JOURNAL OF ADOLESCENT AND YOUNG ADULT ONCOLOGY
Volume 00, Number 00, 2024

DOI: 10.1089/jayao.2024.0015

Cancer and Fertility: Exploring Uncertainty Management Strategies of Young Adult Female Survivors

Annemarie D. Jagielo, MS,[1,2] Alexandra M. Davis, MPH,[1,2] Devon Pons, MA,[3] Michael A. Diefenbach, PhD,[4] Jennifer S. Ford, PhD,[5] Lidia Schapira, MD,[6] and Catherine Benedict, PhD[2,6]

This study describes young adult female (YA-F) cancer survivors' uncertainty management strategies related to fertility/family building. Cross-sectional data were analyzed ($n = 98$). Participants reported higher rates of seeking information to reduce fertility-related uncertainty (M = 5.48, ±1.03), than avoiding information (M = 4.77, ±1.29). Controlling for relevant covariates (i.e., reproductive distress, household income, and health literacy), greater avoidance was related to higher reproductive distress ($\beta = 0.293$, $p = 0.011$) and lower household income ($\beta = -0.281$, $p = 0.047$). Evidence suggests that some survivors may avoid fertility-related information to manage uncertainty and distress, which may impact family-building success. Fertility avoidance may be an important target of intervention.

Keywords: fertility, survivorship, psychosocial, oncofertility, infertility

Introduction

Most young adult female (YA-F) cancer survivors (18–39 years old) are interested in future family building.[1] Gonadotoxic treatments can lead to infertility, reduced ovarian reserve, pregnancy complications, and/or challenges achieving parenthood when natural conception (unassisted reproduction) is unlikely or impossible.[2,3] Many YA-Fs face uncertainty about their fertility potential and path to family building.

The uncertainty management theory is a theoretical framework which suggests that uncertainty is cognitively and emotionally appraised either as a danger or an opportunity, leading to avoidance or information-seeking behaviors as emotion regulation and coping strategies.[4–6] When uncertainty is appraised as a danger, it elicits negative emotions such as anxiety and a drive to reduce uncertainty; when appraised as an opportunity, uncertainty elicits hope and motivation to maintain or increase uncertainty.[4,5] Individuals may seek information to reduce uncertainty and prepare for future challenges. People may also seek information that challenges their beliefs about their illness to increase uncertainty and foster hope.[6,7] For example, many cancer patients seek out personal experiences and patient success stories to challenge negative prognostic perceptions.[5,8] Alternatively, individuals engage in avoidance to protect themselves from overwhelming or distressing information or information deemed insufficient or flawed.[4,6] For example, one might avoid fertility-related information if it is perceived as threatening, and maintaining uncertainty allows hope for the future. Individuals may also intentionally avoid information they perceive as fallacious or unclear.[6]

Avoidance of fertility issues may be particularly maladaptive for YA-F survivors. Women with lowered ovarian reserve due to treatments may miss their reproductive window of opportunity. Family building after cancer may also require assisted reproductive technologies, such as in vitro fertilization or surrogacy and adoption/fostering. Avoidance may result in inadequate preparation for the emotional/psychological, financial, legal, and logistical challenges if fertility problems are encountered.[2,9] In prior studies, higher fertility avoidance was associated with younger age, identifying as non-White, lower education, greater reproductive distress, and lower levels of self-efficacy.[2,10] The present study

[1]PGSP-Stanford Psy.D. Consortium, Palo Alto University, Palo Alto, California, USA.
[2]Department of Psychiatry and Behavioral Sciences, School of Medicine, Stanford University, Stanford, California, USA.
[3]Department of Psychology, University of San Francisco, San Francisco, California, USA.
[4]Donald and Barbara Zucker School of Medicine at Hofstra/Northwell, Manhasset, New York, USA.
[5]Hunter College and The Graduate Center, City University of New York (CUNY), New York, New York, USA.
[6]Stanford Cancer Institute, Stanford, California, USA.

aimed to characterize the uncertainty management strategies of YA-F survivors with an interest in future family building and to identify factors related to avoidance and information seeking.

Methods

Study design

Secondary analyses were conducted using baseline, cross-sectional data from a single-arm pilot study of a decision aid for family building after cancer (NCT04059237). Study procedures were approved by the Stanford University Institutional Review Board and the Stanford Cancer Center Scientific Review Committee (#52143).

