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ORIGINAL ARTICLE

Perceived cancer risk and genetic counseling: A biopsychological perspective

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Abstract

In Italy, genetic testing is becoming a regular part of clinical practice in public healthcare. The clinical implications are that probands' educational level and relatives' ages for cascade genetic screening should be considered during counseling. The study aimed to investigate the role of cancer worry in the psychological dimensions of patients undergoing genetic testing and to analyze its moderating effect thereon. We conducted an observational study based on a sample of 55 patients aged between 19 years and 73 years. The sample was classified into two groups based on genetic-testing indications: oncological diagnosis eligible for hereditary breast and ovarian cancer (HBOC) genetic testing and patients eligible for family cascade testing by known genetic mutation in HBOC. A psychological battery was applied after the first scheduled genetic counseling. Our findings highlighted the relevance of cancer worry in the management of genetic counseling. The influence of cancer worry on dysphoria traits is that patients/relatives undergoing genetic testing feel vulnerable. Genomic medicine oriented to the biopsychosocial (BPS) approach in the counseling process could be the driving force for efficient and integrated genomic-risk assessment.

KEYWORDS
cancer worry, clinical psychology, fear of cancer, fear of cancer recurrence, genetic counseling, genetic mutation, HBOC, personalized medicine

1 | INTRODUCTION

Genetic counseling (GC) as a profession is evolving across the world as genomic models and developments are growing, albeit in a non-homogeneous progression across countries: North America and Europe showed various stages of development due to varying healthcare systems, legal restrictions, and cultural issues (Abacan et al., 2019). The update on the global state of the GC published in 2024 evidenced the significant evolution of the professionals of GC across the globe in the past 5 years: increased numbers of GC professionals, boosted training and research programs continue to expand clinically in a range of ways. A focal point is the efficient embodiment of GCs in multidisciplinary teams as genomic medicine becomes increasingly and rapidly relevant throughout healthcare (Bangham, 2023; Marteau & Croyle, 1998; Ormond et al., 2024). Genetic cancer risk assessment (GCRA) is an interdisciplinary standard-of-care practice based on genetic and genomic tools to identify individuals and families with inherited cancer risk; genetic predispositions to diseases represent a complex medical setting, indicating wide human outcomes. The interest in undergoing genetic testing is more strongly related to perceived risk than objective risk, and cancer susceptibility raises several important distinctive psychological issues impacting negatively individuals, families, and society's quality of life (Croyle et al., 1997). Depression, anxiety, psychological distress, as well as triggered negative feelings such as worry, fear, and confusion are more common negative emotional dimensions that could develop at the disclosure of the results from genetic testing for hereditary cancer risk (Cilli et al., 2024). Moreover, the fear of developing cancer, or the fear of cancer recurrence (FCR), is a known health concern in cancer-affected individuals, survivors

of cancer, and individuals with an increased hereditary risk of cancer. Several studies have dealt with FCR in patients diagnosed with breast cancer (Custers et al., 2020; Lee-Jones et al., 1997; Paperák et al., 2023; Wardle et al., 2000): anxiety, depression, post-traumatic stress disorders, and psychosocial problems are the most frequent psychological and behavioral symptoms (Di Giacomo et al., 2016; Giacomo et al., 2021; Ranieri et al., 2023). In a recent review, Paperák et al. (2023) proposed a study focused on identifying the most effective psychotherapeutic approaches in managing FCR. The authors identified the most frequent psychological treatments applied: (a) Cognitive Behavioral Therapy (CBT) which focuses on challenging and changing cognitive distortions and associated behaviors to improve emotional regulation and develop personal coping strategies that target solving current problems; (b) Acceptance and Commitment Therapy (ACT) is an action-oriented approach to psychotherapy and includes mindful behavior, attention to personal values, and commitment to action to change attitudes and emotional states; and (c) Mindfulness-Based Interventions consist of exercising mindfulness and giving attention to the present experience in an intentional and non-judgmental way to cope successfully with everyday difficulties and stress. These approaches are the most frequent and most effective in managing patients' emotional balancing in oncology; however, authors have highlighted the need to incorporate evidence-based psychotherapy into FCR treatment as the challenge for future research.

