Multilevel Factors Impacting Mammography Screening Decisions in the Elderly: A Clinician and Patient Pilot

Anthony Marcelo Chicaiza  
Georgetown University Medical Center  
https://orcid.org/0000-0002-7336-4070

Katherine Lopez  
Georgetown University Medical Center

Kenneth W. Lin  
Georgetown University Medical Center

Ranit Mishori  
Georgetown University Medical Center

Dongyu Zhang  
Georgetown University Medical Center

Nancy Schoenborn  
Johns Hopkins University School of Medicine

Dejana Braithwaite  
Georgetown University Medical Center

Suzanne C. O’Neill (✉ Suzanne.ONeill@georgetown.edu )  
Georgetown University

Research

Keywords: mammography, screening, elderly, shared decision making

DOI: https://doi.org/10.21203/rs.3.rs-132413/v1

License: ☛ This work is licensed under a Creative Commons Attribution 4.0 International License.  
Read Full License
Abstract

Background

For women age 75 and older, there is insufficient evidence to recommend routine breast cancer screening, as the benefits may not outweigh harms. The objective of this study was to identify variables that clinicians consider influential when making screening mammography recommendations for these women and to assess the acceptability and feasibility of a patient print intervention designed to support patient decision-making and patient-clinician communication about stopping mammography.

Methods

Primary care clinicians who were part of a practice-based research network and patients aged 74–85 from this network completed surveys online and by phone, respectively.

Results

Twenty-two clinicians (18% response rate) completed the survey. The mean age at which clinicians reported that they would stop recommending screening mammography was 77.14 years. Clinicians were most likely to cite patient comorbidity [86.4%], functional status [77.3%], and cancer family history [63.6%], as well as U.S. Preventive Services Task Force (USPSTF) guidelines [81.8%] and new research regarding screening mammography [77.3%] as factors influencing their recommendations. Fourteen patients (70% enrollment rate) completed baseline surveys and received personalized booklets. Eleven (79% retention) completed follow-up surveys, reporting high intervention acceptability. Decreases in perceived breast cancer risk were significant for lifetime perceived risk (M = 26.91 vs. 4.18, p < 0.01). Cancer worry decreased slightly (M = 1.27 vs. 1.09, p = 0.77).

Conclusions

An intervention that addresses a patients’ cancer risk and comorbidities that aligns with USPSTF guidelines appears feasible and acceptable to patients and aligns with clinicians’ values.

Key Messages Regarding Feasibility

1) An uncertainty around feasibility in this study was whether the study would be able to recruit in clinic to find eligible and interested women over 75 who wanted to learn more about their personal risk factors in relation to mammography screening clinics.

2) This intervention has shown it is feasible to recruit such participants and provides a relatively low-cost method to support patient physician communication with overburdening physicians.
3) The implications are that this study would be feasible to reproduce in other clinic or medical setting where women of this target population can be screened.

**Background**

More than a quarter of new US breast cancer cases diagnosed each year occur among women ages 75 years or older.\(^1\) The increasing life expectancy of women and attendant rise in breast cancer cases in older women will likely lead to an increasing absolute number of mammograms performed in this group of patients.\(^2\) However, the US Preventive Services Task Force (USPSTF) currently does not recommend screening mammography among women in this group due to insufficient evidence.\(^3\) Given that survival benefit from screening is not typically observed among women with life expectancy of < 10 years, many older women with co-existing chronic illnesses may not live long enough to benefit from the procedure. Current guidelines emphasize the need to tailor screening mammography to life expectancy and screening preferences.

This need for tailoring poses challenges for effective communication among primary care clinicians and older women. However, there is a paucity of tools to facilitate effective communication and decision-making in the rapidly growing older population.\(^4\)–\(^6\) Factors that may hinder effective communication and decisions include provider factors such as uncertainty regarding the effectiveness of preventive healthcare in the elderly\(^7\)–\(^9\) and discomfort in discussing life expectancy\(^10,11\) and how it impacts care decisions\(^12\)–\(^14\), as well as patient factors such as habits regarding screening mammography usage and related cancer worry\(^15\)–\(^17\). Identifying variables most influential to patient-provider communication in this setting is key to determining how to optimize patient outcomes.