Participant eligibility and study procedures

Inclusion criteria included the following: assigned female at birth, ability to speak and read English, aged 18–45 years old, completed cancer treatment with possible risks of gonadotoxic effects, desire future children or uncertain of family-building plans, access to the internet and use of a computer, tablet, or smartphone, and living in the United States. Patients with significant physical or mental disability preventing completion of study activities were excluded. Participants diagnosed as children (i.e., <15 years old) and patients on long-term adjuvant or maintenance therapies were eligible to participate.

Recruitment was conducted through social media advertising, partnership with young adult cancer organizations (i.e., Stupid Cancer, Cactus Cancer Society), and through clinician referral at Stanford Health Care. Prospective participants completed an eligibility screener and were contacted by the study team through telephone to confirm eligibility and complete informed consent. Informed consent documentation was signed electronically in REDCap.

Study assessments

Participants completed demographic and medical history questionnaires and the Health Literacy Screening Questionnaire (HL-SQ; 8 items), which assesses knowledge and skills to prevent disease and promote health in everyday life (Cronbach's alpha = 0.86).[11]

The Uncertainty Management Preferences Scale (UMP; 15 items) assessed participants' preferences for managing uncertainty, adapted to refer to uncertainty about fertility/family building after cancer.[6] The Avoidance subscale represents preferences to maintain uncertainty through avoidance and/or to avoid information perceived as insufficient. The Information Seeking subscale represents preferences to seek information to increase or decrease uncertainty. Higher scores indicate a stronger preference for a strategy. The scale demonstrated good internal consistency (Cronbach's alpha = 0.74).

Reproductive distress was measured using the Reproductive Concerns after Cancer Scale (RCACS), a validated measure in YA-F cancer survivors.[12] This 18-item multidimensional measure includes the following six domains: concerns about fertility potential, partner disclosure, becoming pregnant, child's health, personal health, and acceptance. Higher scores indicate higher levels of distress. The scale demonstrated good internal consistency (Cronbach's alpha = 0.81).

The Patient-Reported Outcomes Measurement Information System (PROMIS) General Self-Efficacy for Managing Chronic Conditions[13] was adapted and measured confidence in managing fertility/family building concerns (4 items). The PROMIS Self-Efficacy for Managing Negative Emotions was adapted and measured confidence in managing negative emotions related to fertility/family building (4 items). For both, higher scores indicate higher levels of self-efficacy. Both measures demonstrated strong internal consistency (Cronbach's alphas = 0.94 and 0.91). The PROMIS measures are extensively validated[13] and used in cancer populations.[14,15]

Analyses

Descriptive statistics characterized the sample and outcome measures. Bivariate analyses examined relationships between uncertainty management strategies (i.e., information seeking and avoidance) and demographic and medical characteristics, reproductive distress, and self-efficacy variables using Pearson's correlation and analysis of variance. Two linear regression models were specified with information seeking and avoidance as dependent variables. Covariates related at the trend level ($p < 0.10$) in bivariate analyses were included in the regression models.

Results

Participant characteristics

Demographic and medical characteristics are provided in Table 1. Participants ($n = 98$) were mostly White ($n = 85$, 86.7%), Non-Hispanic/Latinx ($n = 84$, 85.7%), and nulliparous (71%). The mean age was 30.98 (SD = 5.61) years. A range of annual household income was reported such that 22% reported income <$50,000, 37% reported income $50,000–100,000, and 35% reported income >$100,000. Health literacy levels were comparable to reported means for females of this age group (HLSQ, M = 28.24, SD = 5.68).[11]

Participants reported average levels of reproductive distress of 64.14 (RCACS, SD = 11.03, range: 33–83). The mean of fertility self-efficacy was 2.95 (SD = 1.07, range 1–5), and the mean of managing negative fertility-related emotions was 3.23 (SD = 0.945, range 1.5–5).

