


Preliminary testing of “roadmap to parenthood” decision aid and planning tool for family building after cancer: Results of a single-arm pilot study

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Abstract

Objective: Many young adult female cancer survivors need to use reproductive medicine, surrogacy, or adoption to have a child. This study pilot tested *Roadmap to Parenthood*, a web-based, self-guided decision aid and planning tool for family building after cancer (disease agnostic).

Methods: A single-arm pilot study tested feasibility, acceptability, and obtained effect size estimates of the Roadmap tool. Participants, recruited via hospital-based and social media strategies, completed a baseline survey (T1), accessed the Roadmap tool (website), then completed surveys at one- and 3-months (T2 and T3, respectively). Feasibility and acceptability were evaluated with rates of eligibility, enrollment, and survey completion, and feedback. Pairwise *t*-tests and repeated measures ANOVA evaluated usage effects. Effect size estimates were calculated.

Results: Participants ($N = 98$) averaged 31 years old ($SD = 5.61$); 71% were nulliparous. Enrollment rate was 73%, T1-T2 completion rate was 80%, and 93% accessed the website. From T1-T2, participants reported improvements in decisional conflict ($p < 0.001$; Cohen's $d = 0.85$), unmet information needs ($p < 0.001$; Cohen's $d = 0.70$), self-efficacy ($p = 0.003$; Cohen's $d = 0.40$), and self-efficacy for managing negative emotions ($p = 0.03$; Cohen's $d = 0.29$); effects were sustained at T3. There was no change in reproductive distress ($p = 0.22$). By T3, 94% reported increased consideration of preparatory actions and 20%–61% completed such actions.

Conclusions: The Roadmap intervention was feasible to conduct, acceptable to users, and led to improvements in key psychosocial outcomes. Future directions will test intervention efficacy in a randomized controlled trial with a larger sample and over a longer period. A web-based tool may help women make decisions about family building after cancer and prepare for potential challenges.

KEYWORDS

cancer support intervention, decision aids, decision-making, eHealth, fertility, young adult oncology

1 | BACKGROUND

Most young adult female (YA-F; i.e., assigned female at birth) cancer survivors report a desire to have children someday or desire to maintain this option.¹ Gonadotoxic cancer treatments may lead to infertility, lowered ovarian reserve or premature ovarian failure (i.e., shortened reproductive timeline), or difficulties conceiving and safely carrying a pregnancy.^{2,3} Most women are unable to undergo fertility preservation procedures pre-treatment,⁴ and difficulties exist later on when using frozen eggs/embryos including low success rates and high costs.⁵ There are many ways to build a family. Family building that requires assisted reproductive technology (ART), such as in vitro fertilization (IVF) and surrogacy, with fresh, frozen, or donated gametes, and adoption/fostering have informational, psychosocial, financial, legal, and logistical barriers. Only 15% of YA-Fs receive post-treatment fertility counseling.⁶ Lack of awareness of infertility risks and the challenges of ART and adoption/fostering, unrealistic expectations about reproductive potential or likelihood of success, and avoidance of fertility-related issues can increase family building costs, logistical difficulties, psychological distress, and risks of missing one's reproductive window.

Multiple decision aids exist for pre-treatment fertility preservation,⁷ but none of them include comprehensive information about decisions to consider after cancer treatment is completed. We identified high rates of unmet needs about family building after cancer; 87% of YA-Fs felt uninformed about their options, 70% wanted more advice, and 35% wanted more emotional support.⁸ In a qualitative study, YA-Fs described their decision making processes related to family building after cancer,⁹ and their unmet needs for informational and emotional support, guidance for next steps, financial information, and peer support resources.¹⁰

We developed "*Roadmap to Parenthood*," an interactive, web-based decision aid and planning tool for family building after cancer (i.e., the Roadmap tool). The tool was designed to help survivors learn about options for family building, identify personal priorities and goals (values-clarification), and guide self-management toward next steps for fertility care and family-building preparation after cancer. For those at risk of early menopause with a shortened reproductive window, survivors may need to consider family-building options earlier than their desired timeline for having a child and the tool may prompt decisions to plan for the future. Early consideration of family-building options may also afford time to prepare for future challenges such as establishing a care plan for ongoing fertility monitoring or beginning to save for the costs. It was developed from extensive pilot work⁸⁻¹² and theory,^{13,14} following healthcare decision aid guidelines,¹⁵ and patient-centered design principles.¹⁶

A single-arm pilot trial was conducted to evaluate the feasibility and acceptability of the Roadmap tool, to evaluate the study procedures, and to obtain effect size estimates for a future large-scale trial. We hypothesized that the Roadmap tool would help YA-Fs manage decisional conflict (primary outcome), feel more informed about fertility/family-building options, manage reproductive distress, feel more confident in addressing fertility-related

issues, and engage in more planning behaviors aligned with family-building goals (secondary outcomes).

