] seeks to gather key concepts on a topic that emerge from a sub-set of the literature and we believe our search still resulted in a thorough scanning of relevant literature.

Furthermore, the varying terminology used to describe similar data in our included studies challenged the comparing and contrasting of findings. We were not always able to effectively group data into consistent themes. For instance, in one study, authors measured whether or not physicians 'offered' screening [29], whereas in another study [28], the authors measured whether physicians 'recommended' screening. We grouped this data together in our analyses, as both indicated a similar disposition towards support for screening for particular patients.

Conclusions

In conducting this critical interpretive review, we aimed to rigorously gather information on the beliefs and approaches of physicians regarding mammography screening decision-making with average-risk women. As stated in article 3 of the Code of Ethics of Physicians in Quebec [25], physicians must promote and protect the health and well-being of a patient, 'both

individually and collectively'. This dual responsibility towards both an individual's needs and to the collective good further emphasizes the need to continue scrutinizing screening.

Upcoming work led by this research group aims to continue this examination, by analyzing comments from physicians in response to clinical evidence on mammography screening. These perspectives, stemming from the Patient Oriented Evidence that Matters™ dataset, will provide further insight on the decision-making processes occurring during visits with primary care providers, and the values guiding the practice of these professionals.

List of Abbreviations

AAFP	American Academy of Family Physicians
ACP	American College of Physicians
CTFPHC	Canadian Task Force on Preventive Health Care
PCP	Primary Care Physician
POEMs	Patient Oriented Evidence that Matters™
USPSTF	United States Preventive Services Task Force

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Authors' contributions:

Sophia Siedlikowski (SS) conducted the literature searches, the initial abstract/title screenings, and was the lead writer of this manuscript. She organized meetings with the two other co-authors when needed and incorporated their feedback into this final version.

Carolyn Ells (CE) worked closely with SS from start to end on this paper. She helped develop the inclusion and exclusion criteria, and screened a sub-set of the articles. CE also provided multiple rounds of feedback for the manuscript and had numerous meetings in person with SS to discuss and track progress.

Gillian Bartlett (GB) contributed to the conceptualization of the research problem, question, and objectives. GB was also consulted for her input in determining the final set of included articles. Additionally, GB provided written feedback on the background and full final draft of this manuscript.

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Chapter IV - Physician perspectives on mammography screening for average-risk women

Preface to second manuscript

In this second manuscript, the question of what are the perspectives of physicians on mammography screening clinical research synopses and the ways they use this research information in their practice will be explored. This study includes an analysis of both quantitative data and qualitative data extracted from a validated questionnaire [54] of closed and open-ended questions completed by physician members of the CMA. Physicians that subscribed to receive the Daily POEM (Patient Oriented Evidence that Matters™) receive a brief synopsis of clinical research and are asked to fill out a questionnaire and comment on the information contained in the POEM. The POEMs pertaining to mammography screening, overdiagnosis, and decision-making will specifically be examined in this study. While the first manuscript reviewed primary care perspectives on mammography more broadly, this second study narrows in on what actually occurs in practice. This study reports on physician's thoughts regarding the use of clinical research in practice as well as their personal experiences in mammography decision-making with average-risk women. By gaining direct insight into physician's thoughts and reflections on mammography research and decision-making, the knowledge generated from this empirical study will add and contribute to the results previously obtained from the critical interpretive review (Chapter III).

This manuscript will be submitted to the *Journal of Family Practice*, a peer-review journal, because of its specific focus on meeting the information needs of family physicians through the publication of relevant valid research on primary care issues.

Contribution of authors

Physician perspectives on mammography screening for average-risk women

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SS, CE, GB, and RG all contributed to the conception and design of the work for this manuscript. The data collection was facilitated by RG (owner of the data), and performed by SS. SS, CE, and RG conducted the data analysis and interpretation. SS was the lead writer and drafted the manuscript. All four authors SS, CE, RG, and GB critically reviewed the manuscript during several rounds of feedback. All four authors gave their approval of the final manuscript in this thesis.

Abstract

Objectives: Although the influence of practice guidelines on physicians' ordering of mammography screening is well established, conflicts exist in the recommended mammography screening initiation ages and screening frequency among different mammography guidelines. Furthermore, growing evidence nuancing the benefits and harms of screening has put systematic screening into question. Understanding physician perspectives on the evidence that affects patient care will be important for informing future best practices as guidelines evolve. A large amount of data exists on these perspectives from thousands of physicians who read and react to clinical research synopses (Patient Oriented Evidence that Matter^{TM}: POEMs) through an ongoing continuing medical education program. The purpose of this study is to explore

physicians' perspectives on clinical research regarding mammography screening for average-risk women and the extent to which they use this POEM information in their clinical practice.

Methods: The Essential Evidence Plus database was searched from 2012 to 2017 with the term "breast neoplasm" to identify relevant POEMs on mammography screening, screening decision-making, and overdiagnosis. Using the Information Assessment Method (IAM), physician ratings and comments about mammography evidence were extracted from reflections on clinical research summarized as POEMs. The items of interest in the IAM were those calling on physicians to reflect on the value of the information and its applicability. Quantitative data were assessed with descriptive statistics. Using an iterative approach, the qualitative data were subjected to both an inductive and deductive analysis. These data were coded thematically into sub-themes, which were grouped into major themes. Connections were sought between both quantitative and qualitative data.

Results: Four POEMs on mammography screening were identified. The number of quantitative POEM ratings ranged from 1243 to 1351. Across all four POEMs, among the physician ratings about using the information for a patient, over 50% were about using it in a discussion with a patient or other healthcare provider. Three major themes emerged from the analysis of 310 qualitative comments across all four POEMs: 1) Perspectives on information presented in POEMs, 2) Applying this information in practice, and 3) Confronting clinical and cultural realities. Physicians held diverse perspectives on the value of the POEMs. Some physicians continued to support screening while others condemned harms such as overdiagnosis. Although physicians noted the potential of the POEMs to improve patient counseling, access to this information did not necessarily diminish perceived challenges in screening discussions. Physicians advocated for the personalization of screening decision-making and patient-centered

approaches to respect each patient's values and preferences.

Conclusion: Divergences exist in the ways physicians value clinical evidence on mammography screening and the extent to which they use it in practice. While some physicians intended to use the POEMs to support balanced screening discussions and prevent unnecessary testing and treatment, others rejected the POEMs and advocated to continue regular screening practices. Physicians also experience challenges in understanding and explaining evidence about screening and overdiagnosis. Despite continuing controversies in mammography screening, physicians expressed the importance of optimizing ethical screening decision-making and respecting women's personal values and preferences. Further research should explore how primary care providers can implement shared decision-making on breast cancer screening with their patients.

Physician perspectives on mammography screening for average-risk women

Background

To encourage early detection and reduce mortality from breast cancer, population-based screening programs exist in many high-income countries. In Canada, organized mammography screening programs are widely implemented [1]; yet, their worth is increasingly being questioned due to growing awareness of the harms of screening for average-risk asymptomatic women [2-4]. Mammography screening has become so contentious that one independent medical board in Switzerland recommended abolishing their screening programs [5] and one in France recommended either abolishing theirs as well or implementing a radically reformed version of their current program[6].

Ongoing conflicts about the true benefit of mammography have led to substantial controversies in the healthcare research community. Nystrom et al.'s study [7], a follow up to randomized controlled trials in Sweden, suggests a 15% relative reduction in breast cancer mortality due to regular mammography screening. Systematic reviews have, however, nuanced such findings. One Cochrane review of 7 trials and 600 000 women found that screening likely reduces breast-cancer mortality but the magnitude is uncertain because of methodological shortcomings of the included trials [8]. The authors concluded that mammography screening does not clearly do more good than harm, thus underlining important ethical implications for clinical practice [8]. Furthermore, the Independent United Kingdom Panel on Breast Cancer Screening conducted a review of studies in 2012 showing that the absolute risk reduction in breast cancer mortality due to screening ranged from 0.05% to 1% [9]. In their book on screening ethics, Juth and Munthe explain that expressing mortality reductions due to screening using relative risk results in exaggerated perceptions of the true benefit of screening and hinders informed decision-making [10]. In addition to these uncertainties regarding the magnitude of the benefit of

mammography screening, systematic screening for average-risk women has been questioned due to growing concerns regarding overdiagnosis.

In mammography screening, overdiagnosis occurs when breast cancers that are detected and treated would not have harmed women during their lifetime had they not been detected and treated. [11]. Individuals who are overdiagnosed undergo unnecessary biopsies and treatment of cancers that would not have caused disability or death [12]. One investigation in the United States found that current estimates of breast cancer overdiagnosis from screening mammography ranged from 0% to 30% [13]. These estimates reach up to 50% of all breast cancers in other studies [14-16]. This substantial range can be explained by disagreement on appropriate methods to calculate such estimates [17]. The denominators used in the formula to calculate overdiagnosis estimates vary [18]. Some researchers use the number of diagnoses during the screening period as a denominator while others use the number of diagnoses in the remaining lifetime leading to variations in the estimates of overdiagnosis. In the case of prostate cancer, due to these important differences in calculation methods, population characteristics and screening protocols, overdiagnosis estimates range from 1.7% to 67% [19]. Some institutions have recently launched programs to address and minimize the harms of overdiagnosis.

