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A Multi-Level Analysis of Barriers and Promoting Factors to Cascade Screening Uptake Among Male Relatives of *BRCA1/2* Carriers: A Qualitative Study

G. Ongaro^{1,2}  | J. G. Hamilton^{1,3}  | V. Groner³ | J. L. Hay¹  | M. Calvello⁴ | S. Oliveri^{2,5}  | B. Bonanni⁴  | I. Feroce⁴ | G. Pravettoni^{2,6} 

¹Department of Psychiatry and Behavioral Sciences, Memorial Sloan Kettering Cancer Center, New York, New York, USA | ²Applied Research Division for Cognitive and Psychological Science, IEO, European Institute of Oncology IRCCS, Milan, Italy | ³Department of Medicine, Memorial Sloan Kettering Cancer Center, New York, New York, USA | ⁴Division of Cancer Prevention and Genetics, IEO, European Institute of Oncology IRCCS, Milan, Italy | ⁵Department of Health Sciences, University of Milan, Milan, Italy | ⁶Department of Oncology and Hemato-Oncology, University of Milan, Milan, Italy

Correspondence: G. Ongaro (ongarog1@mskcc.org)

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ABSTRACT

Background: Pathogenic variants in the *BRCA1/2* genes significantly elevate risks of breast, ovarian, prostate, and pancreatic cancer. Clinical guidelines recommend cascade screening (CS) to identify at-risk family members and advance genetically targeted disease prevention. However, despite the benefits of CS, testing uptake remains suboptimal, particularly among male first-degree relatives (FDRs) of female *BRCA1/2* carriers.

Aims: Little is known about factors that hinder or enhance the implementation of CS in at-risk men in *BRCA*-positive families. This qualitative study explored multifaceted barriers and promoting factors influencing CS in 11 untested male FDRs.

Methods: Participants engaged in semi-structured interviews exploring their experiences and perspectives regarding CS uptake. Thematic analysis, guided by the Health Action Process Approach, revealed a complex interplay of barriers and promoting factors at individual, interpersonal, provider, and environmental levels.

Results: Key barriers included limited awareness and communication, inaccurate knowledge regarding genetic testing, logistical constraints, and concerns regarding potential psychological outcomes. Potential promoting factors encompassed factors such as men's stage of life, actionability of genetic testing results, perceived benefit of prevention, familial cohesion, and provider direct recommendations.

Conclusions: These findings contribute to a deeper understanding of the factors shaping CS uptake within *BRCA*-positive families and hold implications for targeted interventions to enhance CS uptake and improve the management of hereditary cancer syndromes. Gender-specific education and public awareness campaigns are crucial, highlighting male cancer risk and surveillance strategies. Exploring alternative delivery methods, such as direct provider engagement with at-risk males, can address challenges of low CS uptake, moving beyond traditional patient-mediated approaches.

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1 | Background

In the realm of personalized medicine, genetic testing is pivotal for enhancing population health through disease treatment, early detection, and prevention [1]. Identifying germline pathogenic or likely pathogenic variants (PVs) allows for timely management of disease risk, reducing morbidity and mortality for the proband (the first individual in a family identified as possibly having a genetic disorder or condition), and has implications for family members. Effective communication of risk to high-risk relatives and encouraging their genetic testing, known as cascade screening (CS), is crucial. Clinical guidelines recommend offering CS sequentially to at-risk relatives [2], starting with first-degree relatives (FDRs), who have a 50% chance of carrying the same PVs.

Hereditary Breast and Ovarian Cancer Syndrome (HBOC) is a hereditary cancer condition, where CS has been extensively examined due to its autosomal dominant nature [3]. HBOC is predominantly linked to *BRCA1* and *BRCA2* (*BRCA1/2*) PVs that increase the risk of breast, prostate, pancreatic, and ovarian cancers [4–8]. Although risks for women are well-known, the implications for men are often overlooked. For men, the lifetime risk of breast cancer is 1.2% for *BRCA1* carriers and 8.8% for *BRCA2* carriers, compared to 0.1% in the general population [9]. *BRCA2* carriers also have a significantly higher risk of prostate cancer (20%–25%) compared to *BRCA1* carriers and the general population [7]. Additionally, men with these PVs face a higher risk for pancreatic cancer, with a lifetime risk of 2%–3% for *BRCA1* and 3%–5% for *BRCA2* carriers, compared to 1% in the general population [7]. Despite the well-documented risks, CS uptake remains low, especially among at-risk men [1, 10–14].

Several factors may explain the low uptake of CS by relatives. Barriers (factors that prevent adherence to guidelines) include insufficient knowledge among both probands and relatives, inadequate communication, poor attitudes and knowledge of healthcare providers, logistical challenges, and emotional factors influencing the proband or their relatives [15, 16]. Conversely, promoting factors (factors that facilitate adherence to guidelines) include higher educational attainment, being a female FDR of the proband, a desire for information about potential risks to children, personal disease history, and recommendations from healthcare providers [1, 15, 16]. A recent systematic review [15] categorized these factors into interconnected systems operating at multiple levels: individual, interpersonal, and environmental. This categorization highlights the multi-dimensional nature of CS uptake. It is worth noting that this review encompassed various genetic conditions, with distinct characteristics and psychological impacts on both carriers and their relatives.