2 | METHODS

The study was approved by the Stanford Research Ethics Board (IRB #52143) and the Scientific Review Committee of the Stanford Cancer Institute and was registered on ClinicalTrials.gov (NCT04059237). Participants completed informed consent prior to study enrollment. Data collection was completed between February 2020 and December 2022. Study data were collected and managed using REDCap (Research Electronic Data Capture) hosted at the Stanford Center for Clinical Informatics.

2.1 | Participants

Inclusion criteria included: 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 U.S. Patients with significant physical or mental disability that prevented completion of study activities were excluded. Participants could have been diagnosed as children (i.e., <15 years old) and on long-term adjuvant or maintenance therapies such as Tamoxifen.

2.2 | Procedures

A longitudinal pre-post intervention design was conducted. Following completion of a baseline survey (T1; pre-intervention), participants were emailed a link to access the Roadmap tool website. Follow-up surveys were emailed one- and 3-months post-baseline (T2 and T3, respectively). Participants could access the website for the duration of the study. Participants received \$10 compensation for completing all surveys at the end of their participation.

2.3 | Description of the intervention

As previously described, the web-based, interactive Roadmap to Parenthood decision aid and planning tool is for women (assigned female at birth) who have completed gonadotoxic treatment (disease-agnostic) to support future family building (Supplemental Figure S1).^{17,18} It goes beyond fertility preservation to address post-treatment issues, providing general information about cancer treatment effects on fertility and family-building options via ART and adoption/fostering, though explains that natural conception (unassisted reproduction) may still be possible. It does not provide guidance based on personal medical information. It includes a 4-step self-assessment exercise that involves values-clarification, along with

peer stories, suggestions for finding support from friends, family, patient communities, and professional counseling. It includes guidance for “next step” action planning, which includes questions to ask providers, recommendations for talking to a partner, and financial planning. Additional resources were linked to provide more specific information such as state-by-state surrogacy regulations, same-sex family building laws, and means to connect with relevant organizations. It was designed to be used by single and partnered individuals, inclusive of gender identity and sexual orientations with specific guidelines for individuals who identify as LGBTQ+ (lesbian, gay, bisexual, transgender, queer, intersex, asexual+), and appropriate for all stages of decision-making readiness and expected timeline. Guidelines from the International Patient Decision Aid Society^{15,19} and the Ottawa Decision Support Framework^{20,21} and required components of a patient decision aid²² were followed.

2.4 | Recruitment & enrollment

Using social media is advised for recruiting young adult cancer populations.^{23,24} We partnered with Stupid Cancer, Cactus Cancer Society, The Samfund, and Gryt Health to post study ads in their social media sites. Study ads included a link to complete an eligibility screener and provide contact information. Recruitment also included clinician referral. Recruitment and enrollment conversations were conducted via phone. Informed consent was signed electronically via REDCap.

2.5 | Measures

Feasibility of the intervention and study design was evaluated with rates of eligibility, enrollment, and attrition (target: <30%). Reasons for ineligibility were collected. Acceptability was evaluated using self-report data on website access and two items that assessed likelihood of recommending the website to a friend and likelihood of using the website again (5-point scale from ‘very unlikely’ to ‘very likely’). Open-ended questions captured additional impressions of the website.

Data on sociodemographic and medical characteristics, health literacy (3-item screener for detecting inadequate health literacy^{25,26}), cancer-related financial toxicity (Comprehensive Score for Financial Toxicity [COST], version 1^{27,28}), and general financial well-being (InCharge Financial Distress/Financial Well-being scale²⁹) were collected. The eHealth Impact Questionnaire-Part 2 measured the impact of using the decision aid website on understanding health concerns and confidence to manage health issues.³⁰

2.5.1 | Decisional conflict

The Decisional Conflict Scale (DCS; 16 items) assesses personal uncertainty in making health decisions and was adapted to refer to

family-building decisions after cancer. It includes five domains: feeling uncertain, feeling uninformed, feeling unclear about values, feeling unsupported, and ineffective decision making.^{31,32} It is valid, reliable, and responsive to change. Total scores range from 0 to 100, higher scores indicate greater decisional conflict. There is a validated cut-off score in which scores >37.5 indicate clinically significant conflict.³² The measure demonstrated good internal consistency across time points (i.e., T1-T3; Cronbach's alphas = 0.94 to 0.96).