In this study, we assessed factors that clinicians perceive as most influential to their recommendation to stop screening mammography. We then applied these data and existing literature\(^4,5\) to develop a tailored print patient activation intervention to support patients’ understanding of their breast cancer risk, life expectancy, and account for potential benefits and harms of mammography. We also included questions for patients to consider asking their primary care clinician in order to facilitate shared decision-making about continuing or ceasing mammography. We then piloted this intervention to assess feasibility, acceptability, and initial efficacy.

**Methods**

**Participants**

Clinician and patient recruitment and retention are displayed in Fig. 1.

**Clinician survey**
Clinicians were recruited from a primary care research network in the Mid-Atlantic US from February-May 2019. Of the eligible clinicians contacted (N = 131), 22 completed the survey via email (17% response rate) and received a $50 gift card upon completion.

**Patient pilot**

Female patients aged 75–84 years were recruited from three primary care practices in Maryland and Washington, DC between June 2019-November 2019. Eligible patients (N = 20) had received a mammogram within the past two years and not been diagnosed with invasive breast cancer, DCIS, LCIS, or had received prior chest radiation therapy. Patients were screened for eligibility and 14 completed a baseline phone interview (70% recruitment). Baseline data were used to create tailored decision-making aid booklets that were then mailed to patients. 11 patients completed post-intervention interviews (79% retention) two weeks later to provide feedback and received a $20 gift card for each survey.

**Measures**

**Clinician survey**

**Clinician variables**

Clinician demographics (age, gender, race/ethnicity) were obtained via self-report, as were the percentage of their patients in their current practice who were low income, on public insurance, age ≥ 75, and among those 75 or older, the percentage who received mammograms (< 25%, 25–50%, > 50%). Clinicians also reported the age at which they recommend stopping screening mammography. Research network registry data were used to describe practice setting and clinician specialty.

**Variables that influence recommendation to stop screening**

By adapting methods from prior work\(^ {18-21}\) utilizing the literature on overscreening in the elderly,\(^ {22-26}\) clinicians were asked to indicate the extent to which patient variables affect their recommendation to stop screening mammography at age 75 (1 = *Never influences* to 5 = *Always influences*). Scores of 4 or 5 were considered influential. Factors included functional status, overall comorbidity, family history of cancer, pain from the procedure, and a recent death due to cancer in the patient’s family. Other factors included communication (with colleagues, the practice’s policies/norms, the patient’s family and friends’ opinions about mammography screening, media representations of screening mammography, time in the consultation, a language barrier between the clinician and patient, clinicians’ difficulty explaining potential screening mammography benefits and harms, the patient’s difficulty understanding screening mammography benefits and harms, and the nature of screening results) and clinical evidence (new research evidence concerning screening mammography in the elderly, USPSTF guidelines, American College of Radiology (ACR) guidelines, and American Cancer Society (ACS) guidelines)

**Patient pilot**
Baseline

We collected patients’ age, race/ethnicity, marital status, education, income, and insurance status, as well as variables needed to create intervention materials (below). Patients also indicated their 5-year and lifetime perceived breast cancer risk using Personal Absolute Percentage Risk items (0-100 scale)\textsuperscript{22} and their cancer worry oriented to the decision to continue or discontinue mammography.\textsuperscript{27}

Interventional patient materials

Patients received a tailored infographic booklet using baseline data input into NCI’s Breast Cancer Risk Assessment Tool (BCRAT),\textsuperscript{28–31} to show current and future breast cancer risk. The Lee Schonberg Index within the ePrognosis breast cancer screening module\textsuperscript{18–21} was used to calculate the potential screening benefits and harms. Infographics were used to convey numerical information about potential risks and harms while question prompts were utilized to help patients consider their preference and respective benefits of their choice to continue or discontinue mammography. To convey benefits, patients were provided a five-item questionnaire and asked to rate the importance of each item (0 = Not at all important to 10 = Especially important). Potential harms from mammograms in the first year, deaths from breast cancer avoided after 10 years, and deaths from other causes after 10 years, were all conveyed as percentages in the infographics.