However, while approximately 30% of FDRs undergo CS [17], the number of men undergoing testing is more than 10 times lower than that of women, suggesting the existence of gender-specific barriers hindering at-risk men in *BRCA*-positive families from undergoing genetic counseling and testing [18]. Gender plays a critical role in shaping health-seeking behaviors, particularly in the context of hereditary cancer syndromes [11, 12, 19, 20]. In general, men tend to engage less in preventive healthcare than women, often delaying medical consultations

and displaying lower adherence to screening and risk-reducing measures [21, 22]; female partners often play a key role in shaping men's health decisions, encouraging medical consultations and preventive behaviors [23, 24]. Additionally, masculinity-related concerns and socio-cultural norms may contribute to the misconception that *BRCA1/2* PVs are primarily a “female issue,” influencing men's perceptions of genetic testing and reducing their likelihood of engaging in CS [25, 26]. Moreover, studies examining genetic testing in the context of prostate cancer have provided insights into testing barriers for men, highlighting the need for tailored approaches [27, 28]. Recent studies have focused on identifying strategies to increase CS uptake, including some specifically targeting men [25, 29].

Despite these insights, there remains a gap in understanding the specific factors influencing CS uptake among at-risk men in *BRCA*-positive families. Theoretical frameworks, such as the Health Action Process Approach (HAPA) model, may be useful in identifying additional drivers of these decisions. The HAPA model posits that intentions to engage in health behaviors are influenced by an individual's risk perception, outcome expectancies, and action self-efficacy [30, 31]. In the context of CS, the results from our previous quantitative study showed that men who perceive a high risk of cancer and believe in the benefits of early detection are more likely to intend to adhere to CS recommendations [25]. However, the translation of these intentions into actual behaviors depends on their confidence in managing potential obstacles (coping self-efficacy) [25]. These findings reinforce the significance of risk perception and outcome expectations in shaping individuals' intentions, suggesting that action self-efficacy may play a less influential role in the context of CS. Starting from this theoretical background, this study aims to conduct a multi-level analysis of barriers and promoting factors affecting CS uptake intention among male FDRs of female *BRCA1/2* carriers.

2 | Methods

All study procedures received approval from the Institutional Review Board of the European Institute of Oncology (IEO; approval number R1249/20-IEO 1314). Recruitment began by contacting female probands who underwent genetic testing at the European Institute of Oncology between 2010 and 2023 and were carriers of at least one documented PV in either *BRCA1* or *BRCA2* genes. Probands were contacted via telephone or email to explain the study and were asked to share the study information with their male FDRs. If a male FDR expressed interest, the proband provided FDR contact information and permission for the research team to contact him directly. The team then reached out to the interested FDRs, provided them with a study information sheet, and invited them to participate in a 30-min interview. Informed consent was obtained from all participants. Eligibility criteria included being male, age 18 or older, and having at least one FDR with a *BRCA1/2* PV. Exclusion criteria included inability to read or speak Italian, personal cancer history, or prior genetic counseling or testing. Relatives with cancer were excluded because their diagnosis may influence decision-making and they have alternative pathways to genetic testing. Those already tested were excluded to focus on

untested men, whose barriers to genetic testing are less understood.

No pre-existing relationships existed between researchers and participants and no incentives were provided. At the end of the interview, participants could be placed on a waiting list for genetic counseling and testing or to receive contact information for other facilities. Interviews were conducted virtually by G.O. (female, PhD, clinical psychologist trained in qualitative research methods). Interviews lasted between 23 and 71 min ($M = 42.6$ min) and were audio-recorded and transcribed for analysis. Recruitment occurred from November 2022 to March 2023.

2.1 | Measures

Participants were asked about socio-demographic factors, including age, race/ethnicity, marital status, education, employment, parental status, kinship with the proband, risk for PVs, and personal history of cancer or chronic diseases. Semi-structured interviews (see Table 1 for the guide) explored men's experiences with hereditary cancer risks, including knowledge of *BRCA1/2* PVs, decision-making for *BRCA1/2* testing, and factors influencing their intention to undergo genetic testing.

2.2 | Data Analysis

Data analysis was conducted by a team of four experienced researchers with backgrounds in psychology and genetic counseling (G.O., V.G., J.G.H., J.L.H.). Each researcher independently reviewed the interview transcripts, which were translated into English by G.O. and verified by another researcher (S.O.). A qualitative thematic analysis was performed using a semantic

and deductive approach [32], informed by the HAPA model [30, 33]. The analysis began with coding and developing a codebook collaboratively. Then, two coders (G.O. and V.G.) independently coded 10 transcripts to ensure reliability, resolving discrepancies through collective discussion. The finalized codebook was used by the primary coder to recode all data. Themes and subthemes were identified, organized into a thematic map, and reviewed by all authors and an independent reviewer. Data saturation was reached after the ninth interview, with no new themes emerging.