2.5.2 | Unmet information needs

An investigator-designed 5-item measure asked respondents whether they had as much information as they want about risk of infertility after cancer, risk of premature menopause, options to assess fertility status, options to undergoing fertility preservation post-treatment (if possible), and alternative options for family building after cancer (5 items). Responses were yes (0) or no (1). Scores range from 0 to 5 and higher scores indicate greater Unmet information needs (UIN). We have used this measure in several prior studies.^{8,33,34} It demonstrated adequate internal consistency across time points (i.e., T1-T3; Cronbach's alphas = 0.76 to 0.84).

2.5.3 | Reproductive concerns

The Reproductive Concerns After Cancer Scale (RCAC; 18 items) measures six domains of fertility concerns: fertility potential, becoming pregnant, personal health, child's health, partner disclosure, and acceptance.³⁵ Mean scores range from 18 to 90. Higher scores indicate higher levels of concern or distress. The measure demonstrated adequate internal consistency across time points (i.e., T1-T3; Cronbach's alphas = 0.80 to 0.86).

2.5.4 | Self-efficacy

The PROMIS (Patient-Reported Outcomes Measurement Information System) measures assess various aspects of self-efficacy.³⁶ The General self-efficacy (GSE) short form (4 items) asks respondents to rate their level of confidence in managing difficult situations, problems, and events. The Self-Efficacy for Managing Negative Emotions (4 items) asks respondents to rate their level of confidence managing negative feelings, stress, feeling discouraged, and disappointment. Both measures were used in the original forms and were adapted to refer to fertility-related self-efficacy and self-efficacy for managing fertility-related negative emotions, respectively (additional 8 items). All scales demonstrated good internal consistency across time points (i.e., T1-T3; Cronbach's alphas = 0.90 to 0.95).

2.5.5 | Planning behaviors and concomitant care

Investigator-designed questions asked participants at T2 and T3 to rate the extent to which the website prompted them to consider family-building decisions and complete “next steps” toward planning for future family building (i.e., sought guidance from an oncologist or member of their cancer care team or fertility specialist, took steps to learn more about or plan for the costs of family building, accessed support from family, friends, or peers, or spoke to a partner, with an option to list any other action taken). Open-ended questions captured reasons for not completing such actions.

2.6 | Statistical methods

Feasibility and acceptability were assessed using descriptive statistics of rates of eligibility, enrollment, attrition, reasons for refusal, completion rates of surveys, and website access. Independent means *t*-tests and chi-square tests compared acceptors/decliners and completers/non-completers. Descriptive statistics characterized the sample and open-ended questions were summarized.

For our primary analysis, to obtain an effect size estimate of intervention effects on decisional conflict, a pairwise *t*-test evaluated change in DCS mean scores from T1 to T2 and an effect size (Cohen's *d*) was calculated. The trajectory of decisional conflict T1–T3 was evaluated with ANOVA. Similar procedures analyzed changes in secondary outcomes. Descriptive statistics evaluated planning behaviors and concomitant care at T2 and T3.

The target sample size was 100 participants. With a projected 20% attrition rate (selected a priori), this provided sufficient power (80%) to detect an effect size of 0.3 (i.e., moderate effect size based on Cohen's taxonomy) for the T1–T2 change in DCS, with a two-sided paired *t*-test with a 0.05 significance level. We based this on a decision aid intervention for fertility preservation.³⁷ The DCS manual recommends basing sample sizes on detecting an effect size of 0.30 to 0.40.³²

3 | RESULTS

3.1 | Patient eligibility and characteristics

In total, 438 eligibility screeners were completed and, of those, 231 did not respond to follow-up contact attempts (eligibility could not be confirmed) and 76 were determined ineligible. Of those who met eligibility criteria ($n = 140$), 102 agreed to participate and completed informed consent for an enrollment rate of 72.9% (102/140). After enrolling, four participants were lost to follow up and did not begin study activities. In total, 98 participants completed the baseline (T1) survey; 80% of those ($n = 78$ of 98) completed T2 and 70.5% of those ($n = 55$ of 78) completed T3. There were no differences in eligibility

criteria between those who enrolled versus declined or were lost to follow up after completing the eligibility screener (p -values >0.05).