Post-intervention Survey

In addition to perceived cancer risk and cancer worry, patients provided their intentions to continue to get mammograms (1 = Not at all likely to 4 = Very likely) They also indicated intervention acceptability using seven items ‘Yes/No’items\textsuperscript{32} and their overall satisfaction with the materials (1–4 scale).

Data Analysis

Clinician and patient responses were summarized using frequencies and descriptive. Clinician characteristics were compared using prevalence odds ratios. Paired t-tests were used to compare patient cancer risk and cancer worry across time points.

Results

Clinician survey

Primary care clinician characteristics are presented in Table 1. Clinicians (N = 22) were predominantly female (N = 13, 59.1%), White (N = 16, 72.7%), and were on average 51.55 years old. They were most likely to cite patient comorbidity [86.4%], functional status [77.3%], and cancer family history [63.6%] as factors that influence their recommendation to stop screening mammography at age 75. Most [77.3%] clinicians indicated that new research impacted their recommendations. They reported being more influenced by USPSTF guidelines [81.8%] than by either the ACR [50%] or the ACS guidelines [50%]. Approximately half
of clinicians indicated that the opinion of a patient's friends and family [10/22, 45.5%] influenced their recommendation. Notably, clinicians reported being minimally influenced by both difficulty in their explaining potential screening mammography benefits and harms to their patients [3/22, 13.6%] and, conversely, by their patient's difficulty understanding this information [5/22, 22.7%] (Table 2). Clinicians reported that, on average, they recommend stopping screening mammography when a patient is 77 years old (range = 70–85). Clinician association with gender, race, and patient population socioeconomic status are detailed in Table 2.
Table 1
Clinician and patient population demographics

|                        | N (%)                      |
|------------------------|----------------------------|
| **Clinician Participants (n = 22)** |                            |
| Age M (SD)             | 51.55 (10.03)              |
| Gender                 |                            |
| Female                 | 13 (59.1%)                 |
| Male                   | 9 (40.9%)                  |
| Race                   |                            |
| White                  | 16 (72.7%)                 |
| Other                  | 6 (27.3%)                  |
| Specialty              |                            |
| Family medicine        | 17 (77.3%)                 |
| General internal medicine | 3 (13.6%)               |
| Other                  | 1 (4.5%)                   |
| No answer              | 1 (4.5%)                   |
| Practice Setting       |                            |
| Group                  | 11 (50.0%)                 |
| Solo, or stand-alone   | 1 (4.5%)                   |
| University-based       | 1 (4.5%)                   |
| Hospital-based, community, family planning clinic, or other. | 9 (40.9%) |
| % of patients ≥ 75 screened for mammography |                    |
| < 25%                  | 12 (54.5%)                 |
| 25% − 50%              | 4 (18.2%)                  |
| > 50%                  | 5 (22.7%)                  |
| No answer              | 1 (4.5%)                   |
| **Patient Participants (n = 14)** |                        |
| Age M (SD)             | 79 (3.03)                  |
| Gender                 |                            |
| Category                              | N (%)                      | Description                  |
|---------------------------------------|----------------------------|------------------------------|
| **Gender**                            |                            |                              |
| Female                                | 14 (100%)                  |                              |
| Male                                  | 0 (0%)                     |                              |
| **Race**                              |                            |                              |
| White                                 | 8 (57.1%)                  |                              |
| Black or African American             | 6 (42.9%)                  |                              |
| **Education**                         |                            |                              |
| High school grad or less              | 8 (57.1%)                  |                              |
| Some college                          | 3 (21.4%)                  |                              |
| Completed college or higher           | 3 (21.4%)                  |                              |
| **Annual household income**           |                            |                              |
| ≤$10,000- $40,000                     | 5 (35.7%)                  |                              |
| $40,001-$80,000                       | 2 (14.2%)                  |                              |
| >$80,000                              | 4 (28.6%)                  |                              |
| Prefer not to answer                  | 3 (21.4%)                  |                              |
| **Biopsy history**                    |                            |                              |
| Prior biopsy                          | 4 (28.6%)                  |                              |
| No prior biopsy                       | 10 (71.4%)                 |                              |
| **Preexisting Comorbidities**         |                            |                              |
| ≥ one significant comorbidity         | 5 (35.7%)                  |                              |
| No comorbidities                      | 9 (64.2%)                  |                              |
| **Family cancer history**             |                            |                              |
| ≥ first-degree relative with breast cancer | 5 (35.7%)                  |                              |
| No relatives with a breast cancer     | 9 (64.3%)                  |                              |
| **Independent activities of daily living** |                        |                              |
| ≥ one challenge with IADL             | 6 (42.9%)                  |                              |
| no challenges with IADL               | 8 (57.1%)                  |                              |
Table 2
Self-reported influence of variables on clinician recommendation to stop screening at age 75