3 | Results

We contacted 55 female *BRCA1/2* carriers, leading to the identification of 45 male FDRs who were invited by the carriers to participate. Of these, 21 agreed to enroll in the study (46% response rate). However, 10 participants were excluded: 5 had undergone genetic testing, 3 had a personal cancer history, and 2 were unavailable due to scheduling conflicts. The final cohort consisted of 11 male FDRs, aged 32–69 years ($M = 48.36$, $SD = 11.45$). Each male participant was recruited from a different proband with a median enrollment time of 8.2 years (range: 6–10) after the proband's positive test result. The probands had breast cancer ($N = 10$) or ovarian cancer ($N = 1$). For detailed demographic characteristics, see Table 2.

Participants identified barriers and potential promoting factors influencing their CS uptake. The results are organized into two sections: (a) barriers (Table 3) and (b) hypothetical promoting factors (Table 4), with each theme categorized by factors within the HAPA model (risk perception, outcome expectancies, self-efficacy) and others (factors outside of the HAPA model). Subthemes are analyzed at individual, interpersonal, provider, and environmental levels. Figure 1 provides a graphical representation of the levels and constructs of the barriers and promoting factors identified.

TABLE 1 | Qualitative interview guide.

Key Questions	Probes
<ul style="list-style-type: none"> In your own words, what is a hereditary cancer syndrome? What do you know about <i>BRCA1/2</i> gene mutations? These are also called <i>BRCA1/2</i> pathogenic variants, or positive results for the <i>BRCA1/2</i> gene. What do you know about genetic testing? What are your thoughts about getting BRCA genetic testing? Why have you not yet undergone BRCA genetic testing? Which factors would you consider in deciding to undergo or not undergo BRCA genetic testing? What would make you more likely to get BRCA genetic testing? Please tell me about any discussions that you have had with your family members about BRCA genetic testing. Have any of your doctors talked to you about BRCA genetic testing? Tell me more about that. 	<ul style="list-style-type: none"> What are your main thoughts and feelings about this condition? <ul style="list-style-type: none"> How do you see your cancer risk? Is this something you have considered before today? How do you feel about the decision not to have undergone BRCA genetic testing yet? <ul style="list-style-type: none"> What would help you to get testing? Please share the possible reasons why you consider “___” (repeat what the interviewee said)

TABLE 2 | Demographic characteristics of the study participants ($N = 11$).

ID	Age	Educational Level	Degree of Kinship	Marital Status	Parental Status	PVs at Risk For
ID1	54	High School Diploma	Son and brother	Married	2 daughters	<i>BRCA2</i>
ID2	35	University degree	Son	Married	—	<i>BRCA2</i>
ID3	52	University degree	Son and brother	Married	1 son	<i>BRCA2</i>
ID4	69	High School Diploma	Brother	Married	1 daughter and 1 son	<i>BRCA1</i>
ID5	60	University degree	Brother	Single	—	<i>BRCA2</i>
ID6	37	High School Diploma	Son and brother	Divorced	—	<i>BRCA2</i>
ID7	32	University degree	Son	Single	—	<i>BRCA1</i>
ID8	53	High school diploma	Son	Married	1 son	<i>BRCA2</i>
ID9	53	High school diploma	Son and brother	Married	—	<i>BRCA2</i>
ID10	48	University degree	Brother	Divorced	—	<i>BRCA1</i>
ID11	39	University degree	Son	Married	1 daughter	<i>BRCA1</i>

3.1 | Barriers

3.1.1 | Risk Perception

Most participants discussed their cancer risk awareness in connection to the decision to uptake CS. Several recurring barriers were identified that affect men's perception of personal risk across individual, interpersonal, and provider-related levels.

At the individual level, a low level of knowledge or inaccurate knowledge was a common barrier. Among the 11 participants, only two demonstrated awareness of the specific PVs linked to their cancer risk. Many participants held misconceptions, particularly about which organs were at risk, often associating PVs with cancers of personal or familial significance. Misunderstandings about inheritance patterns were also prevalent, as exemplified by ID2 who said, *"If a parent has the mutation, I get the 50% chance that either I have it or clearly the other 50% chance that my brother has it... one of the two."* Low perceived susceptibility to the effects of carrying a PV further hindered engagement with genetic testing. Many participants viewed their cancer risk as distant or irrelevant, with several citing their current "healthy" status as a reason to dismiss genetic testing, fearing it would lead to unnecessary medical procedures. Others associated *BRCA1/2* PVs predominantly with women, perceiving them as a "female matter." Participants with a strong family history of cancer often perceived themselves as already at high risk, which deterred them from genetic testing.

At the interpersonal level, participants framed their risk with regard to male relatives, highlighting how masculinity influenced their illness perceptions. Additionally, the survival of the carrier sometimes diminished the perceived severity of the risk.

Finally, provider-related barriers also shaped participants' perceptions. The lack of a direct recommendation for genetic testing from healthcare providers led them to believe that testing was unnecessary. As ID3 reflected, *"If testing were important, my doctor would have told me."*

3.1.2 | Negative Outcome Expectancies

In men, several negative expectations at the individual, interpersonal, and provider levels act as deterrents to CS.