Sample descriptives are reported in Table 1. Participants ($N = 98$) averaged 31 years old ($SD = 5.61$, range: 18–43) and were mostly White (87%); 21% were currently in school, 81% had at least a college degree, and 77% were employed. Most women were nulliparous (74%). The sample reported “moderate financial distress/moderate financial well-being” (FDFW, $M = 6.05$, $SD = 2.08$)²⁹ and “moderate” cancer-related financial toxicity (COST, $M = 20.82$, $SD = 9.87$).²⁸ Scores on the functional health literacy screener were comparable to published means; 5% were classified as having inadequate health literacy.³⁸

All but 5 participants who enrolled in the study were recruited through social media. Tests of statistical significance by recruitment source were not conducted due to uneven group sizes, though all patients who were referred through clinicians enrolled in the study. No differences were observed between those who completed versus did not complete the study in age, race/ethnicity, education, student status, employment status, income, financial wellbeing/distress, cancer-related financial toxicity, health literacy, or desired timeline for family building (p -values >0.05). Those who completed the study were more likely to report a tendency to seek information to reduce uncertainty related to fertility/family building.

Among participants who completed T1 ($n = 98$), 93% accessed the website and 40% reported using it more than once (range: 1–6x). Average total time spent on the website at T2 was 36 min (interquartile range = 30 min) and total time at T3 was 44 min (interquartile range = 40 min). At T2, 82% reported they were *likely* or *very likely* to use the website again, and 84% were *likely* or *very likely* to recommend to a friend. Additionally, 85% *agreed* or *strongly agreed* that it encouraged them to play a more active role in their healthcare and family-building decisions (eHIQ-Part 2 items).

3.2 | Usage effects on outcome variables over time

Table 2 displays mean values of outcomes across time points (T1–T3).

3.2.1 | Decisional conflict

The Roadmap tool led to an 18-point decrease in decisional conflict from T1 to T3, representing a large effect size (Cohen's $d = 0.85$; Figure 1). The change from T1 to T2 was significant ($t[59] = 14.9$, $p < 0.001$). All DCS subscales decreased from T1 to T2, that is, uncertainty, feeling informed, values clarity, feeling supported, and making an effective decision (p -values <0.05). The average DCS baseline level (T1) was well above the validated cut-off score (>37.5) indicating “significant conflict”; after viewing the Roadmap tool, average scores were below the cut-off at T2 and T3. At baseline, 55%

TABLE 1 Sociodemographic characteristics of study sample (N = 98).

	Mean (SD)	Range
Sociodemographic information		
Age (years)	30.98 (5.61)	18–43
Age at diagnosis (years)	22.63 (11.36)	0–38
Childhood cancer survivors (n = 9), age at diagnosis ^b	6.61 (5.36)	0.08–14.70
Health literacy scale	3.40 (0.48)	2.0–4.67
Cancer-related financial toxicity (COST)	20.82 (9.87)	1.0–40.0
Financial well-being (FDFW)	6.05 (2.08)	1.75–10.0
	n	%
Race		
White	85	86.7%
Black	4	4.1%
Asian or Pacific Islander	6	6.1%
Other	3	3.1%
Prefer not to answer	1	1.0%
Ethnicity		
Hispanic/Latina/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%
Post-graduate degree	38	38.8%
Student status		
Full or part-time	21	21.4%
Not enrolled in school	77	78.6%
Employment status		
Employed full-time	62	63.3%
Employed part-time	13	13.3%
Not employed	23	23.5%
Household income		
Less than \$50,000	22	22.4%
\$50,000 – \$100,000	36	36.7%
Greater than \$100,000	34	34.7%
Unknown/prefer not to answer	6	6.12%
Clinical information		
Cancer type^a		
Breast	40	40.8%
Hodgkin's Lymphoma	13	13.3%
Leukemia	12	12.3%

TABLE 1 (Continued)

	n	%
Cervical, ovarian, uterine, or endometrial	11	11.2%
Other	22	22.5%
Hormone therapy (currently taking)	35	35.7%
Fertility-related information		
Nulliparous	72	73.5%
Underwent fertility preservation <u>before</u> cancer treatment ^a	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 <u>after</u> cancer treatment ^a	7	7.1%
Oocyte cryopreservation (n = 5)		
Embryo cryopreservation (n = 0)		
Other (n = 2)		
Had a fertility evaluation since completing cancer treatment		
Yes	24	24.5%
No	71	72.5%
Unsure	1	1.0%
Been told that you will not be able to get pregnant or carry a pregnancy		
Yes	21	21.4%
No	64	65.3%
Not sure/I don't remember	11	11.2%

Abbreviations: COST, Comprehensive Score for Financial Toxicity; FDFW, Financial Distress/Financial Well-being.