A related issue is the fear of developing cancer. The most common hereditary cancer syndrome is hereditary breast and ovarian cancer (HBOC), which is an inherited genetic condition (Yoshida, 2021). This means that the cancer risk is passed from generation to generation in a family. The condition is responsible for 10%–15% of all breast cancers and 24% of epithelial ovarian cancers (Samadder et al., 2019).

Genetic testing is slowly becoming a regular part of clinical practice. It provides an opportunity to enhance health promotion and long-term health outcomes by identifying at-risk individuals beforehand cancer develops (Calzone & Biesecker, 2002). A recent exploratory review focused on the patient perspective in perceived genetic mutation risk (GMr) highlighted the need to enhance the clinical indices in genetic counseling to improve the patient-centered approach dealing with the mental health interplay and to analyze the magnitude of the impact on mental health in chronic disease conditions, which could be psychologically integrated (Cilli et al., 2024). High stress, psychological distress, depression, anxiety, and worries are relevant in patients at a high risk of genetic mutations. Indeed, avoidance, psychological distress, and intrusive thoughts have emerged as related to cancer diagnosis (Bradbury et al., 2016; Broady et al., 2018; Hoberg-Vetti et al., 2019; Isselhard et al., 2023; Stump et al., 2018). Studies have revealed that predictive behaviors for mental discomfort include family history of disease, young age, short time since cancer diagnosis, low social support, and high-risk self-perception of life (Seven et al., 2022, 2023; Seven & Marie Moraitis, 2022). The clinical implications of the above studies are that probands' educational level and relatives' age for cascade family testing should be considered during genetic counseling. Besides the negative impacts on quality of life, mental health, and psychosocial well-being, cancer worry modulates health-related behaviors such as lifestyle choices and screening participation. Worry levels seem to correlate with a subjectively perceived risk of cancer; however, the relationship between cancer worry and screening behavior seems to be complex and is likely non-linear (Hay et al., 2005; Tilburt et al., 2011; Wardle et al., 2000; Zhang et al., 2021). GC, such as on worry about developing breast cancer, the impact of worries on daily life, and risk perception in women attending a counseling session for genes *BRCA1/2* mutations is relevant in this context. Several studies showed the relevance of cancer worry in young women, who have lost a family member to cancer due to the higher perceived risk of developing cancer (Hamilton et al., 2009; Van Oostrom et al., 2003). The large demand for genetic testing in the healthcare system to enhance oncological care by preventive actions needs to be supported by tailored coping strategies for GC to build functional interventions towards the efficient adherence and persistence of the patients to screening protocols and preventive protocols in order to safeguard the physical, mental, and psychological well-being of involved individuals and families. It is an emerging topic on integrated care towards boosting the lifestyle medicine perspective (Guidi et al., 2021). In this perspective, the biopsychosocial model (BPS) (Engel, 1977, 1980) could be the tailored lens to innovate the genetic counseling process; the model represents a theoretical framework that incorporates 3 relevant components (biological, psychological

What is known about this topic

The fear of developing cancer, or the fear of cancer recurrence, is a known health concern in patients diagnosed with breast cancer: anxiety, depression, post-traumatic stress disorders, and psychosocial problems are the most frequent psychological and behavioral symptoms. Studies have revealed that predictive behaviors for mental discomfort include family history of the disease, youthful age, short time since cancer diagnosis, low social support, and high-risk self-perception of life.