| Influencing Factors | Clinician Characteristics | Male | Female | Non-white | White | Low income < 50% | Low income > 50% |
|---------------------|---------------------------|------|--------|-----------|-------|------------------|------------------|
|                     | Clinician reporting influence N (%) |      |        |           |       |                  |                  |
| Patient             |                           |      |        |           |       |                  |                  |
| Functional status   | 17 (77.3%)                | 88.9 | 69.2   | 100       | 68.8  | 78.6             | 75.0             |
| Overall comorbidity | 19 (86.4%)                | 100  | 76.9   | 100       | 81.3  | 85.7             | 87.5             |
| Family history of breast cancer | 14 (63.6%)           | 55.6 | 69.2   | 66.7      | 62.5  | 57.1             | 75.0             |
| Recent death due to cancer in your patient's family | 11 (50.0%)          | 22.2 | 30.8   | 50.0      | 50.0  | 35.7             | 75.0             |
| Evidence Base       |                           |      |        |           |       |                  |                  |
| New research evidence concerning screening mammography in the elderly | 17 (77.3%)          | 88.9 | 69.2   | 100       | 68.8  | 78.6             | 75.0             |
| USPSTF guidelines   | 18 (81.8%)                | 77.8 | 84.6   | 83.3      | 91.3  | 71.4             | 100              |
| ACR guidelines      | 11 (50.0%)                | 44.4 | 84.6   | 33.3      | 56.3  | 42.9             | 62.5             |
| ACS guidelines      | 11 (50.0%)                | 44.4 | 84.6   | 33.3      | 56.3  | 42.9             | 62.5             |
| Communication       |                           |      |        |           |       |                  |                  |
| Practice norms and policies | 4 (18.2%)      | 0    | 30.8   | 0         | 25.0  | 0                | 50.0             |
| Colleagues          | 4 (18.2%)                 | -    | -      | -         | -     | -                | -                |
| Patient family and friends’ opinions | 10 (45.5%)       | 22.2 | 61.5   | 33.3      | 50.0  | 28.6             | 75.0             |
| Clinician Characteristics Practice Characteristics |
|-----------------------------------------------|
| Difficulty explaining potential screening mammography benefits/harms to patients | 3  
  (13.6%) | 0 | 23.1 | 0 | 18.8 | 14.3 | 12.5 |
| Patients’ difficulty understanding screening mammography benefits/ harms | 5  
  (22.7%) | 0 | 38.5 | 0 | 31.3 | 21.4 | 25.0 |