Choosing Wisely, an international campaign, aims to engage health care professionals and patients to make smarter and more effective care choices. The ultimate goal is to reduce unnecessary medical tests and treatments such as those that may result in overdiagnosis. In 2014, *Choosing Wisely Canada* recommended against routinely doing mammography screening for average risk women aged 40 to 49. The Canadian Task Force on Preventive Health Care (CTFPHC), an independent panel of methodologists and clinicians that make recommendations on preventive care, provided the evidence supporting this health recommendation [15]. Basing its

recommendations on a systematic review of studies [15], the CTFPHC further reports that regular screening only reduces the absolute risk of dying from breast cancer by 0.05%, 0.13%, and 0.22% in women between the ages of 40 to 49, 50 to 69, and 70 to 74, respectively [20]. The CTFPHC however cautions that these calculations may be underestimating the absolute benefit of mammography due to methodological considerations. The United States Preventive Services Task Force (USPSTF) also sought to investigate the benefits of mammography screening in reducing breast cancer mortality but used different measures than those of the CTFPHC. The USPSTF conducted a meta-analysis to calculate the absolute rates of breast cancer mortality reduction per 10 000 women screened during a ten-year period. The number of deaths reduced was 2.9 (CI: – 0.6 to 8.9) for women aged 39 to 49 years, 7.7 (CI: 1.6 to 17.2) for women aged 50 to 59 years; 21.3 (CI: 10.7 to 31.7) for those aged 60 to 69 years; and 12.5 (CI: –17.2 to 32.1) for those aged 70 to 74 years. The absolute reduction for the combined group of women aged 50 to 69 years was 12.5 (CI: 5.9 to 19.5). Despite these findings on absolute risk reductions, results from two studies [21, 22] show that physicians believe in the effectiveness of mammography as a screening test for breast cancer. A study exploring physicians' knowledge about prostate cancer showed that physicians overestimated the benefits of this test, suggesting the potential for physicians to also overestimate the benefits of mammography screening [23]. In a survey of over 400 primary care physicians in the United States, nearly half of the physicians mistakenly thought that a higher incidence of cancer in a screened population versus an unscreened group meant that the screening test saved lives [24]. This finding is concerning because physicians occupy a central role in providing and explaining information to women regarding screening and subsequently referring patients to screening.

Physicians have an important impact on the decision-making process for women considering cancer screening [25]. While the actual mammography test can be completed in many different settings depending on the health care and medical insurance system, the decision to undertake mammography screening often takes place in primary care settings such as family physician offices. Although the influence of practice guidelines on physicians' ordering of mammography screening is well established [21, 22, 26, 27], 65% of physicians in one study found guideline recommendations to be conflicting [28], and 30% of physicians in another study found the guidelines unclear [29]. This is not unexpected as conflicts exist in among mammography screening guidelines as to the recommended initiation ages and screening frequency, despite the fact that the guidelines are based on high quality systematic reviews [30]. Thus, it is important to understand physician perspectives on the evidence that in turn informs practice guidelines and affects patient care.

This paper aims to explore physicians' perspectives on clinical research regarding mammography screening for average-risk women and the extent to which they use this information in their clinical practice. Data obtained from thousands of physicians who read and react to clinical synopses through an ongoing continuing medical education (CME) program may address these aims.

Methods

This study's design is a dynamic cohort study.

Data Source: Patient-Oriented Evidence that Matters (POEMs)™ Database

Since 2005, physician members of the CMA can subscribe to receive the Daily POEM. Each POEM is a short synopsis that concisely describes recently published original clinical research and systematic reviews. The Daily POEM selection process involves the review of over

3000 studies published monthly in 102 journals to identify new clinical research relevant to primary care. The following questions are used to establish the relevance of clinical research that is POEM-worthy (all three criteria must be met):

1. *Did the authors study the outcomes that patients would care about*? Studies for which results require extrapolation to outcomes that matter to patients are excluded.

2. *Is the problem studied common to primary care, and is the intervention feasible*? Only information that can be implemented in primary care practice is considered.

3. *Will the information, if true, require a change in current practice*? Information that confirms existing standards of practice is usually not reviewed [31, 32]

Once an article is identified as relevant, it is appraised for validity using criteria from the Evidence-Based Medicine Working Group, which are continuously updated to include novel study quality issues [33]. Each POEM consists of three parts: a clinical research question, a "bottom line" statement summarizing the conclusions of the article and how they should be applied in practice, and a brief summary of the study design and results. In addition to any financial support, all Daily POEMs are assigned a level of evidence from the Oxford Centre for Evidence-Based Medicine. Each POEM also includes a link to the PubMed entry and original article citation [34].

Accredited in Canada in 2006, the POEMs CME program asks participating physicians to reflect on the information in a Daily POEM. Through this program, physician members of the CMA earn a mini-credit from the College of Family Physicians of Canada (0.1 Mainpro-M1) or the Royal College of Physicians and Surgeons of Canada (0.25 Maincert Section 2). Physician reflections on each POEM are documented in a short questionnaire that includes closed and open-ended questions. This process is called the Information Assessment Method (IAM) [35].

Since 2001, the IAM questionnaire has been refined in publicly funded research involving systematic reviews of the literature and qualitative, quantitative, and mixed methods studies. The IAM is available in English, French, Spanish, and Portuguese, and its content is validated [36].

Data Collection:

The Essential Evidence Plus resource was searched on June 5 2017 from 2012 to 2017 using the term "breast neoplasm" in order to retrieve all relevant POEMs relating to harms and benefits of mammography screening, screening decision-making, and breast cancer overdiagnosis. The database of completed IAM questionnaires was then searched to extract data from these corresponding POEMs.

Quantitative Data**:**

The ACA-LO theoretical model explains the value of information, that is, how information is valuable from the information users' viewpoint. In this model, 4 "levels of outcomes" (LOs)—situational relevance, cognitive impact, use of information, and subsequent health benefits—are associated with the iterative "acquisition– cognition—application" process. The ACA-LO model is operationalized by the Information Assessment Method (IAM) [35] questionnaire. This questionnaire is composed of four main questions targeting different domains or constructs: Cognitive impact (Q1), relevance of this clinical information to a specific patient (Q2), the use or application of this clinical information (Q3 - this question is answered when Q2 is a "Yes"), and expected health benefits (Q4 - this question is answered when Q3 is a "Yes").

For this study, the items of interest in the IAM questionnaire are listed in Table 1. Frequency counts and percentages were calculated for the following nine items.

Table 1. List of IAM questions and items of interest in this study

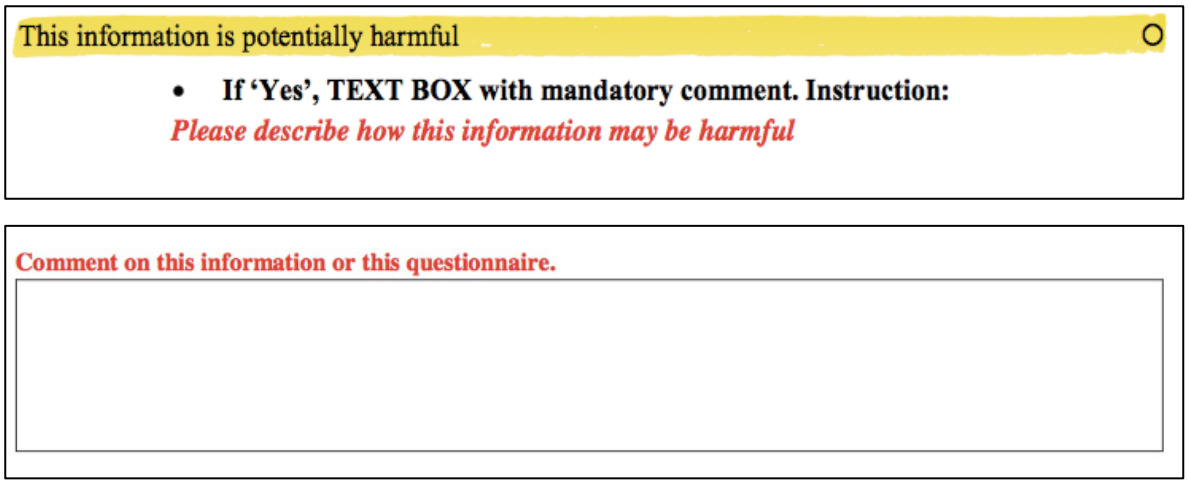
Question	**Item of Interest**

Q1: What is the impact of this information on you or your practice?	o I disagree with the content of this information. o This information is potentially harmful.
Q3: Will you use this information for a specific patient?	o As a result of this information I will manage this patient differently o I had several options for this patient, and I will use this information to justify a choice. o I thought I knew what to do, and I used this information to be more certain about the management of this patient. o I used this information to better understand a particular issue related to this patient. o I will use this information in a discussion with this patient, or with other health professionals about this patient. o I will use this information to persuade this patient, or to persuade other health professionals to make a change for this patient.
Q4: For this patient, do you expect any health benefits as a result of applying this information?	o This information will help to avoid unnecessary or inappropriate treatment, diagnostic procedures, preventative interventions or a referral, for this patient.

Qualitative Data:

Perspectives were extracted from the two free text boxes in the IAM questionnaire (Figure 1). In Q1, when physicians responded "Yes" to the question "This information is potentially harmful", they are asked to describe how this information may be harmful. The final free text box prompts physicians to comment on the POEM information or questionnaire. Note that physicians were unable to see any comments submitted by their colleagues, indicating their comments were independent from those of their peers.

Figure 1. Image of the two free text boxes in the IAM questionnaire



Frequency counts and percentages for each questionnaire item were compared between POEMs. Similarities and differences between frequencies for various items were reported descriptively.

Qualitative data:

One team member (SS) translated the French language comments into English and then coded all qualitative data from each of the POEMs by hand. These initial codes were iteratively refined and NVivo 11.4.1 [37] was used to re-organize these updated codes. Each code was then tagged to its corresponding POEM. During this phase, a meeting was held with team member RG, a practicing family physician and the founder of the POEMs CME program in Canada. This meeting helped to clarify the meaning of selected comments.

The comments were then analyzed using a combined inductive and deductive approach involving iterative coding and categorization of codes into sub-themes, and major themes. Previous research by Pluye et al. [38] using IAM data from the e-Therapeutics CME program established the concept of constructive feedback comments. This concept categorizes data relating to the quality of evidence into four elements: additional content, reservation or

disagreement, contradictory evidence, and need for clarification. The concept of constructive feedback was used to help guide the analysis of the data relating to the quality of the evidence in the POEMs included in this study. CE and SS organized the qualitative data into an initial list composed of major themes, sub-themes, and surface codes. This list was finalized and refined through an iterative process involving meetings with RG and CE until consensus was reached.

Only data relevant to the study question were retained. Furthermore, for consistency purposes in this paper, a physician referring to women at 'low-risk' of developing breast cancer was considered equivalent to a physician referring to women at average-risk of developing breast cancer. One-word interjections and expressions of surprise were excluded from the analysis.