^aNot mutually exclusive.

^bChildhood cancer survivors are defined as being diagnosed <15 years old.

reported clinically significant decisional conflict, which dropped to 29% at T2 and 22% at T3.

3.2.2 | Unmet information needs

Participants reported lower UIN related to fertility/family-building topics after viewing the tool. Scores were significantly lower from T1 to T2 ($t[51] = 5.01, p < 0.001$) and a large effect size was observed (Cohen's $d = 0.70$). The change from T2 to T3 was not significant ($t[45] = -0.29, p = 0.77$).

TABLE 2 Change in outcome measures over study time points.

	Timepoint			p-value ^a
	T1 M (SD)	T2 M (SD)	T3 M (SD)	
Primary outcome				
Decision conflict scale (DCS; primary outcome)	52.25 (24.26)	36.83 (20.03)	34.55 (16.96)	<0.001
Secondary outcomes				
Unmet information needs (UIN)	3.39 (1.81)	2.02 (1.56)	2.09 (1.67)	<0.001
Reproductive concerns after cancer scale (RCAC)	64.14 (11.03)	61.55 (12.30)	60.94 (11.19)	0.10
General self-efficacy (GSE)	3.83 (0.87)	3.91 (0.88)	3.89 (0.75)	0.59
Fertility/Family-building self-efficacy (FSE)	2.95 (1.07)	3.31 (0.94)	3.26 (0.10)	0.02
Self-efficacy for managing negative emotions (SE-NE)	3.23 (0.95)	3.32 (0.90)	3.27 (0.94)	0.52
Self-efficacy for managing fertility emotions (SE-FE)	2.70 (0.93)	2.92 (1.05)	2.92 (1.05)	0.08

Abbreviations: T1, baseline, pre-intervention; T2, one-month post-baseline, post intervention; T3, 3-months post baseline.

^aRepeated measures ANOVA evaluated change in outcome variables across the study time points (T1 to T3).

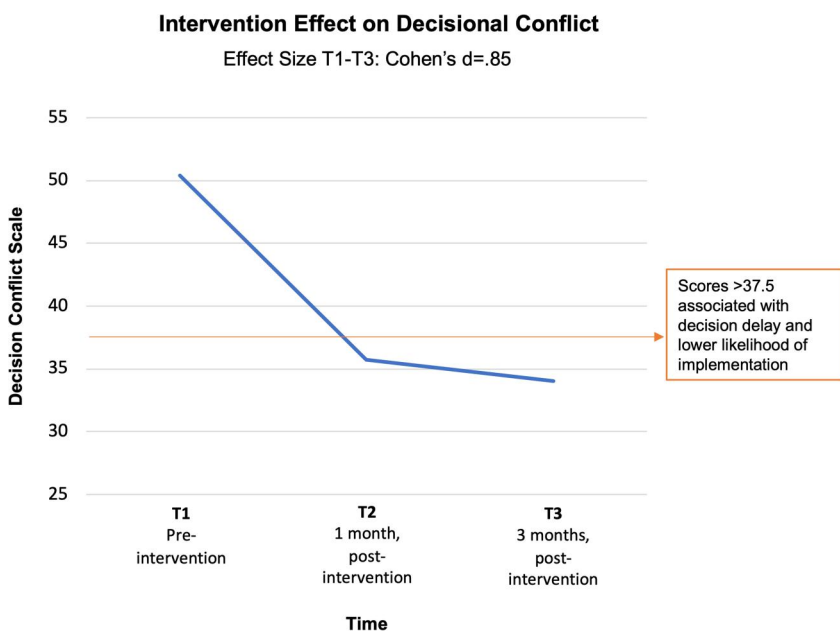


FIGURE 1 The Roadmap tool led to an 18-point decrease in decisional conflict from T1 to T3, representing a large effect size (Cohen's $d = 0.85$). Participants reported baseline levels of decisional conflict ($M = 52.2$, $SD = 24.3$) that were well above the validated cut-off score (>37.5) indicating "significant conflict." After viewing the Roadmap tool, scores were below the cut-off at T2 ($M = 36.6$, $SD = 20.1$) and continued to decrease to T3 ($M = 34.55$, $SD = 16.96$).