Table 3
Patient outcomes pre- and post- intervention

|                              | Pre-booklet (N = 11) | Post-booklet (N = 11) | p-value | t-value |
|------------------------------|----------------------|-----------------------|---------|---------|
|                              | Mean(SD)             | Mean(SD)              |         |         |
| Cognitive and emotional outcomes |                      |                       |         |         |
| 5-year Perceived Cancer Risk | 11.4 (16.5)          | 7.9 (19.6)            | 0.77    | 0.39    |
| Lifetime Perceived Cancer Risk | 26.9 (32.2)          | 4.18 (6.1)            | <0.01   | 2.78    |
| Cancer worry                 | 1.27 (0.91)          | 1.09 (17.6)           | 0.76    | 0.83    |
| Patient reported booklet feedback |                    |                       |         |         |
| Satisfied with booklet length | 11 (100%)            |                       |         |         |
| Found the amount of information covered was about right | 7 (50%)               |                       |         |         |
| Found booklet easy to understand | 9 (64.3%)            |                       |         |         |
| Had thoughts about what they want to discuss with their doctor | 6 (42.9%)             |                       |         |         |
| Booklet would help them make decisions | 8 (57.1%)            |                       |         |         |
| Found the booklet upsetting to use | 1 (7.1%)              |                       |         |         |
| Learned new information from the booklet | 8 (57.1%)             |                       |         |         |
Patient pilot

Patient characteristics are presented in Table 1. Patients (N = 14) were all female, predominantly White (N = 8, 57.8%), and were on average 79 years old. Patient’s perceived lifetime risk of breast cancer, meaning the chance from 0-100 a patient believes they will develop cancer in their lifetime, decreased from pre- to post-intervention (M = 22.91 vs. 4.18, t = 2.79, p = 0.02), with a score more aligned with actual breast cancer risk for these patients (M = 2.69, SD = 0.79, N = 13). Patients were satisfied with the intervention materials (M = 3.3/4) and endorsed the overall length (100%), that the materials were easy to read and understand (64.3%), that the booklet would help them make decisions (57.1%), and that they learned new information from the booklet (57.1%). Few indicated that it was upsetting to use the booklet (7.1%), which is in line with previous surveys in which older women would avoid being reminded of or discussing mammography. Patients indicated that they were somewhat to very likely to talk to their doctor about whether they would continue screening mammography (M = 3.2/4, 4 = very likely). Those who wanted to continue indicated concerns about their specific breast cancer risk factors.

Discussion

Among women aged 75 and older, patient and clinician perspectives both influence the decision to stop screening mammography. Our results support that a clinician’s recommendation to stop screening in older patients is influenced by a combination of the patient’s health, cancer risk factors and clinical guidelines, specifically those issued by the USPSTF. We observed that patients are open to using this information to make decisions about stopping screening, with a significant reduction in perceived breast cancer risk that suggests processing of the information about cancer risk and weighed benefits and harms from mammography. Women often overestimate their breast cancer risk and this led to anxiety and disease-specific worry. In response, family and friends can push women to continue screening past the point where patient would have stopped. Further, women in our study held fairly strong intentions to talk to their primary clinician about stopping mammography. This suggests that shared decision-making encounters that factor in the opinions of their patient’s friends and family could be fruitful in reducing overall screening rates in this population.

This study was limited by the small sample size and recruitment from one primary care research network. The clinician population of this study was weighted towards family physicians and lacks input from physicians in other specialties who might be in a position to have this conversation in the primary care setting. We relied on self-report of the perceived influence on communication and did not address potential language barriers between the clinician and patient, given that our inclusion criteria required both groups to be fluent in English.