Comparing quantitative and qualitative data:

Connections between the frequency count results and the final themes and sub-themes from the qualitative data were assessed and reflected upon in the discussion of this study's findings.

Results

Four POEMs emerged from the Essential Evidence Plus database following the search from 2012 to 2017. A summary of the content of these POEMs is presented in Table 2.

Table 2. Key characteristics of four included POEMs

POEM Title & Date	**Study Design**	**Clinical Question**	**Bottom line**
1. Overdiagnosis of breast cancer is common 2013-01-29 [39]	Cohort, prospective	What proportion of breast cancer is overdiagnosed?	In the past 30 years we have seen a large increase in the detection of early-stage cancers, but little corresponding decline in late-stage cancers. The authors conclude that approximately 1 in 4 breast cancers has been overdiagnosed, which were [sic] unlikely to have ever harmed the woman. (LOE[a] = 2b)
2. Numbers to help women understand the	Review	What are the trade-offs of benefits and harms for women	The authors suggest that balanced discussions about the benefits and harms of screening mammography

benefits/harms of screening mammography 2014-02-14 [3]		considering a mammogram to screen for breast cancer?	should focus not only on the possibility of breast cancer deaths avoided but also the possibility of false alarms and overdiagnosis (the detection of abnormalities that will never progress enough to cause symptoms or death during a patient's lifetime). The numbers for women of different ages are outlined in the synopsis. Although some women are comfortable with a high rate of false positive results, some women will experience lasting consequences (Ann Fam Med 2013; 11:106-15) and should know the risk of harm when making the decision whether to screen. (LOE=5)
3. Mammography doesn't decrease cancer-related deaths long-term 2014-04-16 [40]	Randomized controlled trial (non-blinded)	Over the long term, does screening mammography decrease the likelihood of a woman dying of breast cancer?	Over an average follow up of 22 years in almost 90,000 women, there was a clinically insignificant difference of 5 deaths due to breast cancer (500 vs 505) in women who received 5 annual screening mammograms instead of usual care. Over more than 2 decades, only 1.1% of women died of breast cancer, much lower than the 12.5% (1 in 8) often cited. (LOE=1b)
4. Mammogram decision aid slightly increases informed decisions by women 2015-08-15 [41]	Randomized controlled trial (double-blinded)	Does a decision aid that incorporates data on breast cancer overdiagnosis increase informed decision making in women?	Decisions aids, regardless of whether they contain information about breast cancer overdiagnosis, have a modest influence on a woman's ability to make informed choices about screening. (LOE=1b)

[a]LOE refers to Levels of Evidence from the Centre for Evidence-Based Medicine, Oxford [42]

Quantitative data:

The results of the quantitative data extraction from the IAM questionnaires are shown in tables 3.1, 3.2, 3.3, and 3.4. These four tables present the number and frequency of physician

endorsement for the previously identified IAM items of interest for the four POEMs on mammography screening. The number of POEM ratings (completed IAM questionnaires) ranged from 1243 to 1351.

The lowest frequency of endorsement for the item "This information is potentially harmful" (Q1) was found in POEM 4, with 0 physicians endorsing this item. The highest endorsement for this item was found in POEM 1, with 24 physicians endorsing this item.

Of the physicians who answered "Yes" to using the information for a specific patient (Q3), the item in Q3 that was most frequently endorsed was "I will use this information in a discussion with this patient, or with other health professionals about this patient". The frequencies for endorsement for this item were 56%, 63%, 63%, and 54% POEMs 1, 2, 3, and 4, respectively. This was the only item across all POEMs that garnered more than 50% of endorsement from physicians who had responded "Yes" to the question on using this information for a specific patient. The use of the information found in these POEMs is therefore mostly in the context of discussions with patients or health care providers.

Across all four POEMs, of the physicians who indicated they would use the POEM information for a specific patient, under 25% said they would use the information to manage the patient differently, and under 25% said they would use the information to persuade the patient or other health professionals to make a change for a patient.

In POEMs 1, 2, and 3, of the physicians who answered "Yes" to Q3, over 75% endorsed the item from Q4: "this information will help to avoid unnecessary or inappropriate treatment, diagnostic procedures, preventative interventions or a referral, for this patient". In POEM 4, this item received endorsement from 57% of physicians.

Tables 3.1 Physician ratings for POEM 1

Overdiagnosis of Breast Cancer is Common	**Number of physicians endorsing item (%)**
N= 1293	
Q1. I disagree with the content of this information.	19 (1.47)
This information is potentially harmful.	24 (1.86)
Q3. Will you use this information for a specific patient?	139 (10.75)
Answering 'Yes' to this question enables the following questions:	
N=139	
As a result of this information I will manage this patient differently.	22 (15.83)
I had several options for this patient, and I will use this information to justify a choice.	33 (23.70)
I thought I knew what to do, and I used this information to be more certain about the management of this patient.	18 (12.95)
I used this information to better understand a particular issue related to this patient.	52 (37.41)
I will use this information in a discussion with this patient, or with other health professionals about this patient.	78 (56.12)
I will use this information to persuade this patient, or to persuade other health professionals to make a change for this patient.	21 (15.11)
Q4. This information will help to avoid unnecessary or inappropriate treatment, diagnostic procedures, preventative interventions or a referral, for this patient.	105 (75.54)

Table 3.2 Physician ratings for POEM 2

Numbers to Help Women Understand the Benefits/Harms of Screening Mammography	**Number of physicians endorsing item (%)**
N= 1351	
Q1. I disagree with the content of this information.	7 (0.53)
This information is potentially harmful.	4 (0.30)
Q3. Will you use this information for a specific patient?	214 (15.84)
Answering 'Yes' to this question enables the following questions:	
N= 214	
As a result of this information I will manage this patient differently.	19 (8.89)
I had several options for this patient, and I will use this information to justify a choice.	50 (23.37)
I thought I knew what to do, and I used this information to be more certain about the management of this patient.	33 (15.421)
I used this information to better understand a particular issue related to this patient.	61 (28.51)
I will use this information in a discussion with this patient, or with other health professionals about this patient.	134 (62.62)
I will use this information to persuade this patient, or to persuade other health professionals to make a change for this patient.	16 (7.48)
Q4. This information will help to avoid unnecessary or inappropriate treatment, diagnostic procedures, preventative interventions or a referral, for this patient.	163 (76.17)

Table 3.3 Physician Ratings for POEM 3

Mammography Doesn't Decrease Cancer-Related Deaths Long-Term	**Number of physicians endorsing item (%)**
N=1308	
Q1. I disagree with the content of this information.	150 (1.15)
This information is potentially harmful.	13 (0.99)
Q3. Will you use this information for a specific patient?	156 (11.93)
Answering 'Yes' to this question enables the following questions:	
N=156	
As a result of this information I will manage this patient differently.	19 (12.18)
I had several options for this patient, and I will use this information to justify a choice.	44 (28.21)
I thought I knew what to do, and I used this information to be more certain about the management of this patient.	24 (15.39)
I used this information to better understand a particular issue related to this patient.	49 (31.41)
I will use this information in a discussion with this patient, or with other health professionals about this patient.	99 (63.46)
I will use this information to persuade this patient, or to persuade other health professionals to make a change for this patient.	14 (8.97)
Q4. This information will help to avoid unnecessary or inappropriate treatment, diagnostic procedures, preventative interventions or a referral, for this patient.	122 (78.21)

Table 3.4 Physician ratings for POEM 4

Mammogram Decision Aid Slightly Increases Informed Decisions by Women	**Number of physicians endorsing item (%)**
N=1243	
Q1. I disagree with the content of this information.	4 (0.32)
This information is potentially harmful.	0
Q3. Will you use this information for a specific patient?	79 (6.36)
Answering 'Yes' to this question enables the following questions:	
N=79	
As a result of this information I will manage this patient differently.	6 (7.59)
I had several options for this patient, and I will use this information to justify a choice.	19 (24.05)
I thought I knew what to do, and I used this information to be more certain about the management of this patient.	16 (20.25)
I used this information to better understand a particular issue related to this patient.	34 (43.04)
I will use this information in a discussion with this patient, or with other health professionals about this patient.	43 (54.43)
I will use this information to persuade this patient, or to persuade other health professionals to make a change for this patient.	8 (10.13)
Q4. This information will help to avoid unnecessary or inappropriate treatment, diagnostic procedures, preventative interventions or a referral, for this patient.	45 (56.96)

Qualitative data:

Three hundred and ten comments from physicians who rated the information in these four

POEMs were extracted. POEM 1 contained 29 comments, the lowest number of comments, and POEM 2 contained 125 comments, the largest number. Table 4 presents the number of physcian ratings and comments for all four POEMs.