What this study adds to the topic

This study evidenced the relevance of emotional regulation in genetic counseling, highlighting the key point for innovative and tailored genetic counseling from a developmental perspective. Using the biopsychosocial approach, the communication process of diagnosis and life implication for the patients and relatives should be part of integrated clinical care based on engagement in testing and risk-reducing strategies. Our interesting finding could significantly and practically contribute to psycho-educational and therapeutic interventions as part of clinical support for patients dealing with the fear of recurrence or of developing cancer.

and social) into individuals' quality of life: all three interact in daily living, shaping people's protective scenario and risk perspectives; their interplay determines the cause, manifestation, and resolution of an illness or risk thereof. Genomic medicine oriented to the BPS approach in the counseling process could be the driving force for efficient and integrated genomic-risk assessment. The updated setting based on a patient-centered approach, tailoring clinical practice on the integration of physical, mental, and social factors to patients' and relatives' well-being, seems to be a fruitful research and practice scenario to enhance healthcare and patient lives.

This study aimed to investigate the role of cancer worry in the psychological dimensions of patients undergoing genetic testing and to analyze its moderating effect thereon: we wanted to investigate not only the presence/absence of cancer worry; our aim was to analyze the relationship of cancer worry on the emotional dimensions of individuals to protect him/her. We hypothesized that fear of developing cancer, or FCR, could moderate the mental health of patients undergoing comprehensive genomic DNA testing. Our scope was to analyze in-depth the relations among negative psychological dimensions and verify the potential role of coping strategies to apply in the GC making more efficient the genetic clinical practice in lifestyle medicine.

2 | METHODS

2.1 | Participants

Eligible participants were approached to agree to be recruited in the study at the Medical Genetic Division (Director Prof. F. Brancati) of San Salvatore Hospital ASL 1 Abruzzo (Italy). Inclusion criteria included patients older than 18 years with an oncological diagnosis eligible for HBOC genetic testing and/or for family cascade testing by known genetic mutation in HBOC.

Exclusion criteria were (a) psychiatric disorders; (b) alcohol or substance abuse; (c) mood-modifying medications; and (d) neurological disorders.

2.2 | Instrumentation

The psychological battery comprised three standardized tests measuring emotional dimensions as well as depression, anxiety, stress (DASS-21), dysphoria (NDS), and cancer worry (CWS), as detailed below.

Depression anxiety Stress Scale 21 (DASS-21) (Bottesi et al., 2015). The DASS-21 is a self-administered questionnaire that measures the degree of severity of the core symptoms of depression, anxiety, and stress. It comprises 21 questions with responses on a 4-point Likert-type scale.

Nepean Dysphoria Scale (NDS) (Berle et al., 2018). The NDS is a self-administered questionnaire that requires respondents to provide ratings of the frequency with which they have experienced dysphoria-relevant symptoms on a scale from 0 ('not at all') to 4 ('every day, most of the time'): irritability, discontent, interpersonal resentment, and surrender.

Cancer Worry Scale for Genetic Counseling (CWS-GC) (Caruso et al., 2018). The CWS-GC measures anxiety that is specific to breast cancer and cancer/genetic risk perception. It comprises 7 items, and the scoring is based on cancer worry and cancer-risk perception. Cancer worry is an emotional reaction to the threat of cancer. Cancer-risk perception is a cognitive dimension that refers to one's belief about the likelihood that an adverse event, such as cancer, occurs. The internal consistency measured by Cronbach's alpha is ≥0.70.

2.3 | Procedures

Medical geneticists in the Medical Genetic Unit identified enrolled patients, who were then recruited before genetic testing. The participants were outpatients recruited from ambulatory care after the first scheduled genetic counseling they had access to due to oncological diagnosis or family cascade testing. Medical geneticists conducted the genetic counseling by collecting the medical-clinical information and family history before identifying the appropriate clinical indication for genetic testing. The genetic test and all personal and familial clinical implications were explained to the patients in this setting. A trained psychologist attended genetic counseling and conducted the psychological evaluations in a quiet room after genetic counseling and genetic testing. The evaluations lasted for 20 min. Written consent was obtained from all participants before the psychological evaluation. Data were collected anonymously. The participants were divided into two groups based on genetic-testing indications: oncological diagnosis eligible for HBOC genetic testing and patients eligible for family cascade testing by a known genetic mutation in HBOC.