Conclusions
Our results suggest that clinicians and patients are prepared to take part in shared decision-making discussions about discontinuing mammography screening for women over 75. Replication of this study in a larger population has the potential to assist primary care clinicians in incorporating conversations around screening and recommendations in routine care. Primary care clinicians report barriers such as uncertainty in predicting prognosis, difficulty in discussing prognosis, and concern about patient reactions. Patients stand to gain a more accurate understanding of their breast cancer risk, experience reduced cancer-related distress, and utilize information from the intervention in shared-decision making. For these reasons, research should be conducted to promote communication between physician and patients around the use of screening mammography in elder patients.

**Declarations**

**Ethics approval and consent to participate**

The study protocol was reviewed and approved by the Institutional Review Board of Georgetown University.

**Consent for publication**

Not applicable

**Availability of data and materials**

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

**Competing interests**

The authors declare that they have no competing interests.

**Funding**

This research was in part supported by grants R01CA190221 (SCO), R01CA190841 (DB) and P30CA051008.

**Authors' contributions**

A.C. drafted the original version of the manuscript and made final edits before submission. K.L. contributed to the discussion, introduction, some data analysis, and the conclusion as well as the revision process. R.M and D.Z. conducted the analysis for this study and reported on results. N.S contributed primarily to the background, and methods, sections of the manuscript. The primary investigators D.B. and S.O conceptualized the project, provided supervision assuring adherence to the protocol throughout the duration of the study. D.B. and S.O. reviewed the manuscript and made contributions to all sections. All
authors provided critical feedback and content which helped shape the research, analysis and manuscript.

Acknowledgements

We thank all study participants and study staff for contributing to this work, including clinicians at our primary care practices.

References

1. National Cancer Institute. Cancer Stat Facts: Female Breast Cancer.

2. Mandelblatt JS, Cronin KA, Bailey S, et al. Effects of mammography screening under different screening schedules: model estimates of potential benefits and harms. *Annals of internal medicine*. 2009;151(10):738-747. doi:10.1059/0003-4819-151-10-200911170-00010

3. Siu AL, U. S. Preventive Services Task Force. Screening for Breast Cancer: U.S. Preventive Services Task Force Recommendation Statement. *Annals of internal medicine*. 2016;164(4):279-296. doi:10.7326/M15-2886

4. Street RL, Makoul G, Arora NK, Epstein RM. How does communication heal? Pathways linking clinician-patient communication to health outcomes. *Patient Educ Couns*. 2009;74(3):295-301. doi:10.1016/j.pec.2008.11.015

5. Breslau ES, Gorin SS, Edwards HM, Schonberg MA, Saimontz N, Walter LC. An Individualized Approach to Cancer Screening Decisions in Older Adults: A Multilevel Framework. *Journal of general internal medicine*. 2016;31:539–47. doi:10.1007/s11606-016-3629-y

6. Pace LE, Keating NL. A systematic assessment of benefits and risks to guide breast cancer screening decisions. *JAMA: the journal of the American Medical Association*. 2014;311(13):1327-1335. doi:10.1001/jama.2014.1398

7. Walter LC, Covinsky KE. Cancer screening in elderly patients: a framework for individualized decision making. *JAMA: the journal of the American Medical Association*. 2001;285(21):2750-2756.

8. Capurso S, Gambassi G, Bernabei R. Cancer in the elderly: to screen or not to screen? *Journal of the American Geriatrics Society*. 2003;51(12):1816; author reply 1816-7.

9. Soung MC. Screening for cancer: when to stop?: A practical guide and review of the evidence. *The Medical Clinics of North America*. 2015;99:249-262. doi:10.1016/j.mcna.2014.11.002

10. Schoenborn NL, Lee K, Pollack CE, et al. Older Adults’ Preferences for When and How to Discuss Life Expectancy in Primary Care. *J Am Board Fam Med*. 2017;30(6):813-815. doi:10.3122/jabfm.2017.06.170067