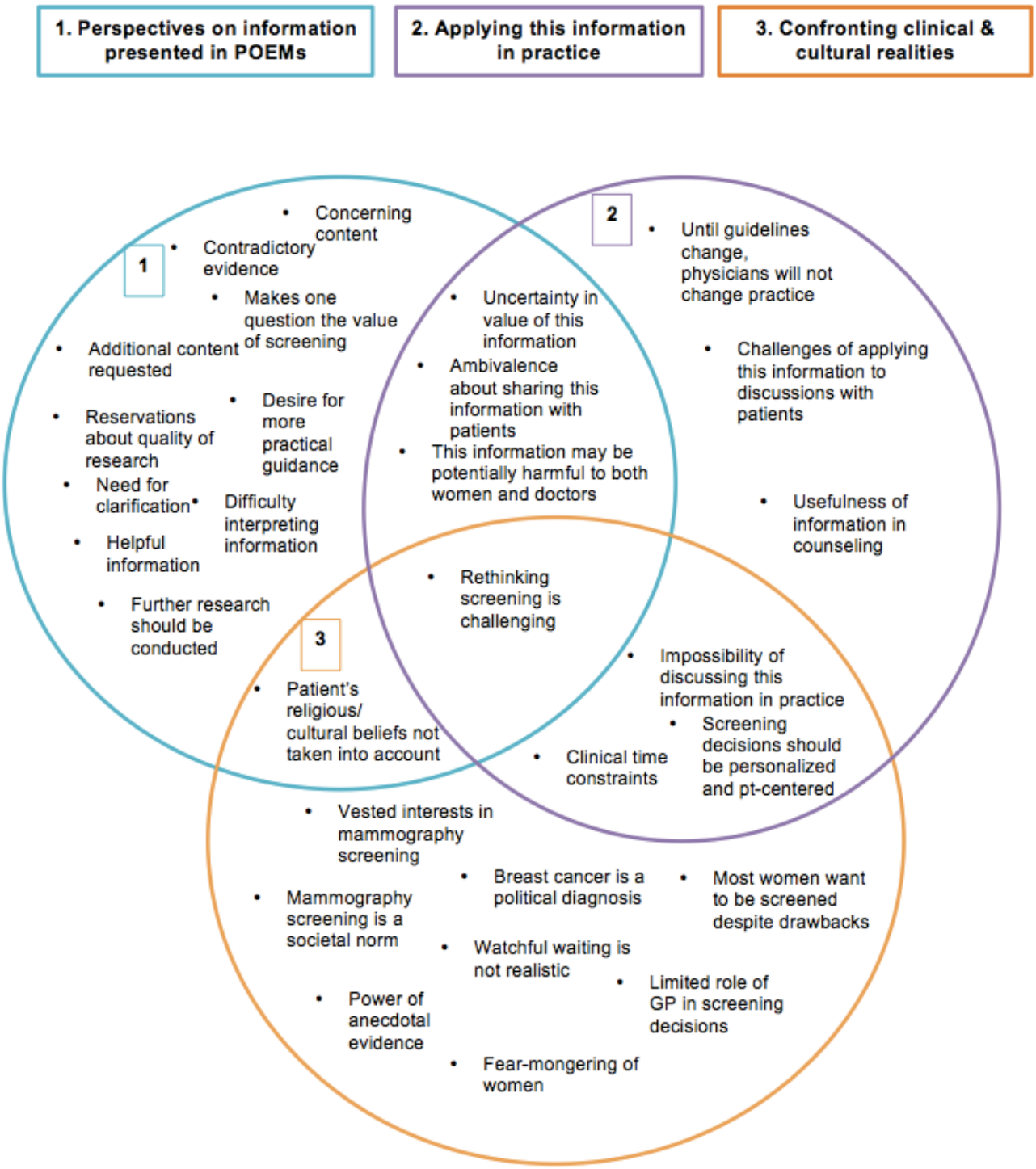
Table 4. Number of physician ratings and comments per POEM

POEM	Number of Ratings (N= 5195)	Number of Comments (N=310)
1	1293	29
2	1351	125
3	1308	93
4	1243	63

The results from the thematic analysis of physician comments across all four POEMs are presented in Figure 2. Three major themes emerged from the analysis: (1) perspectives on information presented in POEMs; (2) applying this information in practice; (3) confronting clinical and cultural realities. Each of these three major themes is comprised of a number of sub-themes, which themselves were created through the assembly of similar codes. Some sub-themes overlapped between two or more major themes. A Venn Diagram was therefore created to illustrate these zones of overlap (see Figure 2).

Given the large number of comments and the goal of broadly collecting physician reflections on POEMs, the comments that we elaborated on in the results have not been tied to a specific POEM. Therefore, throughout this manuscript, the mention of a physician's thoughts on a POEM refers to a physician's response to any POEM (1, 2, 3, or 4). However, the detailed quotes provided in the results to specifically highlight certain issues (Table. 5 and additional findings) were linked to their corresponding POEMs.

Figure 2. Venn Diagram of major themes and sub-themes emerging from data in free-text comment boxes of the four IAM questionnaires



Theme 1 Perspectives on information presented in POEMs

Physicians expressed diverse perspectives on the information contained in each POEM. A number of physicians found the information in the POEMs generally helpful and interesting. Physicians were also pleased that the POEM presented a balanced view on screening. In reflecting on the decision-making approach proposed in one of the POEMs, one physician commented:

> *"I myself strongly support this approach, and am glad more balance is reported in how to approach this volatile subject."* – POEM 3

The meaning of the information presented in the POEMs was not always clear to physicians. Several physicians asked for clarification about certain concepts in the POEMs they did not understand. Some physicians did not understand the concept of a benign cancer, and asked how one could know whether or not a cancer would progress. Several physicians mentioned they would need to read the original article in order to better understand the information in the POEM. Physicians also indicated a wish for further research to be conducted in order to obtain clearer practical guidance.

> *"So now the epidemiologists need to say what really is the best thing to do, and do that soon!"* – POEM 3

Numerous comments from physicians had to do with questioning the value of mammography screening and whether screening should still be recommended, given the POEM information. Others, however, showed concern about the potential harms of the POEM information, for instance, sharing information on overdiagnosis with women.

> *"Patients after hearing about this information may be reluctant to seek medical advice."* - POEM 1

Another comment explained that POEM information would lead to confusion among doctors.

Not all physicians were in agreement with the POEM information. Some physicians found it contradictory with information they had read from other sources.

> *"This information contradicts current practices and many other papers, however, I will need to review the paper more thoroughly in order to determine what, if any, impact it may have on current practices."* – POEM 2

Finally, many comments elaborated on concerns related to the quality and reporting of the research, such as methodological flaws, missing information, or problems with the representativeness of the study sample. While this first theme covers physicians' perspectives on the POEM information itself, the second theme groups physicians' thoughts about the applicability of this information in practice.

Theme 2 Applying this information in practice

Similar to the diversity of views within the first theme, physicians had varying opinions on the applicability of the POEM information to their practice. Although some physicians noted the potential of the information to improve counseling, awareness of this information did not necessarily minimize challenges experienced in discussions about screening.

Several physicians thought the POEM information would be useful in counseling women, especially having access to numbers and statistics to share with their patients.

> *"These are powerful statistics to use in day to day practice. This information is especially helpful in counseling women who prefer less frequent screening mammograms."* – POEM 2

In contrast, other physicians were uncertain about the value of the information in the POEMs and whether or not it would improve screening discussions with their patients.

> *"Looking at the numbers, I am not sure I can arrive at a decision confidently. I am not sure I can help my patients to make their decision!"* – POEM 3

Physicians had varying levels of willingness to share the information with their patients. While some thought the information in the POEM should be shared with women, others thought

it should only be shared if the patient was considering not to screen or if they brought up the information themselves.

Finally, physicians mentioned the difficulty of having discussions about the information presented in some of the POEMs due to factors external to the patient-provider relationship.

> *"There is no opportunity to discuss this with patients in the current political environment of women's health"* – POEM 2

Such challenges impeding physicians' and patients' ability of having balanced discussions about mammography screening are further explored in the third and final theme of this analysis.

Theme 3 Confronting clinical and cultural realities

The third theme speaks to the clinical and cultural realities that physicians must face, and how these issues have an impact on their capacity to think about and apply the POEM information in their practice.

Physicians expressed that the practice of regular mammography remains the standard of care and that mammography is still recommended despite the known POEM information. In addition, physicians highlighted the difficulty of presenting the limited benefits of mammography to women because mammography has been the norm for so long and there is so much advertising encouraging them to get screened.

Furthermore, comments elaborated on the particularly emotional nature of mammography screening and the ways emotions such as fear play into screening decisions. Physicians also spoke about the power that anecdotes hold in women's decision-making process about screening.

> *"Breast screening is a particularly emotive area for discussion. Often anecdotal evidence and experience plays a greater role in patients' decision making than objective evidence."* – POEM 4

They also pointed out that women who have friends and relatives who are healthy as a

result of breast cancer treatment will not change their routine mammography screening practice. In addition, physicians explained that the majority of women wish to be screened despite knowing about the drawbacks and harms.

> *"I suspect majority of women would prefer to take the risk of having a cancer over-treated rather than miss treating a cancer that required treatment. So what if anything should be done differently?"*
> – POEM 1

Physicians indicated that most women would rather go through the experience of a false alarm than missing a breast cancer diagnosis.

> *"Counselling women about breast cancer screening benefits and risks is very difficult. Very few of my patients are able to make an informed choice. Even when my patients have false positive screens, which require further imaging and biopsies that are negative, they are happy that they were screened. They see it as a "close call," and sometimes say, "It's a good thing I did that," or "Thank goodness we have this system." "*
> – POEM 4

A considerable number of comments discussed the screening culture present in our society. Physicians brought up the fear-mongering of women, for instance by cancer agencies. Other comments discussed the vested interests in mammography screening, including the government's strong endorsement of screening.

Time was brought up as a barrier to holding balanced discussions with their patients based on the information presented in the POEMs. Physicians also situated family physicians within the broader screening picture, pointing out their limited influence on women's decision-making due to aggressive screening programs.

Finally, physicians spoke about the importance of personalizing screening decision-making, and underscored the importance of adopting a more patient-centered approach in their practice.

Additional findings

Although they did not fit into one of the three major themes, other findings of interest include physicians' use of metaphors, imagery, and analogies to explain their perspectives on the current state of mammography screening. Most poignantly, one physician also compared the current mammography screening controversy to what happened with hormone replacement therapy in response to POEM 3:

> *"Some of us can hardly deal with the overflow of contradictory info so how can we expect them to keep trying to understand all those figures. It reminds me of the HRT crises & subsequent confusion [ongoing] that we have been living with since the train derailed ~ 1998, 2002."*

Several physicians also made reference to the prostate-specific antigen screening test in their comments on mammography screening. They mentioned the popularity of both screening tests at conferences, and the difficulty of asking patients to reconsider these screening tests because regular screening has been a practice for so long. Additionally, reflecting on the information in the POEMs prompted some physicians to share their general beliefs regarding mammography. These beliefs varied substantially. Many claimed that early breast cancer detection was valuable and that physicians should and will continue to recommend mammography.

> *"I still recommend strongly that women consider screening mammograms."* – POEM 3

> *"I am still an advocate for mammogram screening. If I can pick up an early breast cancer and hopefully save a patient's life, it's worth it."* – POEM 2

Overall, the findings from this thematic analysis reveal that physicians describe mammography screening as a complex evolving healthcare topic that remains confusing and unresolved.