Uncertainty management preferences

Participants reported higher levels of seeking information (M = 5.48, SD = 1.03) compared with avoiding information (M = 4.77, SD = 1.29). The average rating of seeking information to reduce uncertainty (M = 5.71, SD = 1.04) was greater than the average rating of seeking information to increase uncertainty (M = 5.09, SD = 1.27). Regarding avoidance, participants reported higher levels of avoiding information to maintain uncertainty (M = 4.92, SD = 1.63), compared with avoiding information perceived as insufficient (M = 4.57, SD = 1.37).

Item-level analysis characterized YA-Fs' use of information seeking and avoidance (Fig. 1). The most frequently endorsed item related to fertility avoidance indicated that 47% of YA-Fs tended to avoid information about fertility and family building because reminders made them feel nervous. Conversely, related to information seeking, the most frequently endorsed item indicated that 70% of YA-Fs sought information about fertility/family building due to a belief that being knowledgeable can be helpful.

Table 1. Demographic and Medical Characteristics of the Sample ($N = 98$)

Patient demographics	*Mean (SD)*	*Range*
Age (years)	30.98 (5.61)	18–43
Age at diagnosis (years)	22.63 (11.36)	0–38
Mean time since cancer treatment (years)	26.62 (7.46)	0–38
	n	%
Race		
White	85	86.7%
Black	4	4.1%
Asian/Pacific Islander	6	6.1%
Other	3	3.1%
Prefer not to answer	1	1.0%
Ethnicity		
Hispanic/Latinx	14	14.3%
Highest Education		
High school	1	1.0%
Vocational training, other than high school	2	2.0%
Some college but no degree	16	16.3%
College degree	41	41.8%
Postgraduate degree	38	38.8%
Household income		
Less than $50,000	22	22.4%
$50,000–$100,000	36	36.7%
Greater than $100,000	34	34.7%
Unknown or prefer not to answer	6	6.12%
Cancer Type[a]		
Breast	40	40.8%
Hodgkin's Lymphoma	13	13.3%
Leukemia	12	12.3%
Cervical, ovarian, uterine, or endometrial	11	11.2%
Other	22	22.5%
Underwent fertility preservation before cancer treatment	27	27.6%
Oocyte cryopreservation ($n = 19$)		
Embryo cryopreservation ($n = 7$)		
Ovarian tissue cryopreservation ($n = 1$)		
Ovarian transposition ($n = 0$)		
Ovarian suppression ($n = 5$)		
Other ($n = 0$)		
Underwent fertility preservation after cancer treatment	7	7.1%
Oocyte cryopreservation ($n = 5$)		
Embryo cryopreservation ($n = 0$)		
Other ($n = 2$)		

[a]Not mutually exclusive.

Factors related to uncertainty management preferences

In bivariate analysis, information seeking was not related to age, race, ethnicity, years since treatment, level of education, household income, fertility preservation history, health literacy, reproductive distress, or fertility self-efficacy. Therefore, we did not conduct multivariable analyses to understand correlates of information seeking.

In bivariate analysis, higher levels of avoidance related to lower health literacy ($r = -0.243$, $p = 0.030$) and greater reproductive distress ($r = 0.408$, $p \leq 0.001$). With regard to reproductive distress, higher levels of avoidance were positively correlated with greater concerns about fertility potential ($r = 0.205$, $p = 0.048$), partner disclosure ($r = 0.209$, $p = 0.043$), personal health ($r = 0.341$, $p < 0.001$), and becoming pregnant ($r = 0.372$, $p < 0.001$) subscales. Higher levels of avoidance also related to lower household income ($F[2,88] = 7.00$, $p = 0.002$). Specifically, participants who reported a household income of $50,000 or less, and those who reported a household income of $50,000–100,000, reported higher levels of avoidance compared with those who reported a household income of $100,000 or more. Avoidance was not related to age, race, ethnicity, years since treatment, level of education, fertility preservation history, or fertility self-efficacy.