3.2.3 | Reproductive distress

Levels of reproductive distress lowered across time points, but differences between T1 and T2 ($t[64] = 1.25$, $p = 0.22$) and T2 and T3 ($t[58] = 0.66$, $p = 0.51$) were not significant.

3.2.4 | Self-efficacy

Self-efficacy for managing fertility/family-building issues increased from T1 to T2 ($t[59] = -3.13$, $p = 0.003$) with a moderate effect size (Cohen's $d = 0.40$). Women reported improved self-efficacy for managing negative fertility-related emotions from T1 to T2 ($t[59] = -2.25$, $p = 0.03$) with a small effect size (Cohen's $d = 0.29$).

For both types of self-efficacy, non-significant increases from T2 to T3 were observed. In contrast, there was no difference in GSE or self-efficacy for managing negative emotions not specific to fertility across time points (p -values > 0.05).

3.3 | Planning behaviors and concomitant care

The website prompted participants to consider family-building decisions and "next step" preparatory actions, and 20%–61% completed such actions in the 3-month study time period (Table 3). In response to an open-ended question, many women reported that the Roadmap tool made them consider their future desires more seriously and served as a reminder to "stay on top" of their fertility. This included

TABLE 3 Planning behaviors and concomitant care.

	T2 1-month post-baseline (n = 78)	T3 3-month post-baseline (n = 55)
Endorsed cognitions (i.e., 'a little bit' to 'extremely')		
Considered family building decisions	86%	91%
Considered "next step" preparatory actions	85%	76%
Completed behaviors		
Spoke to their partner about family-building options		61%
Sought social support related to family-building concerns		51%
Took steps to plan for the financial costs		39%
Sought guidance from their cancer care team		24%
Saw a fertility specialist		20%

having a greater awareness of family-building options not previously considered, for example, "[It] opened my mind about using a gestational carrier" and "It makes me consider the possibility of adoption through foster care a little more." Using the tool appeared to prompt a more active engagement in decision making, for example, "It mostly just made me take a hard look at my situation and make sure I am comfortable with where I am at." Several women noted the website prompted them to "think about [their] finances," though no action was taken.

Reasons for not completing actions included having already done them prior to participation, still being on hormone or maintenance therapy with plans to complete actions in the future and waiting for their next medical visit to pursue fertility-related conversations. A few women reported a hesitation due to emotional readiness, for example, "I haven't felt ready yet. There's also some fear about what I may find out." Others had made a conscious decision to postpone fertility-related actions because of the emotions evoked, for example, "I think the idea of struggling with my fertility scares me and I don't want to stress about it at this stage in my life." Others reported cost and COVID-19 as barriers to accessing care. Reasons for not seeking support included lack of peers with relevant experiences to understand, for example, "I feel like there is no one in my community that knows what this is like or could provide guidance."

4 | DISCUSSION

This study demonstrated that a web-based decision support tool for family building after cancer, Roadmap to Parenthood, was feasible to conduct and well received by users. The tool led to improvements in key outcomes including decisional conflict, UIN, self-efficacy, and increased planning behaviors for future family building.

We met our retention goal of 80% of participants completing baseline and 1-month follow-up surveys (T1 to T2). Although respectable, our enrollment rate of 73% was short of our 80% target. We were unable to reach most respondents recruited through social media to confirm eligibility or assess interest (or reasons for declining). Although social media recruitment offers distinct advantages, it often leads to lower enrollment rates.³⁹ For comparison, clinical trials of fertility preservation decision aids reported enrollment rates between 64% and 79% and retention rates between 45% and 87%.^{37,40} Future trials may improve recruitment and retention by adapting methodologies for this age group.²³