Table 5 presents a selection of quotes highlighting specific concerns physicians voiced when responding to the POEMs. One example of a physician's preoccupation is provided for each of the thematic groupings (Figure 2).

Table 5. Select quotes illustrating physicians' concerns for each thematic grouping and their corresponding POEM

Theme(s)	Quotes from Physicians	POEM
1	"With the assumption of a constant underlying disease burden" What if this assumption is wrong? The hypothesis of overdiagnosis is interesting but no compelling proof is offered. If we assume overdiagnosis then screening will be decreased or eliminated. This is, at best, premature. There may be another explanation for the decrease in advanced disease not reflecting the increase in early detection. The nature of the disease itself may be changing and screening may still be of great benefit. Have they proven that the early cases, if not detected would not lead to advanced disease?"	1
1&2	"This may discourage women from getting a diagnosis who would benefit from it; demoralize women who have been treated when they may not have needed it; and leave doctors confused as to the right course to pursue."	1
1&3	"I think that this information did not incorporate cultural and religious beliefs of the patients. A provisional diagnosis like breast cancer goes a long way to affect the psychological foundation of most patients. I once managed a patient who developed major depression after such diagnosis and that was what contributed significantly to her death."	4
2	"I do use this information in two ways, the first being in engage a patient in discussion about the utility of mammograms if they are considering not getting screened (which is their choice). The second is when discussing the reduction of CAD [Coronary Artery Disease] risk factors as a motivational tool, since deaths from CAD certainly outweigh those from breast cancer. However, I tend not to bring this information up for women wanting to pursue screening as per the provincial guidelines unless they bring it up themselves; it causes undue stress and raises questions regarding why the screening is endorsed in the first place. Screening does lead to earlier detection and is strongly endorsed by the government; unless those recommendations change, this information still does not change practice."	2
2&3	"As a general family doctor the reality of having a "balanced discussion" that is fruitful in guiding a patient to an informed decision in a general appointment of 15 minutes on this ever so MIRKY topic frankly fills me with a sense of defeatism."	3
3	"Very difficult area-lots of emotions-a lady with DCIS-she does NOT want to just wait and watch...how to know which ones will progress? And to not do mammograms, as they don't save lives...everyone has stories about people who had advanced cancer diagnosed, and they had treatment, and very much prolonged their lives from what it would have been....very confusing picture..."	3
1&2&3	"Very difficult to 'retrain' women as to the benefit versus harm. Difficult to 'retrain' us docs as well."	3

Discussion

To our knowledge, our study is the first of its kind to use ratings of synthesized evidence as a means of understanding physician perspectives on research regarding mammography screening and the potential use of these syntheses in practice. The data from physician reflections on these clinical research synopses indicate what physicians think of mammography screening, overdiagnosis, and screening decision-making with women at average-risk of breast cancer. Grad et al. examined the profile of the physicians who rated POEMs in 2014 [43]. Their study revealed that the majority of the respondents were in general practice or family practice. Out of 3718 physicians, 76.8% were general practitioners or family physicians. While 86.7% of the physician respondents were in fulltime or part-time practice, 66.6% were general physicians or family physicians in fulltime or part-time practice.

Access to POEM synopses provides a direct opportunity for clinicians to become aware of research to improve patient experiences and health outcomes. Reviewing clinicians' reactions to these synopses can in turn help better understand what occurs in physicians' clinical practice. This study may also help underscore the ethical and clinical values and professional obligations guiding physicians' practice. Researchers have previously used this "big data" from POEMs to identify studies that are consistent with the principles of Choosing Wisely [44, 45]. The IAM process linked to POEMs has also helped identify future topics for specialty societies participating in the Choosing Wisely campaign [46, 47].

The analysis of both quantitative and qualitative data in our study allow for an examination of physicians' current appreciation of clinical research on mammography screening. This study provides access to physicians' perspectives and can illustrate convergences and divergences among physicians' practices. The findings from this analysis elaborate not only on

physicians' specific thoughts on mammography screening with average-risk women, but on the ways physicians perceive their role within the context of organized government-based screening programs.

The findings from the analysis of the qualitative data (Figure 2) generally echoed those from the quantitative data (Tables 3.1-3.4). For instance, the reported frequencies of intended use of POEMs information during a discussion with a particular patient (Tables 3.1-3.4; Q3) were over 50% in the four POEMs. In line with this strong reported intention to use the information with their patients, a considerable number of physicians commented on the various practical uses of the POEM information in discussions with patients. These numerous comments fit into our second major theme on the applicability of the POEM information in practice. Concerning the harms of the POEM information, the second item of Q1 "This information is potentially harmful" received endorsements below 2% across all POEMs. Only 16 of the 310 comments explicitly described possible harms of the POEM information.

The first major theme resulting from this thematic analysis provided an overview of physician's perspectives on the POEM information. Since POEMS 1, 2, and 4 clearly focused on overdiagnosis, numerous questions and comments about this phenomenon emerged. Although some physicians had clear knowledge of it and expressed the need for overdiagnosis rates to decrease, others asked for clarifications regarding the meaning of overdiagnosis, and how one can know which tumors end up being overdetected. In addition, the responses to Q4 (Tables 3.1-3.4) in the quantitative data reveal physician's awareness of overdiagnosis. In three of four POEMs, among the physicians who answered "Yes" to Q3, over 75% thought that the POEM information would help avoid unnecessary or inappropriate treatment, diagnostic procedures, preventative interventions or referrals for patients. However, some physicians brought up the

harms of sharing information relating to overdiagnosis with patients. The quote from the physician responding to POEM 1 (Table 4; themes 1&2) illustrates these concerns, that sharing information on overdiagnosis could demoralize those who may have been overdiagnosed and subsequently treated unnecessarily. Carter et al. [48] agree that concerns about women finding out they may have been overdiagnosed, as public awareness about overdiagnosis increases, must be addressed.

Conceptualizing overdiagnosis in cancer and the mechanisms to address it have been widely discussed in medical and ethical literature [2, 4, 49]. In her work focusing on the limitations of situating overdiagnosis solely within a utilitarian framework, Carter discusses the difficulty in understanding the concept of overdiagnosis and describes the counterintuitive thinking required to appreciate the harms of overdiagnosis [50]. As any screening intervention involves benefits and harms, Carter highlights that efforts to prevent overdiagnosis will benefit some yet inevitably harm others. Given that overdiagnosis is a population-level problem, the solution will also require a utilitarian approach involving a change in healthcare systems to maximize the public's wellbeing. If screening programs were to be abolished, however, a minority of individuals would develop aggressive cancers and would have lost out on avoiding illness or death had they been screened earlier. Efforts to reduce overdiagnosis should therefore not overlook the experiences of these individuals, who will require care and support [50].

The second major theme addresses the potential applicability of the POEM information in practice as well as the limits of its use. Numerous physicians indicated the usefulness of the POEM information in improving counseling discussions with patients. A small number of physicians mentioned that until guidelines change, physicians' screening practices would not change. Among these three comments, it would have been helpful to know what physicians

meant by their practice not changing, if it was their approach to screening decision-making with their patients, or the actual practice of referring patients to mammography screening. It would have also been relevant to know which respondents valued which guidelines but unfortunately respondents did not share this information, nor did they comment on which guidelines influenced their practice. In response to POEM 2, however, one physician mentioned their doubt about guidelines written by radiologists and another physician expressed the need for new guidelines. The creation of and adherence to guidelines are themselves a popular topic of investigation. Norris et al. examined the relationship between screening guideline panel members, their conflicts of interest, and screening recommendations for asymptomatic average-risk women aged 40 to 49 [51]. They found that five of the eight guidelines recommending screening had a radiologist member, but none of the four guidelines recommending against routine screening had a radiologist member. They also found that the proportion of primary care physicians on guideline panels recommending non-routine screening was significantly lower than that of panels recommending routine screening. In addition, despite the influence of guidelines on physicians' practice, over a third of physicians in two studies found mammography guideline recommendations conflicting or unclear [28, 29], revealing the limits of their ability to guide physicians' practice. Interestingly, none of the clinical bottom lines in the POEMs recommended to physicians to discontinue mammography screening, but numerous physicians nonetheless expressed their reservations about changing their practice based on this information and re-affirmed their support for screening.

The third and last major theme addressed various issues physicians must confront as part of their clinical reality and the culture within which we live, since these elements affect their mammography screening discussions and practices with their patients. Many of the comments

within this theme pointed to the existence of a screening culture, an important sub-theme in this group. Our study revealed that identifying as a woman entails being the target of breast cancer screening advertising, fear mongering, and pressure from government agencies. These features of screening culture in North American settings have been described in the literature, notably as one of the drivers of overdiagnosis [52]. Specifically, physicians in our study commented on the political environment of women's health impeding their ability to discuss screening with women, and the vested interests in mammography screening. Others acknowledged that retraining both doctors and women to rethink screening after years of public messaging and culturally ingrained expectations would represent a genuine challenge. Indeed, these realities result in a pressure to screen and leave little room to discuss the drawbacks of screening with patients. Yet Woloshin and Schwartz [53] affirm that in a world where selling screening is much easier than selling informed choice, women must be reminded that mammography screening is a genuine choice. Similar to the hormone replacement therapy crises in the early 2000s and subsequent ongoing confusion, it can be difficult to accept that the value in a medical test like mammography screening can change over time due to evolving evidence. The study of medical and evidence reversals focuses on these challenges, and the consequences of abandoning practices that are either deemed no longer effective or deemed to have harms that now outweigh the benefits [54]. Debates about the worth of mammography persist due to issues in the quality and trustworthiness of the evidence used to establish claims about reduction in overall mortality and overdiagnosis [55].

In addition, the data within this third theme pointed to the power of anecdotal evidence in screening beliefs. Physicians highlighted that the majority of women have sisters, aunts, and mothers who have been diagnosed with breast cancer and this knowledge weighs more in their

screening decision-making than does other evidence such as scientific knowledge. Knowing someone who experienced breast cancer seemed to increase the likelihood that an individual would support screening. Raffle and Gray have described this "popularity paradox" whereby the greater the phenomenon of overdiagnosis and overtreatment, the greater the number of individuals believe that they owe their health or their life to the screening program [56].