A linear regression model was specified to better understand contributing factors related to fertility avoidance while controlling for covariates (reproductive distress, household income, and health literacy; Table 2). Higher levels of reproductive distress ($\beta = 0.293$, $p = 0.011$) and lower household income (i.e., $50,000 or less compared with $100,000 or more; $\beta = -0.281$, $p = 0.047$) were related to greater

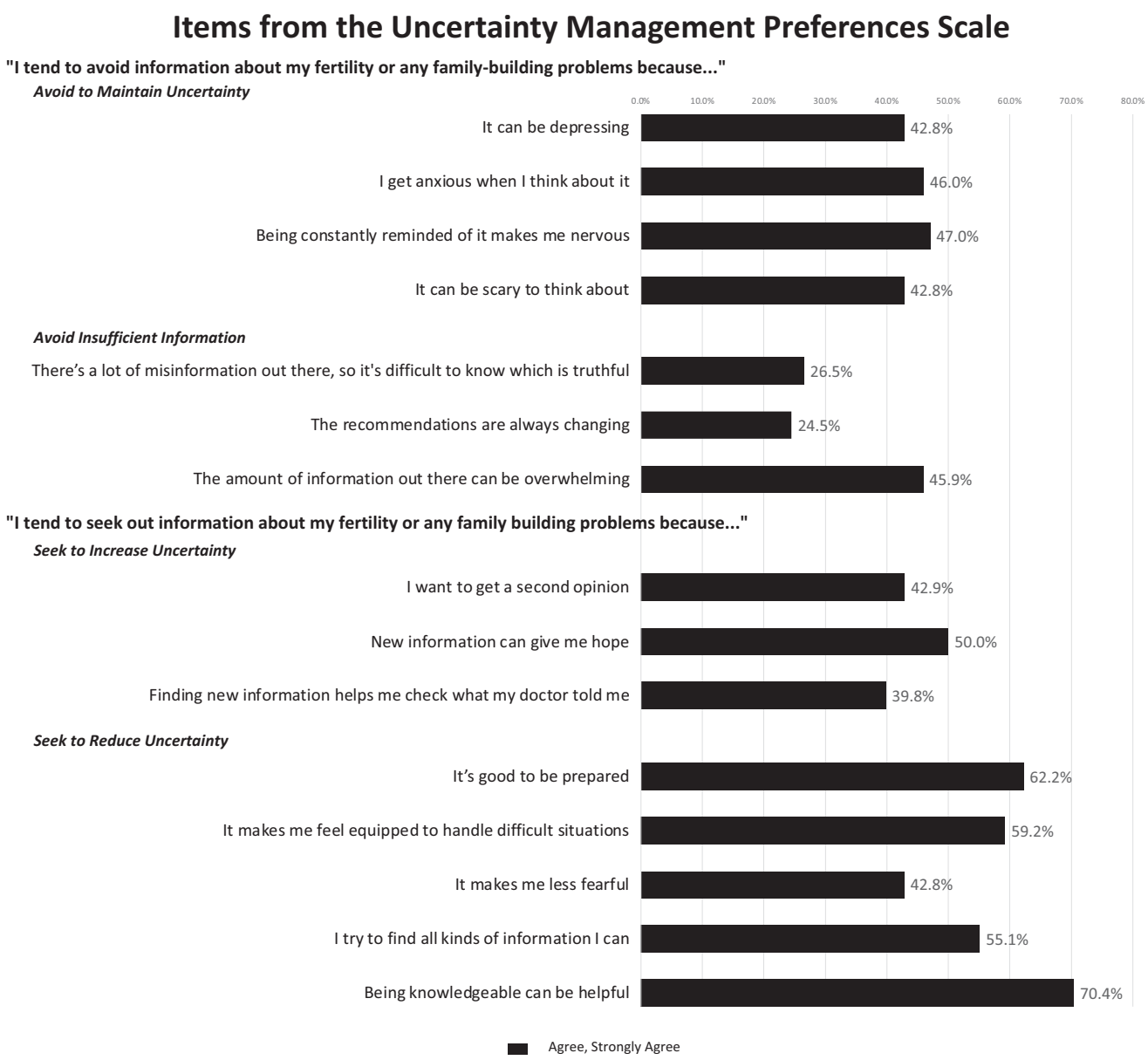

FIG. 1. Item-level analysis of the use of information seeking and avoidance among young adult female survivors as measured using the Uncertainty Management Preferences Scale.

avoidance. At the trend level, lower health literacy (β = –0.178, $p = 0.097$) was related to higher levels of avoidance.