At the individual level, psychological concerns were a primary deterrent, with participants fearing the emotional burden of knowing their carrier status, including anxiety, heightened cancer concerns, and regret over the information burden. Limited knowledge about follow-up options and the association of genetic testing with a cancer diagnosis added to their hesitation. For some, testing was perceived as a "wake-up call" requiring lifestyle changes, while others worried about medical overtreatment or excessive interventions. As ID2 shared, *"Maybe it is not the best to go to hospitals, to be hospitalized, to check yourself all the time... Now I check myself, but I don't do it excessively!"* The association between genetic testing and cancer itself was another source of anxiety. Many participants equated a positive test result with a direct cancer diagnosis, further deterring them from testing. Skepticism about the effectiveness of preventive measures also emerged, with participants acknowledging benefits for women but doubting their relevance for men.

At the interpersonal level, the proband's cancer journey often shifted the family's focus away from genetic risk, limiting discussions about testing.

Provider-related barriers included a perceived lack of male risk-reduction strategies, particularly for prostate cancer. Limited understanding of the testing process, often seen as invasive or complex, further discouraged engagement.

3.1.3 | Self-Efficacy

Self-efficacy reflects individuals' beliefs in their ability to manage challenging demands and their own functioning. Few

TABLE 3 | Barriers to CS uptake for male FDRs.

Theme	Level	Subthemes	Exemplar quotations
Risk perception	<i>Individual level</i>	Low level of knowledge/inaccurate knowledge	"I thought throat cancer could be a risk, but I was told it's not the same for men and women. I don't know much about the mutation" (ID9)
		Low perceived susceptibility/vulnerability	"I'm fine, I don't see how this mutation could affect me now" (ID8)
		"Healthy" status	"As long as it doesn't affect me directly then it is better that I don't deal with it, I mean, in the end, I'm healthy...I'm fine, I didn't feel it was something that affected me." (ID10)
		"Female matter"	"The test seems more relevant for my daughters rather than me, with their family history of breast cancer" (ID1)
		Already perceived high risk	"There is something that scares me, maybe because I suppose I am already part of that 'at risk' category." (ID10)
	<i>Interpersonal level</i>	Perception of risk for diseases in the male relatives	"The mutation comes from mom, but my real concern is prostate cancer, which runs in the male side of the family...because male-male...Yes, because that's the thing that I perceived even physically" (ID1)
		"The carrier is still alive"	"That is, in the end, both of them, mom and aunt, had cancer in both breasts. My aunt also had colorectal cancer, but they are still alive. I Mean so they are not "bad" memories for me." (ID6)
	<i>Provider level</i>	Lack of provider recommendation	"If the provider didn't suggest the test, I assume there's no urgent need for it" (ID5)
	<i>Environmental level</i>	/	/
	Negative outcome expectancies	<i>Individual level</i>	Psychological concerns
Limited risk management knowledge			"I'd probably have to change my habits, take medication, or undergo treatment" (ID11)
Health responsibility			"Knowing the mutation would make me feel responsible for changing my lifestyle" (ID2)
Perceived overtreatment			"Because I'm always afraid that it is then a 'Pandora's box,' and that there would be something to do...I fear that genetic testing could lead to unnecessary treatments, and I'm already healthy" (ID8)
Direct link to cancer			"I avoided discussing it with my mom because it made me think too much about cancer, about being sick." (ID11)
No trust in prevention/no perceived benefit			"I think the test wouldn't change my life; my uncle did regular checkups, but still got prostate cancer...I don't think it would turn my life upside down anyway. Because I don't perceive danger for me and benefit." (ID4)

(Continues)

TABLE 3 | (Continued)

Theme	Level	Subthemes	Exemplar quotations
	<i>Interpersonal level</i>	Anxiety/fear for proband's health	"Talking about my sister's health concerns only increased my anxiety." (ID9)
	<i>Provider level</i>	Lack of risk reduction strategies for men	"A positive result for men doesn't change much; it just means more checkups, but no real solutions" (ID6)
		Inaccurate knowledge related to the testing procedure	"I think the test involves something invasive, like bone marrow, not just a blood test" (ID1)
	<i>Environmental level</i>	/	/
Self-efficacy	<i>Individual level</i>	Avoidant coping strategies	"I tend to avoid topics like health issues... I'd rather stay ignorant than deal with it, maybe because of a little superficiality." (ID5)
		Procrastination	"I often put off medical decisions... I Might delay appointments for weeks or months" (ID3)
	<i>Interpersonal level</i>	/	/
	<i>Provider level</i>	/	/
	<i>Environmental level</i>	/	/
Others	<i>Individual level</i>	Demographics	"In the sense that my age leads me meanwhile to be very busy with other things, other aspects of life." (ID2)
		Competing life concerns	"With COVID and other life changes, genetic testing hasn't been a priority" (ID7)
		Fatalistic attitude	"It is luck or bad luck to have it or not to have it. Also because let's imagine that we do the test, we find out that I don't have the mutation... But after a year I could still find cancer in my body... And the same thing in reverse, that is, I could have a mutation and not have cancer the next year." (ID3)
		Reluctance about medical check-ups	"My last blood draw, I think it was around 15 years ago." (ID7)
		Low levels of self-care	"I smoke a lot, and even though I know I should quit, I don't care enough to make the change" (ID8)
	<i>Interpersonal level</i>	Lack of communication	"I talked to my brother about it a couple of years ago, but we haven't discussed it since" (ID2)
		No other relatives tested	"In my family, no one has been tested as far as I know" (ID3)
	<i>Provider level</i>	Lack of communication and confidence in providers	"I've never discussed it with my general practitioner, and I don't think they'd know much about it" (ID2)
		Time-consuming or difficult procedure	"I don't want the test to be complicated or take too much time, like being hospitalized" (ID2)
	<i>Environmental level</i>	Accessibility of genetic testing	"I never looked into genetic testing because it's too inconvenient for me to travel so far to get it" (ID10)