Finally, multiple physicians advocated for more personalized approaches to screening, one of the sub-themes within the third major theme. Numerous physicians talked about the importance of assessing each woman's particular preferences and tolerance of specific harms. Physicians recognized that patients and providers must carefully weigh the benefits and harms of mammography screening according to each patient's values, since each patient has a unique way of defining their quality of life and the tradeoffs they are willing to make.

Shared decision-making can allow physicians and their patients to constructively discuss options for a decision while facing clinical and cultural realities in a patient-centered manner. This decision-making approach is currently being recommended for primary care decisions such as whether or when to begin mammography screening for average-risk women [57, 58]. However, health care providers may not always be aware that patients differ in their desired levels of involvement in screening decisions. For example, in our study, one physician shared that they were surprised to discover some of their patients still desired a more paternalistic approach. In the comments, physicians also described their perceptions of patient needs and expectations, and at times made assumptions about what they believed patients wanted. In one study by Dubenske et al. [59], however, findings showed the existence of a disconnect between what patients desired and what their providers thought their patients wanted with respect to mammography screening discussions. Furthermore, findings from Smith et al. [27] suggest that women are not necessarily

getting the opportunity to discuss screening in the way and at the time they would like. These concerns must be addressed to improve patient experience. As an alternative to the information presented in the POEMs, validated decision aids are increasingly used and recommended. An update of a Cochrane systematic review of 105 studies on decision aid effectiveness showed that individuals exposed to decision aids felt better informed than those who had usual care [60]. This review also found that decision aids reduced the number of undecided participants and seemed to improve communication between patients and providers. A randomized control trial looking at women's screening decision-making using two different decision aids also showed that compared to the controls, fewer women in the group that was exposed to information on overdetection of breast cancer had positive attitudes towards mammography [41].

Regardless of whether a physician shares the information contained in the POEMs or uses a decision aid with a patient, other factors will have an influence on the discussion between a physician and their patient about the decision to do mammography screening. Several factors were revealed in a critical interpretive review of literature reporting primary care providers' perspectives and approaches on mammography screening with average-risk women [61]. These include, among others: clinical time, organizational guidelines, patients' requests for screening, patients' anxiety about breast cancer, and physicians' colleagues' and mentors' practices, and the fear of missing potentially lethal cancers.

Finally, data from both the aforementioned critical interpretive review and the POEMs analysis indicate the importance of building trusting relationships between providers and patients to improve patient experience and long-term care outcomes.

Implications

This research has important implications for practice, future research, and policy-making. Physicians' intent to use the POEM information to support more nuanced screening discussions and to prevent unnecessary testing and treatment suggests the potential of this information to promote informed-decision making and to reduce overdiagnosis at the level of the patient-provider consultation. The POEM information can help improve discussions between some physicians and their patients by creating an honest space for both parties to express concerns, questions, and re-evaluate preferences based on current clinical research.

Despite the noted potential uses of the POEM information, our results also revealed challenges experienced by physicians in understanding and explaining evidence about screening and overdiagnosis. These challenges should be addressed in follow-up investigations. Our research gives consideration to the constant evolution of evidence on mammography screening and points to the difficulty physicians face in deciding what exact information should be shared with average-risk women considering screening. Despite continuing controversies in mammography screening, physicians expressed the importance of optimizing ethical screening decision-making and respecting women's personal values and preferences. Further research should therefore also probe into practical mechanisms of implementing shared decision-making between providers and patients.

In addition, this study clearly shows the impact of factors external to the patient-provider context on women's and physician's screening beliefs and approaches. Further consideration should be given to these factors, including the lack of consistent and accessible pre-screening counseling upon entry to provincial population-based screening programs.

Limitations

There are several limitations of this study. First, the free text box in the last section of the IAM, from which we extracted the majority of the qualitative data, does not prompt physicians with a specific question. This format therefore left room for a wide range of responses to emerge and at times resulted in a lack of cohesiveness in the data. Identifying patterns within these comments did present challenges. Even so, the free text box encouraged diverse and rich responses from physicians, which aligned with the study's aim to broadly collect perspectives about the research analyzed in the POEMs.

Second, the quantitative data pertaining to the intended use of the POEM information reflects physicians' immediate thoughts, reactions, and intentions written at single moment in time. These intentions to use the information at a given moment may not necessarily represent what physicians will do later on in practice. The extent to which physicians end up applying the information the way they express they will at the time of receiving the Daily POEMs remains unknown. To our knowledge, there have been no follow-up studies to assess physician behaviour change in practice since learning about POEM information; this offers an interesting avenue for future research.

Third, limited IAM data in the years preceding 2012 prevented the inclusion of POEMs released prior to this date. This restriction, however, was considered to be a minor limitation because this particular study aims to gather more recent physician insights on mammography screening evidence.

Fourth, the sample of physician CMA members who rated POEMs does not represent the majority of Canadian physicians; they represent approximately 10% of physician members. The

CME program such as the POEMs program does not enroll randomly selected physicians. We recognize that it draws in physicians with a particular interest in staying up to date with clinical evidence and a willingness to share their opinions on this research. Although the results of this study stem from a limited sample of Canadian physicians, they can be used in future studies such as deliberation sessions with a different sample of physicians, to gain broader views on specific issues identified in this study.

Lastly, it was unfortunately not feasible to trace back demographic information from the physicians to the comments and ratings for each POEM. Practice settings and patient populations vary from physician to physician and not knowing the specific demographics of the participating physicians does limit the generalizability of our findings. However, based on a brief survey evaluating the demographics of physician respondents in 2014, we do know the majority of physicians in 2014 were in general or family practice. Despite not knowing more detailed characteristics about the physician respondents, the study's results are valuable in that they provide an overview of physician perspectives through a diversity of CMA physician members across Canada.

Conclusion

In summary, this study aimed to thoroughly examine physicians' perspectives on mammography screening information presented in POEMs, and the ways they relate it to their clinical practice. By focusing our analysis on reflections from physicians across Canada on clinical research summaries, this study adds a unique perspective into research on mammography screening.

Building on the knowledge generated by this study, future research endeavours may seek to share and nuance these findings in facilitated deliberation sessions with both practicing family physicians and women who are at average risk of getting breast cancer.

Whether or not provincial governments continue to systematically invite average-risk women to enter mammography programs, physicians' responsibility of providing balanced information to women about the benefits and harms of mammography screening will remain paramount to optimizing patients' experiences and promoting ethically sound decision-making.

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Chapter V - Discussion and Conclusion

1. Summary of findings

This thesis explores mammography screening and decision-making for average-risk women from the perspective of primary care providers working in high-income settings.

The background and literature review (Chapters I and II) summarized the peer-review literature discussing the context in which this thesis was constructed. A growing body of knowledge aims to measure and nuance the benefits of mammography screening [55], as well as estimate its harms [5, 32, 34, 56]. Yet increasing clinical evidence points to the complexity of quantifying overdiagnosis [33, 35], one of the main concerns of systematic screening. Uncertainties around the magnitude of the harms and benefits of screening partly explain the variability in screening guidelines available to primary care providers [36]. The role of these professionals, however, entails supporting women in mammography decision-making and inconsistencies in these guidelines and the research informing them render this decision-making process increasingly challenging. With regards to women's perceptions and experiences in mammography screening, one study showed that women strongly believed in the effectiveness of mammography screening in reducing mortality due to breast cancer [40]. Women in this study thought that abstaining from screening would increase their chance of premature and preventable death. Other studies show that women are not aware of overdiagnosis [44], but understand the concept [43]. When women in one study were informed of estimates of overdiagnosis, they expressed concerns regarding screening, and considered alternative management plans to a breast cancer diagnosis, such as watchful waiting [43]. Higher estimates of overdiagnosis provoked increased concerns in participating women [57]. Ethics literature also discusses the need to consider alternatives to aggressive treatment of breast cancer including watchful waiting [21]. Anecdotal knowledge, however, may play a stronger role in women's perceptions of screening

and their subsequent decisions, than their beliefs about screening effectiveness and their knowledge of the harms of screening such as overdiagnosis. One Danish study's findings revealed that the attitudes of women's friends and acquaintances played a dominant role in screening decision-making, as compared to the information from the official governmental invitation to join the screening program [42]. This decision-making has also been looked at from an ethical perspective. Carter's article [22] for instance, suggests that an individual's knowledge of a close friend's personal experience with breast cancer may increase the emotional salience of breast cancer, and may lead them to accept risking harms such as those brought on by overdiagnosis. Since the decision to start screening often takes place in a primary care setting, the literature review additionally sought to explore studies that examined communication about screening including overdiagnosis. Parker et al.'s study revealed that health care experts disagreed on the values to prioritize in the context of communication strategies for breast cancer screening and held differing views on what it meant to respect values such as autonomy [45].

Given primary care providers' role in referring women to screening programs, analyzing the ethical and professional responsibilities of these providers to their patients was also important to explore in the context of screening decision-making. The Codes of Ethics of physicians practicing in Quebec [48] and the Canadian Medical Association Code of Ethics [47] are comprised of principles specifically relating to informed consent, decision-making, judicial use of resources, and joint duties held by physicians to both the individual and to the population. This last obligation may be particularly challenging to conceptualize in the case of systematic mammography screening. On the one hand, physicians in Canada may wish to follow guidelines and encourage participation in provincial screening programs, yet they must also contend with inconsistencies in guideline recommendations and uncertainties in the evidence about the harms

and benefits of screening. In counseling average-risk women about mammography, they must also acknowledge each woman's unique set of preferences, needs, and values.