Discussion

This study examined YA-F cancer survivors' uncertainty management strategies related to fertility and family building after cancer. Both information seeking and avoidance were used to manage fertility-related uncertainty. The most used strategy was "seeking information to reduce uncertainty," a strategy used when uncertainty is appraised as a danger,[4] which enables future preparation. This suggests that many YA-Fs may be taking proactive steps to manage infertility risks. Notably, YA-Fs also reported a tendency to seek information to increase uncertainty, which may indicate efforts to find competing information to instill hope. Future work should explore informational resources (e.g., providers, peers, internet searching, source content) and distinguish benefits and risks of various sources and reasons for preferences. Providers can be a trusted source for information and should offer guidance throughout the survivorship trajectory.[16] Community belonging and peer support may be another important source for information and emotional support, but may lead to misinformation and/or misconceptions.[16] While the internet provides easy access to health information, it may also be misleading, difficult to comprehend, and lead to inaccurate self-diagnoses or unrealistic expectations.[17] Contextual factors associated with information seeking, such as adolescent and young adult developmental stage, cancer continuum stage, and type of support needs, should also be investigated and could inform intervention development.

Over one-third of our sample endorsed high levels of avoiding information about fertility/family building to maintain uncertainty, and reproductive distress was the strongest correlate of fertility avoidance. Consistent with our prior work,[2]

Table 2. Linear Regression Analysis to Evaluate Predictors of Avoidance in YA-F Survivors

	R^2	$R^2\Delta$	*B*	*SE*	β	*t*	p
Model 1							
DV: Avoidance (UMP), $F(4,74) = 5.398$; $p < 0.001$							
Step 1	0.236	0.192					
Constant			4.26	1.05		4.03	<0.001
Reproductive distress (RCACS)			0.557	0.213	0.293	2.62	0.011
Health literacy (HL-SQ)			–0.037	0.022	–0.178	–1.68	0.097
Household income							
Less than $50,000 (Reference)							
$50,000–$100,000			–0.309	0.321	–0.128	–0.965	0.338
Greater than $100,000			–0.695	0.344	–0.281	–2.02	0.047

this suggests that some YA-Fs avoid distressing information to manage negative emotions.[6] The present findings expand on this work by underscoring the contributing role of health disparities in fertility-related avoidance. Although findings are preliminary, individuals with lower household incomes were more likely to use avoidant strategies to manage uncertainty, and in bivariate analysis, those with low health literacy were more likely to report avoidance. Health disparities affect access to fertility care,[18] suggesting lower access to informational support as well. Notably, avoidance may be an adaptive response for those without access to reproductive medicine (e.g., due to financial barriers). Poor health literacy may limit one's ability to engage adequately in fertility-related conversations with providers and navigate health systems to access care.[19] Indeed, a small minority of our participants indicated that they avoided information perceived as insufficient or confusing, suggesting that additional support may be needed to ensure comprehension. A lack of understanding of written educational resources is also a barrier to optimal care.[20] Educational resources, developed for low health literacy populations, may help support patient–provider communication.[20,21]

Taken together, our findings suggest that YA-F survivors may benefit from tailored support resources to help build adaptive uncertainty management skills. Acceptance and integration of uncertainty to some degree may be an important part of learning a "new normal" as a cancer survivor.[22] Interventions aimed at acceptance, such as mindfulness-based interventions, may be adapted to focus on oncofertility issues.[23] In addition, fertility avoidance may reinforce the cycle of distress and anxiety, as is the case in the etiology and maintenance of anxiety disorders.[24] Cognitive behavioral therapy incorporates various types of exposure therapy so that patients learn to tolerate discomfort rather than escape it.[24] Qualitative research is needed to adapt interventions for oncofertility distress and avoidance.

Information seeking was not related to any variables of interest. As these were secondary analyses, it is possible that important covariates were missing such as generalized anxiety,[25] cancer worry,[26] and health status.[27] Contrary to existing research,[2,10] avoidance was not related to age, race, ethnicity, level of education, or fertility self-efficacy. More research is needed to better understand how these variables contribute to avoidance. Undergoing fertility preservation before or after treatment was also not related to avoidance. This may be due to limited power, as only a small subset of our sample preserved their fertility. Going forward, research should explore the impact of fertility preservation on uncertainty management behaviors. Notably, our findings are limited by the cross-sectional assessment of study outcomes and our participant cohort of mostly White and highly educated individuals.