barriers at the individual level affected men's self-efficacy. Many participants avoided health information to maintain emotional balance, while procrastination delayed decision-making until external prompts were received. As ID3 admitted, "*If I have to decide and say, 'I'll call now and get tested, I'll never get tested... If we set an appointment, then I'll do it.'*"

3.1.4 | Others

Participants reported additional factors and barriers beyond the HAPA model that influenced their decision-making regarding CS, and which occurred at the individual, interpersonal, provider, and environmental levels.

TABLE 4 | Promoting factors to CS uptake for male FDRs.

Theme	Level	Subthemes	Exemplar quotations	
Risk perception	<i>Individual level</i>	Stage of life	"I'm going into my fifties...and in general I would have done medical checkups. I Would have done a general check...so I'm also opting to do this genetic test." (ID10)	
		Personal history of risk factors/ disease	"I've had some health issues, like stress and hypertension, which made me focus more on healthy habits and consider genetic testing" (ID9)	
		<i>Interpersonal level</i>	Concerns for family health	"But when it, unfortunately, touches you because you have sisters and father who have had cancer, it is clear then that it interests you a little more ... that's why I am worried about my children, not about me" (ID4)
			Communication with the carrier about male risk Carrier's death	"She told me it was important for men too because we're all at risk in this family" (ID3) "After my mom passed, I started thinking more about investigating this, but not urgently, I still believe life should be lived lightly" (ID2)
	<i>Provider level</i>	/	/	
	<i>Environmental level</i>	/	/	
	Positive outcome expectancies	<i>Individual level</i>	Trust in medicine/research	"I've always trusted medicine, if you don't trust doctors, who else can you trust?" (ID6)
			Knowledge of genetic testing and prevention	"There is a possibility to understand if you are actually predisposed to certain cancers... so maybe intervene with prevention and control!" (ID7)
			Perceived benefit of prevention	"I am convinced of the fact that information is always an extra weapon that one can have in short. If I know maybe I can do prevention." (ID2)
			Avoidance of regret	"I'd regret not taking the test and finding out too late, thinking I could've done something sooner" (ID2)
<i>Interpersonal level</i>		Engagement in caregiving	"Men my age who haven't dealt with something like I did with my mom wouldn't even know about genetic mutations. I Certainly by bad luck ended up with it." (ID2)	
		Carrier communication about genetic testing relevance	"She told me it was important for my health to know if I had the mutation, for prevention" (ID7)	
		<i>Provider level</i>	Actionability of results	"Knowing you're at risk and having options to reduce future problems is a huge advantage" (ID6)
Provider recommendation			"The email about this study was decisive for me. Without it, I probably wouldn't have made the decision to test now"	
<i>Environmental level</i>		/	/	
Self-efficacy		<i>Individual level</i>	Previous experience with hospitals and examinations	"I've had many surgeries, so nothing scares me. I wouldn't be afraid to take the test" (ID1)
	<i>Interpersonal level</i>	/	/	
	<i>Provider level</i>	/	/	
	<i>Environmental level</i>	/	/	

(Continues)

TABLE 4 | (Continued)

Theme	Level	Subthemes	Exemplar quotations
Others	Individual level	Perceived “right time”	“The birth of my daughter is changing my perspective. I Want to stay healthy as long as possible for her” (ID11)
		Search for information	“The Angelina Jolie story, especially after my sister’s surgery, made me want to look deeper into genetic testing” (ID9)
	Interpersonal level	Social support	“I talked to my brother, wife, and best friend about the test, but not with any medical professionals” (ID11)
		Health status of the carrier	“I feel less afraid now that my sister’s health is improving” (ID10)
		Family cohesion	“We always communicated well, also about genetic testing, like satellites pointing at each other” (ID2)
	Provider level	Clear information about logistics	“I would like to know what the test is, how it works, when I have to do it, some more clarity would help me” (ID11)
	Environmental level	/	/

At the individual level, demographic factors such as age often diminished the perceived relevance of genetic testing. Competing life priorities, including work and family obligations, frequently delayed decision-making. A fatalistic outlook also played a role, with some feeling that preventive actions were futile. Reluctance toward medical check-ups and low levels of self-care further hindered engagement, with some perceiving genetic testing as inconsistent with their general health behaviors.