11. Torke AM, Schwartz PH, Holtz LR, Montz K, Sachs GA. Older adults and forgoing cancer screening: “I think it would be strange”. *JAMA Internal Medicine*. 2013;173:526–31. doi:10.1001/jamainternmed.2013.2903
12. Schoenborn NL, Bowman TL, Cayea D, Boyd C, Feerer S, Pollack CE. Discussion Strategies That Primary Care Clinicians Use When Stopping Cancer Screening in Older Adults. *Journal of the American Geriatrics Society*. 2016;64:e221–e223. doi:10.1111/jgs.14444

13. Schoenborn NL, Janssen EM, Boyd CM, Bridges JFP, Wolff AC, Pollack CE. Preferred Clinician Communication About Stopping Cancer Screening Among Older US Adults: Results From a National Survey. *JAMA Oncol*. 2018;4(8):1126-1128. doi:10.1001/jamaoncol.2018.2100

14. Schoenborn NL, Boyd CM, Lee SJ, Cayea D, Pollack CE. Communicating About Stopping Cancer Screening: Comparing Clinicians’ and Older Adults’ Perspectives. *Gerontologist*. 2019;59(Suppl 1):S67-S76. doi:10.1093/geront/gny172

15. Xie Z, Wenger N, Stanton AL, et al. Risk estimation, anxiety, and breast cancer worry in women at risk for breast cancer: A single-arm trial of personalized risk communication. *Psychooncology*. 2019;28(11):2226-2232. doi:10.1002/pon.5211

16. Hawley ST, Janz NK, Griffith KA, et al. Recurrence risk perception and quality of life following treatment of breast cancer. *Breast Cancer Res Treat*. 2017;161(3):557-565. doi:10.1007/s10549-016-4082-7

17. Smith J, Dodd RH, Hersch J, Cvejic E, McCaffery K, Jansen J. Effect of different communication strategies about stopping cancer screening on screening intention and cancer anxiety: a randomised online trial of older adults in Australia. *BMJ Open*. 2020;10(6):e034061. doi:10.1136/bmjopen-2019-034061

18. Davis K, Haisfield L, Dorfman C, Krist A, Taylor KL. Physicians’ attitudes about shared decision making for prostate cancer screening. *Fam Med*. 2011;43(4):260-266.

19. O’Neill SC, Luta G, Peshkin BN, Abraham A, Walker LR, Tercyak KP. Adolescent medical providers’ willingness to recommend genetic susceptibility testing for nicotine addiction and lung cancer risk to adolescents. *J Pediatr Psychol*. 2009;34(6):617-626. doi:10.1093/jpepsy/jsn086

20. O’Neill SC, Peshkin BN, Luta G, Abraham A, Walker LR, Tercyak KP. Primary care providers’ willingness to recommend BRCA1/2 testing to adolescents. *Fam Cancer*. 2010;9(1):43-50. doi:10.1007/s10689-009-9243-y

21. O’Neill SC, Taylor KL, Clapp J, et al. Multilevel Influences on Patient-Oncologist Communication about Genomic Test Results: Oncologist Perspectives. *J Health Commun*. 2018;23(7):679-686. doi:10.1080/10810730.2018.1506836

22. Braithwaite D, Demb J, Henderson LM. Optimal breast cancer screening strategies for older women: current perspectives. *Clin Interv Aging*. 2016;11:111-125. doi:10.2147/CIA.S65304

23. Braithwaite D, Mandelblatt JS, Kerlikowske K. To screen or not to screen older women for breast cancer: a conundrum. *Future Oncol*. 2013;9(6):763-766. doi:10.2217/fon.13.64

24. Braithwaite D, Walter LC, Izano M, Kerlikowske K. Benefits and Harms of Screening Mammography by Comorbidity and Age: A Qualitative Synthesis of Observational Studies and Decision Analyses. *J Gen Intern Med*. 2016;31(5):561-572. doi:10.1007/s11606-015-3580-3
25. Braithwaite D, Zhu W, Hubbard RA, et al. Screening Outcomes in Older US Women Undergoing Multiple Mammograms in Community Practice: Does Interval, Age or Comorbidity Score Affect Tumor Characteristics or False Positive Rates? *Journal of the National Cancer Institute*. Published online February 5, 2013. doi:10.1093/jnci/djs645