Little is known about primary care providers' perspectives on mammography screening and decision-making with average-risk women and their thoughts on the growing body of evidence nuancing the benefits and harms of mammography screening. Yet, these primary care providers are responsible for counseling women and referring them to screening. The primary objective of this thesis was therefore to explore primary care providers' views on mammography screening with average-risk women. The first study (Chapter III), a critical interpretive review, answered the question: What are the perspectives of primary care providers with respect to mammography screening decision-making with average-risk women? Additionally, with respect to screening discussions with average-risk women, this study sought to understand the factors guiding primary care providers in their practice, the ways primary care providers understand and manage clinical uncertainty, and their experiences supporting patient decision-making. In the second study (Chapter IV), the question explored was: What are the perspectives of physicians on mammography screening clinical research synopses (POEMs) and the ways they use this research information in their practice? This second study was a dynamic cohort study using a validated questionnaire with closed and open-ended questions.

The findings from this thesis revealed that physicians hold a wide range of perspectives and practice patterns and perspectives regarding mammography screening for average-risk women. Both the critical interpretive review and the analysis of the POEMs data showed that primary care providers greatly differed in terms of their beliefs in screening effectiveness, their level of trust in screening guidelines, and their thoughts about the recommended age at which average-risk women should begin mammography screening. The analysis of the POEMs data

was based on physician ratings of four POEMs. The number of quantitative POEM ratings ranged from 1243 to 1351. Across all four POEMs, the most frequently endorsed item of the IAM about using the POEM information for a specific patient was the use of it in a discussion with a patient or with a healthcare provider about that patient. Few physicians disagreed with the POEM information or found it harmful. As expected, the qualitative data echoed results from the quantitative data, and further elaborated on specific elements of the quantitative data in more detail.

Globally, the results of this thesis indicate that physicians find mammography guidelines unclear, contradictory, and ambiguous [41, 58, 59]. One study from the critical interpretive review specifically showed that the difficulty of reconciling divergent organizational guidelines was strongly associated with recommending screening to women aged 45–49 [60]. Conflicts in the current guidelines show that screening for women in the 40 to 49 age range is still particularly contentious [61]. Other evidence confirms these conflicts. Some studies and professional organizations endorse it [62-64] while other groups such as the CTFPHC recommend against it [55], or state that the decision to screen in this particular group should be an individual one [65]. The POEMs analysis indicated that physicians are strongly voicing a desire for newer, clearer, and more practical guidelines and advice from researchers to support their clinical practice. Yet guidelines and beliefs regarding screening effectiveness are not the only factors influencing a physician's decision to order a screening test. One study analyzed in the critical interpretive review [61] found that of the 40% of physicians who did not think breast cancer screening was necessary for women aged 40 to 49, 62% of them would nevertheless order mammography if their patients requested it. In addition to these patient-related factors, this thesis points to several other factors that influence physicians' decisions to order screening tests.

Multiple elements affect the decision-making process between women and their health providers and have an influence on physician's screening practices. Patients' anxiety about getting breast cancer and patients' expectations to have mammography increased the likelihood that a physician would order a screening test [58-61]. In one reviewed article [59], if a physician thought that mammography for women aged 40 to 49 was not recommended or was unclear, then a patient's expectation of having mammography tripled the probability that mammography would be ordered. Furthermore, some physicians seem to recommend screening tests if their colleagues recommended them [58, 59, 61]. As many as 89.6% of physicians in one of the reviewed studies [59] stated they would order a screening test that they would not usually recommend if the specialists with whom they worked recommended the test. In addition to patients' and colleague's influences, the time available to discuss screening was shown to affect the screening decision-making process [41, 59, 61, 66]. Physicians reported lack of time as a barrier to supporting women making informed decisions and a desire for efficient discussions [41, 66] despite holding strong intentions to support women in this decision-making [66]. Approximately 30% of the physicians in one study [59] stated they would order mammography if it would take less time than convincing patients that they do not need it. The POEMs data also revealed physicians perceived time as a barrier to the ability of holding balanced discussions with their patients guided by the POEM information. The majority of the physicians in one of the reviewed studies [61], however, claimed that time was never or rarely an issue in mammography screening discussions. Barriers to the implementation of shared decision-making in preventive health care have been previously studied in medical literature, and insufficient time is the most frequently cited barrier [67]. However, the results from multiple studies reveal no solid evidence that shared decision-making takes up more time than any other usual care practice [68, 69]. Légaré and Witteman also note that

time constraints are the most commonly identified barrier to any change in clinical practice, yet shared decision-making is no different than any other practice improvement intervention [67]. The vast majority of the physicians in one reviewed study in this thesis perceived that women wanted to discuss screening mammography, yet only 50% of the physicians claimed to discuss the risks and benefits of screening with their patients [61]. Physicians may therefore not be giving women the opportunity to engage in optimal decision-making according to their preferences. The POEMs data confirmed that this situation occurs in practice. Some physicians only brought up POEM information with women who were considering less frequent screening or who mentioned they were not sure about whether or not they wanted to undergo screening at all. Otherwise, physicians would not engage in discussions regarding the benefits and harms of screening since these physicians perceived it would cause undue stress and raise doubts about the reason the screening was initially endorsed. This finding is concerning, given that a study on public opinions on overdiagnosis found that an overwhelming majority of participants thought that screening discussions should be balanced, and include information both on overdiagnosis and the benefits of screening [44].

Overall, however, the results generated in this thesis revealed that physicians do recognize the importance of acknowledging the drawbacks of mammography screening and informing their practice by giving consideration to clinical evidence. Among the physicians who did not offer screening to women aged 40 to 49 in one of the reviewed studies [61], the most commonly expressed reason for not offering screening was a lack of evidence of decreasing breast cancer-related deaths with screening. In that same study [61], approximately 20% of physicians reported not offering mammography screening to women aged 40 to 49 because they thought the risk of harms such as increased anxiety, unnecessary radiation exposure, high false

positive rates, unnecessary biopsies, and overtreatment of benign results outweighed any benefits of the screening for that group. Numerous physician comments in the POEMs data underscored the belief that women may have a different threshold of tolerance for undergoing the risks of experiencing screening harms such as false positives and unnecessary testing and treatment from overdiagnosis. Given the uniqueness of each patient's values, preferences, and beliefs, physicians emphasized the importance of patient-centered care, and an evaluation of each patient's willingness to tolerate the risks of screening or not screening. Other comments supported this approach and recommended that patients and physicians develop therapeutic relationships built on trust in order to improve long-term patient outcomes. Interestingly, one of the reviewed articles in the critical interpretive review[58] reported the patient-doctor relationship as a factor influencing a physician's decision to order a screening test including mammography screening. This study found that a good quality patient-doctor relationship significantly decreased the odds that physicians would order mammography screening for women aged 40 to 49. Although codes of ethics do not dictate patient-provider relationships and do not necessarily determine specific medical acts, they guide physician's professional practice and can inform decision-making.

Using Thorne's interpretive descriptive framework [53], the assessment of the resulting critical interpretive review themes against ethical and professional obligations of physicians practicing in Canada and in Quebec [47, 48] showed the limitations of these codes of ethics to guide physicians' practice in controversial health topics such as mammography. The analysis showed that due to the complexity of mammography screening and the joint duties of physicians to the individual and to the population as whole, consistently engaging in informed decision-making and practicing medicine according to scientific principles is not straightforward.

While several physicians continue to support screening and do not believe current practices should or will change, other physicians condemn the harms of screening such as overdiagnosis and the consequences of false positives. A considerable number of physicians questioned the value of mammography screening, and wondered whether and how systematic screening was still justified in light of emerging evidence on screening drawbacks. Harris et al. defined a set of required criteria to justify the implementation of a screening program [19] based on Wilson and Jungner's criteria from 1968 [18]. Their proposed "balance approach" is based on an assessment of the magnitude of the harms and benefits of the screening program, in addition to the availability of the resources required to implement and monitor these screening programs. Although the financial costs and resources needed to run a screening program did not substantially emerge in the findings of this thesis, the emotional and physical costs incurred by screening such as the impact of false positives and overdiagnosis represented important concerns expressed in the physician data. These concerns of physicians regarding the harms of screening may be warranted. Brodersen et al.'s study identified lasting psycho-social harms of false-positive mammography screening test results in women [32].

In addition, several concerns regarding the quality of clinical research were brought up. Although physicians described the potential of clinical research synopses to improve patient counseling, access to this information did not necessarily diminish perceived challenges in screening discussions. Some physicians expressed uncertainties about the value of the POEM information and were not sure how to use it to advise women making decisions regarding screening. The results from the physician data in the POEMs analysis also pointed to the fact that numerous physicians continue to grapple with the complex, uncertain, and controversial nature of mammography screening. They compared the evolution of mammography screening to the

hormone replacement therapy crisis in the early 2000s and ensuing confusion. After years of mammography screening being ingrained in both the population's and the medical community's minds, it becomes challenging to rethink screening. Accepting that the value in a medical test like mammography screening can change over time due to evolving evidence may be counter-intuitive for individuals and society. Medical and evidence reversals describe these scenarios, and the challenges and consequences of abandoning practices that are either deemed no longer effective or deemed to have harms that now outweigh any benefits [70].

In addition to this sense of confusion, physicians raised issues about their limited ability to intervene appropriately and support patients in screening decision-making due to system-related factors external to their practice, creating a powerful screening culture. These factors included aggressive advertising and fear mongering from breast cancer agencies, anecdotal information spread through friends and relatives, as well as pressure from government agencies targeting women to be screened. The physician data from this thesis did not explicitly link the presence of such external factors to overdiagnosis. Pathirana et al., however, studied the influence of such factors on overdiagnosis [71]. In mapping the drivers of overdiagnosis, they identified the five following domains: culture, health system, industry and technology, healthcare professionals, and patients and the public. These five domains align with the elements raised in the POEM comments.

In sum, the data from physicians reflecting on clinical research synopses contributed another layer of understanding to the discussion of primary care provider perspectives on mammography screening. The results of the POEMs analysis echoed the richness and diversity in the findings of the critical interpretive review and added valuable data from a wide range of

physicians practicing across Canada. Overall, this thesis work holds a strong potential to enrich the fields of both bioethics and family medicine research.

2. Significance to the fields of Bioethics and Family Medicine Research

The results of this thesis are significant to the field of bioethics and family medicine research for: the uniqueness of the chosen topic, and the use of both a critical interpretive review and an analysis of empirical health data to explore decision-making ethics in the context of primary care.