Participants reported lower decisional conflict about family building after viewing the Roadmap tool, which was our primary outcome. Average decisional conflict scores decreased by 18 points from T1-T3, representing a large effect size. Participants reported lower uncertainty and felt more informed, reported greater values clarity, felt more supported, and were able to make more effective decisions. Notably, a sizable subgroup still reported clinically significant decisional conflict after viewing the website and reasons for not pursuing "next step" actions included fear and lack of emotional readiness, suggesting some YA-Fs may need more support. For some, it may be sensible to postpone such actions until they feel ready, whereas for others, additional support may increase self-efficacy for coping with negative emotions and pursuing desired actions. For those who were uninformed at baseline, some degree of decisional conflict and uncertainty may be expected as they incorporate new information into existing values, priorities, and goals, and renegotiate decision options and expectations for the future. Participants reported the Roadmap tool reminded them to be more engaged in fertility/family-building decisions, even if actions were not completed. It may be that the tool moved survivors from a pre-contemplation to a contemplation or preparation stage before taking action to address fertility or family-building decisions.⁴¹ For those with more support needs, the Roadmap tool may be used as a resource to aid counseling.

After viewing the website, YA-Fs reported feeling more informed about fertility and family-building topics, more confident in addressing their concerns, more confident in managing negative fertility-related emotions, and engaged in more planning behaviors aligned with family-building goals (secondary outcomes). The Roadmap tool did not change levels of reproductive concerns, which may reflect reasonable emotional reactions upon learning new information about oncofertility risks and potential difficulties. Similarly, prior work has shown YA-F survivors who received fertility counseling before cancer treatment reported higher levels of reproductive concern after treatment compared to those that did not receive counseling, irrespective of whether they underwent fertility preservation.⁴² Patient decision aids often improve knowledge and reduce decisional conflict, but do not always affect health anxiety levels.⁴³ It is reassuring that women reported greater self-efficacy for managing fertility-related negative emotions after viewing the Roadmap tool, though additional supportive services may be needed for some survivors with high levels of distress. Minoritized groups are more likely

to experience barriers in access to reproductive medicine, and may need additional resources to manage the challenges they face and navigate healthcare systems.^{5,44,45}

4.1 | Clinical implications

Future work should explore how these outcomes evolve over time, whether the Roadmap tool is useful as survivors' needs change, and whether additional resources should be offered. Ultimately, many survivors will need personalized information to learn about viable family-building options based on medical history, reproductive health, as well as personal financial, legal, and logistical considerations. Counseling may help those grieving the loss of fertility. Decisional conflict may increase upon learning that a preferred family-building option is not viable or after a failed attempt, such as a failed IVF cycle. Decisions may need to be revisited based on new information or changes in health status or priorities. Conceptually, the Roadmap tool may be used iteratively with evolving situations. Survivors report a desire for better communication with providers about fertility and family building in post-treatment survivorship,¹⁰ and the Roadmap tool may facilitate communication and prompt earlier referrals.

4.2 | Study limitations

The study sample was predominantly White and well educated, recruited primarily via social media, and we were limited in our ability to assess subgroup differences based on racial/ethnic or cultural identity and educational attainment. This may have led to an underestimation of the challenges survivors face. Future work will test the Roadmap tool in a larger, more diverse sample. Data on gonadotoxic treatment and fertility status were collected via self-report. As a pilot study, we did not measure long-term changes in outcomes. Most women visited the website only once. Future work should explore whether cultural adaptation is needed and whether additional features would improve engagement, including among low health literacy groups. This study focused on patient factors in family-building decisions and, although the Roadmap tool included information about talking to one's partner, partner-specific resources were lacking.

5 | CONCLUSIONS

The overarching goal of the Roadmap to Parenthood tool is to support survivors in achieving their family-building goals. This pilot study demonstrated the web-based intervention was feasible, acceptable to users, and improved key outcomes related to fertility and family building after cancer. Future work will aim to test the intervention in a randomized controlled trial and explore implementation strategies

across clinical settings including in oncology, primary care, gynecology, and reproductive medicine.

AUTHOR CONTRIBUTIONS

Study conception, design, material preparation, data collection, and analysis were performed by Catherine Benedict, Jennifer Ford, Lidia Schapira, Pamela Simon, Davis Spiegel, and Michael Diefenbach. The first draft of the manuscript was written by Catherine Benedict and Alexandra Davis, and all authors reviewed and edited the manuscript. All authors read and approved the final manuscript.

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CONFLICT OF INTEREST STATEMENT

Non-financial interests: Catherine Benedict has served on the board of directors for Stupid Cancer and as a research advisor to Gryt Health. There are no other conflicts of interest to disclose.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

This study was approved by the Stanford University IRB. Informed consent was obtained from all individual participants included in the study.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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