To our knowledge, this is the first study to examine the uncertainty management strategies of YA-F survivors related to fertility and family building. Findings highlight the multifaceted nature of uncertainty management and suggest that YA-Fs may engage in multiple strategies depending on contextual and situational factors, including the sources of uncertainty and the efficacy of responses used to manage it.[4] Importantly, both avoidance and information seeking may be adaptive or maladaptive depending on the context and goals of the individual. Results demonstrate that YA-Fs dynamically experience uncertainty positively and/or negatively, and their readiness to manage uncertainty and choice of uncertainty management strategy may fluctuate throughout the fertility trajectory. Longitudinal assessment of YA-F uncertainty management strategies is warranted to ascertain how these strategies change throughout the cancer continuum. Future research should explore individual factors and fertility-related beliefs that may impact one's uncertainty appraisals,[5] as well as the interplay between different uncertainty management strategies. Our data demonstrate that YA-Fs with greater reproductive distress, lower socioeconomic status, and lower health literacy may be more likely to manage fertility-related uncertainty by practicing avoidance. These findings are clinically relevant as they may inform provider discussions to optimize oncofertility and survivorship care.

Authors' Contributions

All authors made substantial contributions to the conception and design, acquisition of data, or analysis and interpretation of data. All were involved in drafting the article or revising it critically for important intellectual content. All provided final approval of the article and agree to be accountable for all aspects of the work.

Author Disclosure Statement

Nonfinancial interests: C.B. has served on the board of directors for Stupid Cancer, member of the research advisory board for Cactus Cancer Society, and as a research advisor to GRYT Health. There are no other conflicts of interest to disclose.

Funding Information

This work was supported by a grant from the National Cancer Institute (K07CA229186, PI: Benedict).