2.4 | Data analyses

We conducted an observational study. Descriptive analyses were performed on demographic and clinical data. The normality test (Shapiro–Wilk test) was then conducted to examine the variables. Thereafter, Pearson's correlation and Generalized Linear Mediation (GLM) analyses were performed to verify the influence of negative emotion as a mediator of psychological dimensions.

All statistical analyses were conducted using Jamovi (2022). The level of statistical significance was $p < 0.05$.

3 | RESULTS

The participants (n. 55; n. 42 females) had a mean age ± SD: 45.6 ± 13.5 and age range 19–73 years. They were classified into two groups based on genetic-testing indications: (1) Oncological

Diagnosis (OD): patients with oncological diagnosis eligible for the HBOC syndrome; and (2) Genetic Mutation risk (GMr): patients eligible for family cascade testing by known genetic mutation in HBOC. The OD group comprised 24 participants (mean age ± SD: 49.9 ± 10.2), while the GMr group comprised 31 participants (mean age ± SD: 42.3 ± 15.0). Fifty-five subjects were considered eligible and invited to participate in the study. Descriptive analyses were conducted on demographical data. Table 1 reports the data.

The sample comprised 55 individuals divided into 24 (43.6%) patients with oncological diagnoses eligible for HBOC and 31 (56.4%) subjects for family cascade testing by known genetic mutations in HBOC. Almost all were females (76.4%), married (80.1%), and employed (69.2%).

First, we analyzed the detected psychological data. Table 2 reports the mean values and standard deviations of the sample for standardized psychological testing (DASS-21, CWS, NDS).

The Shapiro–Wilk test was conducted, and except for the cancer worry index, all the variables were not normally distributed, as reported in Table 2.

We then sought to verify the relationships among the psychological emotions using Pearson's correlation test. Table 3 reports the elaboration data outcome. Statistical analyses highlighted the extensive positive correlation among almost all the evaluated psychological dimensions. In particular, the cancer worry index showed positive correlations with the depression, anxiety, and stress variables, as well as with negative emotion (discontent).

TABLE 1 Demographic data of sample.

	Sample ($N = 55$)
Demographics	
Age (years)	X 45.6 SD ± 13.5
Gender: *n* (%)	
Male	13 (23.6%)
Female	42 (76.4%)
Marital status: *n* (%)	
Single	11 (19.9%)
Married	44 (80.1%)
Educational level: *n* (%)	
Graduate	31 (56.4%)
No graduate	24 (43.6%)
Occupational status: *n* (%)	
Unemployed	17 (30.8%)
Employed	28 (51.0%)
Self-employed	10 (18.2%)
Genetic testing condition	
Typology: *n* (%)	
Oncological diagnosis eligible for HBOC	24 (43.6%)
Family segregation by known genetic mutation in HBOC	31 (56.4%)

Abbreviations: %, percentage; M, mean value; SD, standard deviation.

TABLE 2 Raw scores of psychological evaluations and Shapiro–Wilk.

	Mean	SD	Shapiro–Wilk W	Shapiro–Wilk *p*
DASS-21				
Depression	10.55	10.35	0.87	<0.001
Anxiety	7.75	7.92	0.86	<0.001
Stress	14.98	9.98	0.95	0.015
CWS				
Cancer worry	56.36	22.68	0.84	<0.001
Risk perception	57.76	20.26	0.93	0.003
NDS				
Irritability	8.25	7.55	0.88	<0.001
Discontent	6.67	6.16	0.87	<0.001
Interpersonal resentment	4.56	4.99	0.84	<0.001
Surrender	3.96	4.01	0.85	<0.001

Abbreviations: CWS, Cancer Worry Scale; DASS-21, Depression Anxiety Stress Scale – 21; NDS, Nepean Dysphorya Scale.

The cancer-risk perception index was correlated with irritability and surrender. Moreover, the psychological dimensions of DASS were significantly related to the negative emotions (NDS indexes) (Figure 1).