Interpersonal barriers included limited communication within families, particularly between female carriers and male relatives. Additionally, the absence of testing among other relatives created skepticism about its necessity or importance.

Provider-related barriers centered on insufficient communication and a lack of confidence in healthcare providers’ expertise regarding genetic risks. Some participants perceived genetic testing as overly specialized and doubted their providers’ competence in addressing it. Logistical concerns, such as the perceived complexity or time-consuming nature of the testing process, also deterred some individuals. As ID6 remarked, “It would be more practical if I could book it online and avoid taking time off work.”

Environmental factors, including accessibility issues, compounded these challenges. Logistical obstacles, such as the distance to testing facilities, often made it difficult for participants to follow through.

3.2 | Promoting Factors

3.2.1 | Risk Perception

Several factors at the individual and interpersonal levels positively impact men’s perception of cancer risk and their intention to uptake CS.

At the individual level, life stage played a key role, with reaching certain age milestones prompting men to reflect more on their health and consider preventive measures. As ID7 explained, “As I age, I start thinking more about my health and whether I should get checked.” A personal history of health issues or risk factors also encouraged some participants to reconsider genetic testing.

At the interpersonal level, concern for family health, particularly children’s health, acted as a motivator for genetic testing only for one participant. ID4 shared, “With cancer in my family, I worry more about my children’s health.” Communication with female carriers also raised awareness about male risk. Additionally, the death of a family member from cancer often prompted men to consider the importance of genetic testing.

3.2.2 | Positive Outcome Expectancies

Positive outcome expectancies associated with genetic testing represented the pros of that action. Several positive outcome expectancies at the individual, interpersonal, and provider levels may act as promoting factors for CS uptake.

At the individual level, trust in medical science and research was a key motivator for many participants, with several viewing genetic testing as a valuable preventive tool. Awareness that genetic testing could lead to early cancer detection and prevention, alleviating anxiety, further encouraged participants. Additionally, the desire to avoid future regret for not acting influenced some men’s decisions.

At the interpersonal level, personal experiences with caregiving, such as supporting a family member in their cancer treatment, deepened emotional engagement with the issue of genetic