26. Demb J, Breast Cancer Surveillance Consortium, Abraham L, et al. Screening mammography outcomes: risk of breast cancer and mortality by comorbidity score and age. *JNCI: Journal of the National Cancer Institute*. Published online September 6, 2019. doi:10.1093/jnci/djz172

27. Degner LF, Russell CA. Preferences for treatment control among adults with cancer. *Res Nurs Health*. 1988;11(6):367-374. doi:10.1002/nur.4770110604

28. Lee SJ, Boscardin WJ, Kirby KA, Covinsky KE. Individualizing Life Expectancy Estimates for Older Adults Using the Gompertz Law of Human Mortality. Berthold HK, ed. *PLoS ONE*. 2014;9(9):e108540. doi:10.1371/journal.pone.0108540

29. Lee SJ, Lindquist K, Segal MR, Covinsky KE. Development and validation of a prognostic index for 4-year mortality in older adults. *JAMA: the journal of the American Medical Association*. 2006;295(7):801-808. doi:10.1001/jama.295.7.801

30. Schonberg MA, Davis RB, McCarthy EP, Marcantonio ER. Index to predict 5-year mortality of community-dwelling adults aged 65 and older using data from the National Health Interview Survey. *J Gen Intern Med*. 2009;24(10):1115-1122. doi:10.1007/s11606-009-1073-y

31. Schonberg MA, Li V, Marcantonio ER, Davis RB, McCarthy EP. Predicting Mortality up to 14 Years Among Community-Dwelling Adults Aged 65 and Older. *J Am Geriatr Soc*. 2017;65(6):1310-1315. doi:10.1111/jgs.14805

32. Jayasekera J, Vadaparampil ST, Eggly S, et al. Question Prompt List to Support Patient-Provider Communication in the Use of the 21-Gene Recurrence Test: Feasibility, Acceptability, and Outcomes. *JCO Oncol Pract*. Published online May 28, 2020:JOP1900661. doi:10.1200/JOP.19.00661

33. Schonberg MA, Ramanan RA, McCarthy EP, Marcantonio ER. Decision making and counseling around mammography screening for women aged 80 or older. *Journal of general internal medicine*. 2006;21(9):979-985. doi:10.1111/j.1525-1497.2006.00487.x

34. Schrager S, Ovsepyan V, Burnside E. Breast Cancer Screening in Older Women: The Importance of Shared Decision Making. *J Am Board Fam Med*. 2020;33(3):473-480. doi:10.3122/jabfm.2020.03.190380

35. Graves KD, Huerta E, Cullen J, et al. Perceived risk of breast cancer among Latinas attending community clinics: risk comprehension and relationship with mammography adherence. *Cancer Causes Control*. 2008;19(10):1373-1382. doi:10.1007/s10552-008-9209-7

36. Rutherford EJ, Kelly J, Lehane EA, et al. Health literacy and the perception of risk in a breast cancer family history clinic. *Surgeon*. 2018;16(2):82-88. doi:10.1016/j.surge.2016.06.003

37. Abbott A, Rueth N, Pappas-Varco S, Kuntz K, Kerr E, Tuttle T. Perceptions of contralateral breast cancer: an overestimation of risk. *Ann Surg Oncol*. 2011;18(11):3129-3136. doi:10.1245/s10434-011-1914-x
38. Schoenborn NL, Massare J, Park R, Pollack CE, Choi Y, Boyd CM. Clinician Perspectives on Overscreening for Cancer in Older Adults With Limited Life Expectancy. *J Am Geriatr Soc*. Published online March 31, 2020. doi:10.1111/jgs.16415

**Supplementary Files**

This is a list of supplementary files associated with this preprint. Click to download.

- ROSEManuCONSORTChecklistPFS.doc