To our knowledge, this is the first thesis comprising a manuscript accepted for publication that examines peer-reviewed literature that rigorously and thematically summarizes viewpoints of primary care providers regarding mammography screening with average-risk women. The resulting themes were interrogated against professional codes of ethics that inform the practice of physicians in Canada, thus contributing to knowledge about these professionals' guiding ethical values.

Ethics constitutes an integral part of each healthcare encounter between a family physician or primary care provider and a patient [72]. In primary care, family doctors routinely engage in value-based decision-making with their patients. This process requires knowledge and skills to analyze health issues from an ethical viewpoint. Ethical considerations to principles of patient consent, justice, and autonomy have been included in this thesis, particularly in the discussions of the two manuscripts. The results of this thesis discuss the ethical issues found in the balancing of harms and benefits when making a decision about screening, specifically with regards to overdiagnosis. This work has shed light on the uncertainty and ambiguity family physicians feel when counseling their patients, which may lead to feelings of ethical tension or moral discomfort. The qualitative article in the first manuscript review described physicians

feeling inept to help their patients, which contrasted with the results from the patients, who thought their physicians had all the knowledge needed to counsel them appropriately. This finding has implications for the provider-patient relationship, which relies on a solid foundation of trust.

Historically, medical ethics has generally concerned issues relevant to secondary or tertiary care [73]. These situations tend to involve patients and health care providers at more critical stages of care. Ethical issues in emergency, neonatal, or intensive care, for instance, are highly dramatic in nature, often requiring rapid decision-making related to life or death matters. On the other hand, ethics in primary care "pervade the smallest and simplest health issue, and serve to create a framework for everyday practice" [74]. Ethics should therefore not only be understood in the context of complex controversies. This thesis reveals examples of these everyday tensions and uncertainties faced by family physicians: promoting informed decision-making, discussing challenging issues such as overdiagnosis, all while confronting ambiguous guidelines and complex clinical and cultural realities. The results of this thesis therefore add knowledge to the fields of bioethics in and family medicine research, by narrowing in on the evolving role of these healthcare professionals in screening decision-making with average-risk women. Ethics pervades this decision-making process, which is complicated by the numerous factors influencing physicians' decisions to order mammography screening. Decision-aid development has focused on the potential for these tools to improve screening decision-making.

Studies have evaluated the potential of decision-aids to improve women's experiences in mammography screening decision-making. Hersch et al. conducted a randomized controlled trial in New South Wales, Australia to determine the impact of including information on overdiagnosis in a breast cancer decision-aid on informed choice in women aged 48 to 50 [75].

Their findings showed that women in the intervention group had higher rates of informed choice than women who used the standard decision-aid without information on overdiagnosis, but this influence was modest. The potential of decision-aids to help individuals make informed decisions is indeed uncertain. An update to a Cochrane systematic review of 105 randomized controlled trials involving 31,043 participants compared the effects of decision aids to usual care and/or alternative interventions [(76)]. The results from this review showed that decision aids reduced the proportion of undecided participants and seemed to have a positive impact on patient-clinician communication. Individuals who were exposed to decisions aids were just as or more satisfied with their decision, the decision-making process, and/or the preparation for decision-making than those who had received usual care. The authors, however, found no difference in terms of anxiety, general health outcomes, and condition-specific health outcomes when comparing individuals exposed to decision aids versus those receiving usual care. Sasieni et al. caution that researchers have yet to develop a decision-aid that successfully increases women's ability to make an informed decision regarding mammography screening [(77)]. They specifically recommend that further research should first focus on ways for decision aids to maintain proportion about the likely positive and negative effects of screening. Sasieni et al. also warn that not only must agreement be reached on the identification of appropriate information to include in the decision aid, but consideration should also be given to the format and manner in which the information will be delivered. Finally, they recommend that researchers evaluate whether the target population for the decision aid judges the aid to be biased, and whether it increases or reduces indecision. Although Sasieni et al. point out the complexity of decision-aid development, they do not recommend which experts should be involved in the required research

steps previously described, which may be the sources of some of the disagreements in decision-aid content and delivery.

Improving screening decisions may require a deeper understanding of patient preferences and needs. Woolf et al. approached the issue of cancer screening decision-making in patients using a participatory lens [78]. Since clinicians are faced with scarce clinical time, the authors of this study sought to learn about patients' decision-making preferences and engage them outside of the clinical setting using an online interactive health module. Their study involved women and men who were either overdue for a screening test or who had not undergone a mammogram or a prostate-specific antigen test recently. Participants in this study who were deciding about screening preferred first speaking to their health provider, second reading and researching on the screening test, and third consulting with trusted friends or family. They expressed the following information priorities: the extent to which screening improves life expectancy, comparative test performance, and the prevalence and health risks of the cancer. Their most frequently reported fears were getting cancer or receiving a delayed diagnosis, followed by abnormal test results, and finally testing complications such as false positives and unnecessary treatment. Lastly, women eligible for mammography were less likely to express fears about testing complications and less likely to prioritize the balancing the harms and benefits over gut feelings, compared to men eligible for prostate-specific antigen testing. The findings from this study therefore have implications for the development of more patient-centered and effective strategies of engaging with patients regarding screening decisions. It would be clinically and socially interesting to further investigate why the women in this study were more likely to value their gut feelings over the weighing of the harms and benefits of mammography screening. The fear-mongering of women through breast cancer awareness campaigns and the illusion of screening as a societal

expectation may partly explain women's instinct to strongly value screening [79]. The potential impact of this screening culture resonates with the findings in this thesis. In addition to pressure from cancer agencies and governments, physicians recognized the weight of anecdotal evidence in their patients' decision-making. The preference of anecdotal evidence indicates a limitation of the POEM information's potential to improve screening discussions between patients and providers. Some physicians stated that a patient's knowledge of a close relative's experience with breast cancer weighs more in that patient's decision to screen than knowledge originating from their physician, clinical research, or guidelines. This finding relates to the results of Henriksen et al.'s study, which found that women prioritized their preconceptions about screening and anecdotal knowledge over the Danish government's official screening information leaflet [42].

Although the optimization of decision aid development for women may represent one research avenue worth further exploring, the results from this thesis suggest there may be a need for accessible decision-making resources for primary care providers, and specifically family physicians. Some of these resources could be tools tailored to mammography screening using an ethics lens. Others could be tools to further bridge the gap between current clinical research information and practice, when such information may be clinically and ethically important to discuss but has not yet concretely informed practice guidelines available to family physicians.

Finally, this thesis contributes to the growing body of knowledge discussing the differences and commonalities between clinical medical ethics concerning providers and patients, versus a more general public health ethics, concerning the wellbeing of the broader public [80]. The physician data in the POEMs manuscript revealed that physicians questioned their duties to the population versus those to the individual patient. This complex dual

responsibility results from the interaction between a provider and their patient situated within the broader context of government-based population screening. These findings therefore give a voice to the tensions experienced when attempting to reconcile both of these responsibilities within their role, which can become a substantial challenge.

3. Future directions

Future research in family medicine and bioethics may build upon the findings produced through both manuscripts in several ways. First, further qualitative research should probe into the perspectives and approaches of primary care providers about their experience in mammography screening decision-making with average-risk women. Of the nine included articles in the critical interpretive review of this thesis, only one article [41] qualitatively explored physicians' experience in discussions about screening with their patients using focus groups and interviews. This particular article discussed the physicians' feelings of ineptitude in the ability to counsel their patients about mammography screening. Another study should aim to gain further insights into these feelings of uncertainty and inadequateness. Similarly, three of the included studies in the review indicated physicians perceived screening guidelines as ambiguous or unclear [41, 58, 59]. Further qualitative research should explore these uncertainties, and what physicians do to overcome them. Overall, more research should focus on understanding the experiences of family physicians using qualitative paradigms to generate additional knowledge in the field of decision-making in family medicine. In addition, other qualitative research methods such as ethnography could be explored, to more comprehensively understand the interactions between providers and patients during screening conversations.

Second, as indicated in the limitations of the POEMs manuscript, the data collected from participating physicians only represent their thoughts and intentions at a given moment in time,

and not necessarily their actual behaviours in practice. As a future research initiative using this POEMs database, it would be clinically relevant and interesting to conduct a follow-up survey with the physicians who indicated their intention to use the information at a later point in time. For instance, 6 months following their receipt of the Daily POEM, physicians could receive another short questionnaire inquiring about their mammography screening practices, determining what information they retained from the POEMs, and if and how they ended up using that information in practice. This type of study would require access to participating physicians' contact information and their consent to participate in a follow-up study.

Lastly, studies evaluating the training of medical students and family medicine residents with regards to decision-making and strategies of coping with uncertainty in the area of mammography screening should be considered. Research focusing on primary care providers' ability to communicate this uncertainty in discussions of more contentious clinical topics such as mammography screening, combined with studies of patients' experiences of these discussions, should be explored.

In summary, the results from this thesis create space for several opportunities to advance knowledge in mammography screening decision-making, optimization of discussions between providers and patients, education of primary care providers, while giving important consideration to the ethical and professional duties of family physicians to their patients and to the collective public.

4. Conclusion

In closing, the findings generated from this thesis highlight primary care physicians' diverse perspectives and practice patterns with respect to mammography screening decision-making for average-risk women in high-income settings. Although primary care providers find

themselves in a privileged position to support average-risk women in mammography screening decisions, they face ongoing challenges at the levels of the provider, patient, health care system, and greater society. In addition, uncertainties about clinical research informing these recommendations and differing opinions about the worth of applying research more actively in primary care practice should continue to be scrutinized. As the body of ethical and clinical knowledge about the harms and benefits of mammography screening continues to grow and evolve, primary care providers in Canada and beyond will need to adapt and keep up to date on these changes in order to effectively deliver and promote ethically sound high-level support in screening decisions for average-risk women. At the crux of this clinically and ethically complex area of primary care lies shared decision-making. Despite implementation gaps, this approach holds significant potential to create space for health care providers and patients to engage in discussions and deliberations, guided by patients' values, preferences, and both patients' and providers' knowledge and experiences.

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