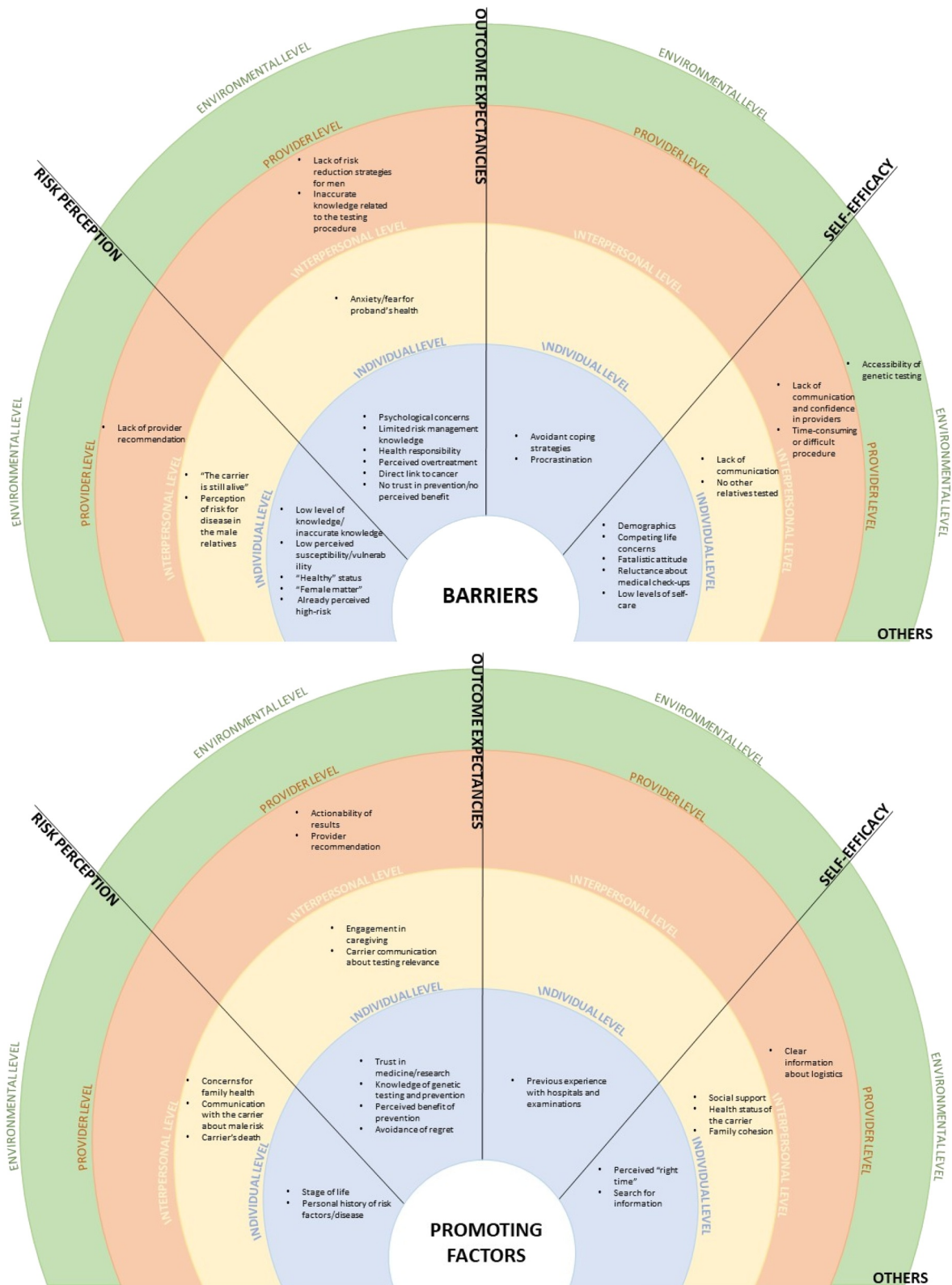


FIGURE 1 | Barriers and promoting factors to CS uptake.

testing. Effective communication from carriers about the relevance of genetic testing also fostered increased consideration for testing.

At the provider level, the actionability of genetic testing results, such as the availability of interventions to manage health risks, made testing more appealing. Direct recommendations from

healthcare providers also played a crucial role in motivating men to consider testing. ID8 reflected *“If a doctor told me to get tested, I would do it immediately.”*

3.2.3 | Self-Efficacy

At the individual level, only previous experience with hospitals and medical examinations emerged as a factor that could promote men's uptake of CS. Participants who had undergone hospital visits or medical procedures demonstrated a more positive attitude toward genetic testing, likely due to their familiarity and comfort with the healthcare system.

3.2.4 | Others

Participants described several factors at the individual, interpersonal, and provider levels that could serve to promote CS uptake yet were beyond the HAPA model.

At the individual level, some participants felt that genetic testing should be aligned with significant life events or milestones, such as job stability or family achievements. Active information-seeking also played a key role, with participants seeking out information from various sources.

At the interpersonal level, social support was crucial. Encouragement from family members, particularly those in similar situations, increased motivation to undergo genetic testing. As ID7 mentioned, *“Discussing it with my brother and getting encouragement from my wife increased my motivation to get tested.”* Participants also felt more inclined to test if the health status of a carrier improved, which helped reduce fears. Additionally, strong family cohesion facilitated open communication and motivated individuals to pursue genetic testing.

At the provider level, participants valued clear logistical information, such as details on how and where to undergo testing, and what the process would entail.

4 | Discussion

This study used qualitative methods to explore barriers and potential promoting factors to men's uptake of CS for *BRCA1/2* PVs. Various individual, interpersonal, provider, and some environmental factors were identified as influencing men's decisions about CS. Consistent with our quantitative findings [25], our results showed how barriers and promoting factors affect risk perception and outcome expectations, with self-efficacy playing a lesser role. Additional factors beyond those in the HAPA model were found to impact CS uptake, indicating the need for a broader understanding of factors influencing CS uptake.

Our findings reveal notable issues with limited awareness and misinformation adversely affecting participants' perceptions of health threat severity and personal susceptibility. Men's views on the severity of *BRCA1/2* PVs-related health threats and their vulnerability strongly influenced their attitudes toward genetic

testing. Notable gaps in men's knowledge about *BRCA1/2* genetic testing emerged in three areas: inheritance pattern, testing procedure, and health implications. Addressing these inaccuracies with clear information is crucial for informed decision-making and increasing men's engagement in CS [29]. Additionally, men showed heightened concern for cancers affecting male relatives, highlighting the role of gender concordance in shaping risk perceptions, as men may be more likely to engage with genetic testing and preventive measures when the implications are framed in the context of male-specific risks [20, 34]. A primary obstacle to CS for men is the fear of psychological consequences and excessive screening post-testing. Literature indicates the uncertainty of genetic risk information deters individuals from genetic testing due to potential psychological implications [24, 35, 36]. Additionally, the lack of perceived benefits linked to testing impedes CS uptake [16, 25]. Men's limited knowledge about managing elevated risk and viewing screening as an ineffective control strategy contributes to this barrier. Conversely, believing in the actionability and effectiveness of health measures after testing is vital. Understanding the benefits of early detection and risk reduction can motivate men to get tested.