References

1. Van Dijk M, Van Den Berg MH, Overbeek A, et al. Reproductive intentions and use of reproductive health care among female survivors of childhood cancer. Hum Reprod 2018;33(6):1167–1174; doi: 10.1093/humrep/dey058
2. Benedict C, Stal J, Davis A, et al. Greater fertility distress and avoidance relate to poorer decision making about family building after cancer among adolescent and young adult female survivors. Psychooncology 2023;32(10):1606–1615; doi: 10.1002/pon.6212
3. Van Dorp W, Haupt R, Anderson RA, et al. Reproductive function and outcomes in female survivors of childhood, adolescent, and young adult cancer: A review. J Clin Oncol 2018;36(21):2169–2180; doi: 10.1200/JCO.2017.76.3441
4. Brashers DE. Communication and uncertainty management. Journal of Communication 2001;51(3):477–497; doi: 10.1111/j.1460-2466.2001.tb02892.x
5. Peng W, Carcioppolo N, Occa A, et al. Feel worried, overloaded, or fatalistic? the determinants of cancer uncertainty management preferences. Health Commun 2021;36(3):347–360; doi: 10.1080/10410236.2019.1692489
6. Peng W, Carcioppolo N, Occa A, et al. Reducing, maintaining, or escalating uncertainty? The development and validation of four uncertainty preference scales related to cancer information seeking and avoidance. Health Commun 2016;36(3):347–360; doi: 10.1080/10810730.2016.1184357
7. Brashers DE. A theory of communication and uncertainty management. In: Explaining communication: Contemporary theories and exemplars. (Whaley, BB, Samter, W. eds.) Routledge: New York; 2006. pp 2001–2218.
8. Dickerson SS, Boehmke M, Ogle C, et al. Seeking and managing hope: Patients' experiences using the internet for cancer care. Oncol Nurs Forum 2006;33(1):E8–E17; doi: 10.1188/06.ONF.E8-E17
9. Canzona MR, Victorson DE, Murphy K, et al. A conceptual model of fertility concerns among adolescents and young adults with cancer. Psychooncology 2021;30(8):1383–1392; doi: 10.1002/pon.5695
10. McCloud RF, Jung M, Gray SW, et al. Class, race and ethnicity and information avoidance among cancer survivors. Br J Cancer 2013;108(10):1949–1956; doi: 10.1038/bjc.2013.182
11. Abel T, Hofmann K, Ackermann S, et al. Health literacy among young adults: A short survey tool for public health and health promotion research. Health Promot Int 2015;30(3):725–735; doi: 10.1093/heapro/dat096
12. Gorman JR, Su HI, Pierce JP, et al. A multidimensional scale to measure the reproductive concerns of young adult female cancer survivors. J Cancer Surviv 2014;8(2):218–228; doi: 10.1007/s11764-013-0333-3
13. Gruber-Baldini AL, Velozo C, Romero S, et al. Validation of the PROMIS® measures of self-efficacy for managing chronic conditions. Qual Life Res 2017;26(7):1915–1924; doi: 10.1007/s11136-017-1527-3
14. Bradford N, Pitt E, Rumble S, et al. Persistent symptoms, quality of life, and correlates with health self-efficacy in adolescent and young adult survivors of childhood cancer. J Adolesc Young Adult Oncol 2022;11(4):410–418; doi: 10.1089/jayao.2021.0104
15. Pitt E, Cashion C, Rumble S, et al. Associations between health behaviors, health self-efficacy, and long-term outcomes in survivors of childhood cancer: A cross-sectional study. Semin Oncol Nurs 2023;39(4):151434; doi: 10.1016/j.soncn.2023.151434
16. Benedict C, Nieh J-L, Hahn AL, et al. "Looking at future cancer survivors, give them a roadmap": Addressing fertility and family-building topics in post-treatment cancer survivorship care. Support Care Cancer 2021;29(4):2203–2213; doi: 10.1007/s00520-020-05731-3
17. Chua GP, Tan HK, Gandhi M. Information sources and online information seeking behaviours of cancer patients in Singapore. Ecancer 2018;12:880; doi: 10.3332/ecancer.2018.880
18. Letourneau JM, Smith JF, Ebbel EE, et al. Racial, socioeconomic, and demographic disparities in access to fertility preservation in young women diagnosed with cancer. Cancer 2012;118(18):4579–4588; doi: 10.1002/cncr.26649
19. Nahata L, Anazodo A, Cherven B, et al. Optimizing health literacy to facilitate reproductive health decision-making in adolescent and young adults with cancer. Pediatr Blood Cancer 2023;70 (Suppl 5):e28476; doi: 10.1002/pbc.28476
20. Ussher JM, Perz J, Hawkey AJ. A randomized controlled evaluation of an educational resource to address fertility concerns after cancer. Psychooncology 2021;30(9):1442–1448; doi: 10.1002/pon.5703
21. Tam S, Puri N, Stephens D, et al. Improving access to standardized fertility preservation information for older adolescents and young adults with cancer: Using a user-centered approach with young adult patients, survivors, and partners to refine fertility knowledge transfer. J Cancer Educ 2018;33(3):528–535; doi: 10.1007/s13187-016-1108-0
22. Mishel MH. Uncertainty in Chronic Illness. Annu Rev Nurs Res 1999;17(1):269–294; doi: 10.1891/0739-6686.17.1.269
23. Dawson G, Madsen L, Dains J. Interventions to manage uncertainty and fear of recurrence in female breast cancer survivors: A review of the literature. Clin J Oncol Nurs 2016;20(6):E155–E161; doi: 10.1188/16.CJON.E155-E161
24. Foa EB, McLean CP. The efficacy of exposure therapy for anxiety-related disorders and its underlying mechanisms: The case of OCD and PTSD. Annu Rev Clin Psychol 2016;12(1):1–28; doi: 10.1146/annurev-clinpsy-021815-093533
25. So J, Kuang K, Cho H. Information seeking upon exposure to risk messages: Predictors, outcomes, and mediating roles of health information seeking. Communication Research 2019;46(5):663–687; doi: 10.1177/0093650216679536
26. Van Stee SK, Yang Q. Online cancer information seeking: Applying and extending the comprehensive model of information seeking. Health Commun 2018;33(12):1583–1592; doi: 10.1080/10410236.2017.1384350
27. Baker L, Wagner TH, Singer S, et al. Use of the internet and E-mail for health care information: Results from a national survey. Jama 2003;289(18):2400–2406; doi: 10.1001/jama.289.18.2400

Address correspondence to:
Annemarie Jagielo, MS
PGSP-Stanford Psy.D. Consortium
Palo Alto University
1791 Arastradero Road
Palo Alto
California 94304
USA

E-mail: ajagielo@stanford.edu