At an interpersonal level, our results suggested several factors influencing men's CS decisions. Effective family communication is crucial; limited discussions with female carriers and low involvement in cancer and testing conversations contribute to a lack of awareness and motivation for CS. In some cultures, discussing genetic testing or cancer risk is stigmatized or uncommon [10, 37–39]. Conversely, open discussions between female carriers and male relatives about the importance of testing and the implications of *BRCA1/2* PVs can promote CS, emphasizing the value of social support and dialogue [40]. Social support often comes from spouses and female relatives, who may play a key role in disseminating risk information and fostering engagement with CS [24]. When cancer occurs in the family, relatives may experience heightened fear and anxiety, which can deter consideration of genetic testing [36]. Conversely, factors such as carrier's health status and the temporal distance from the cancer diagnosis can promote CS uptake. Interestingly, only one participant reported being motivated to undergo genetic testing primarily to protect their family. This contrasts with literature, which often portrays men's testing decisions as driven by familial duty, particularly toward children [11, 20, 37, 41]. This discrepancy highlights the diverse motivations men may have when considering genetic testing, suggesting that non-tested men in a pre-intentional phase may emphasize the general benefits of testing without fully grasping the broader familial implications [25]. The role of spouses and female relatives in influencing the decision-making process in this context needs further analysis particularly as studies have highlighted the significant role they may play in shaping the decision-making process [23].

Our findings highlight the crucial role of healthcare providers in CS. However, some participants noted a lack of knowledge among physicians. Providers substantially influence men's decisions by shaping their risk perceptions and outcome expectations. Without proper information, direct recommendations, and communication, men may feel falsely reassured and uninvolved. A direct recommendation from a trusted provider, however,

encourages genetic testing, especially when accurate information is provided to support informed decision-making [16, 42–44]. This aligns with research suggesting that more supportive counseling may be necessary in the context of hereditary cancer syndromes, emphasizing the need for innovative approaches such as direct relative contact strategies [17, 43, 45]. Healthcare providers should be trained to navigate the balance between providing clear recommendations and maintaining a non-directive counseling approach, ensuring that information emphasizes both the potential benefits and limitations of genetic testing while respecting individuals' autonomy. Notably, 63% of participants expressed interest in *BRCA1/2* testing after the study, with 6 placed on a waiting list, and 1 undergoing testing. Their study involvement and discussions were key motivators, underscoring the impact of direct provider involvement on men's CS.

Among environmental factors, accessibility to healthcare services, including genetic counseling, directly affects men's decisions. Men are more likely to engage in CS when services are accessible and affordable. Interestingly, factors outside the HAPA model, such as low self-care, reluctance to seek medical check-ups, and competing life concerns, also impact decision-making.

These findings underscore the complexity of the decision-making process and the importance of addressing personal, practical, and temporal factors in promoting CS. While previous findings have primarily focused on individual-level barriers, such as knowledge gaps and psychological resistance, our results emphasize the interconnected roles of interpersonal dynamics, provider recommendations, and systemic accessibility, allowing for a more comprehensive understanding of the barriers and promoting factors to CS uptake.

4.1 | Study Limitations

Limitations of this study include the homogeneous sample of White males from Italy, restricting the generalizability of the findings. Future research should include diverse geographical and racial samples. Additionally, the participants may have had a higher interest in genetic testing, introducing self-selection bias and potentially inflating positive views. Moreover, many participants belonged to families with probands who underwent genetic testing during earlier periods when awareness of male-specific implications was limited, potentially influencing participants' knowledge and perspectives. Lastly, promoting factors were inferred from participants' responses. Future studies should compare untested individuals with those who have undergone genetic testing to identify effective strategies for promoting CS uptake.

4.2 | Clinical Implications and Conclusions

A multi-level approach is needed to optimize CS uptake among at-risk men. At the individual level, interventions should prioritize correcting misconceptions by delivering clear and accessible information about inheritance patterns, male-specific implications of *BRCA1/2* PVs, testing procedures, and the actionable benefits of results. At the interpersonal level,

promoting open communication between female carriers and male relatives is key. Strategies for passing on written information within the family, as well as providing access to reliable online resources, can facilitate this communication. At the provider level, direct recommendations from healthcare professionals, coupled with practical support for scheduling genetic testing and sustained engagement with families, can significantly enhance participation. Additionally, mainstreaming testing models, such as those applied for patients with cancer where non-genetics specialists offer testing directly with post-test genetic counseling in selected cases, could streamline access and reduce barriers while ensuring necessary support [46, 47]. Finally, at the environmental level, improving accessibility to healthcare services, such as simplifying testing procedures, clarifying associated costs, and addressing logistical barriers, can help create a more supportive environment for CS implementation. Future interventions should integrate these targeted strategies across all levels to foster informed decision-making and enhance CS uptake among men.

Author Contributions

G. Ongaro: conceptualization, methodology, recruitment, data curation, writing – original draft preparation, writing – review and editing, **J. G. Hamilton:** data curation, writing – original draft preparation, writing – review and editing, **V. Groner:** data curation, writing – review and editing, **J. L. Hay:** data curation, writing – review and editing, **M. Calvello:** recruitment, writing – review and editing, **S. Oliveri:** writing – review and editing, **B. Bonanni:** writing – review and editing, supervision, **I. Feroce:** writing – review and editing, **G. Pravettoni:** supervision.

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Ethics Statement

The study has been approved by the Ethical Committee of the European Institute of Oncology (protocol code R1249/20-IEO 1314, approval date 06-07-2020).

Consent

Written informed consent was obtained from all subjects involved in the study.

Conflicts of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Data Availability Statement

The data presented in this study are available upon request from the corresponding author.

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