Finally, the GLM model was estimated to determine the predictive effect of cancer worry on dysphoria (NDS indexes: irritability, discontent, interpersonal resentment, and surrender), depression, anxiety, and stress. Linear regression analyses showed a significant mediation effect of the cancer-risk perception index on the psychological dimensions of depression ($\beta = 0.38$; $z = 2.66$; $p = <0.008$), anxiety ($\beta = 0.28$; $z = 2.03$; $p = <0.04$) and stress ($\beta = 0.38$; $z = 3.00$; $p = <0.003$); regarding dysphoria, cancer-risk perception significantly moderated irritability ($\beta = 0.31$; $z = 2.22$; $p = <0.02$) and discontent ($\beta = 0.29$; $z = 2.10$; $p = <0.03$) dimensions. No significant differences were found between the two groups (OD vs. GMr).

4 | DISCUSSION

The study aimed to explore the role of cancer worry in the psychological dimensions of patients with a high risk of oncological diagnosis. Particularly, the genetic risk perception of cancer influenced directly the negative emotions of patients independently of being part of HBOC/BRCA groups. The main outcome of our research is related to the role of genetic risk perception in cancer worry emotional dimensions: being hereditary oncological patients and/or their relatives is a determinant for a mental negative perspective and understanding the magnitude of the phenomena in GC procedures and following interventions.

Our interesting finding could significantly and practically contribute to GC therapeutic interventions as part of clinical support for

TABLE 3 Pearson correlation test on psychological dimensions.

	CWS – CG		DASS-21			NDS			
	Cancer worry	Risk perception	Depression	Anxiety	Stress	Irritability	Discontent	Interper resent	Surrender
Depression									
Pearson's *r*	0.27*	0.40**	—						
p-value	0.044	0.002	—						
Anxiety									
Pearson's *r*	0.29*	0.34**	0.78***	—					
p-value	0.033	0.010	<0.001	—					
Stress									
Pearson's *r*	0.39**	0.48***	0.80***	0.70***	—				
p-value	0.003	<0.001	<0.001	<0.001	—				
Irritability									
Pearson's *r*	0.17	0.33*	0.63***	0.45***	0.56***	—			
p-value	0.225	0.015	<0.001	<0.001	<0.001	—			
Discontent									
Pearson's *r*	0.31*	0.37**	0.68***	0.52***	0.58***	0.84***	—		
p-value	0.021	0.006	<0.001	<0.001	<0.001	<0.001	—		
Interper resent									
Pearson's *r*	0.09	0.23	0.52***	0.33*	0.45***	0.78***	0.63***	—	
p-value	0.511	0.096	<0.001	0.015	<0.001	<0.001	<0.001	—	
Surrender									
Pearson's *r*	0.22	0.28*	0.68***	0.47***	0.59***	0.89***	0.90***	0.70***	—
p-value	0.113	0.037	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	—

Note: $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Abbreviations: CWS, Cancer Worry Scale; DASS-21, Depression Anxiety Stress Scale – 21; NDS, Nepean Dysphorya Scale.

patients dealing with FCR or fear of developing cancer. Our study evidenced the relevance of cancer worry in the management of GC not only as specific psychological dimensions such as influencing elements for negative triggers for depression, anxiety, stress, irritability, and discontent; taking into account genetic risk perception as key for CG, during the communication process of genetic results disclosure, and more for the family members' engagement in testing finalized to the risk-reducing strategies. Indeed, a genetic specialist can allow a patient to discuss not only the risks associated with genetic cancer syndromes but also the psychological or emotional impact these syndromes may have on families. GC turns out to be a complex communication process in which patient engagement should be exploited. It is an emerging topic, as highlighted by Samadder et al. (2019): indeed, only 1.7% of 143 clinicians felt confident in their ability to interpret risk based on family history and to provide a patient with screening, treatment, and/or risk-reduction recommendations. Individuals' ability to comprehend and dynamic adaptability are simultaneously required to promote adherence to the patient-life perspective: the integration of genetic information and medical, psychosocial, and familial implications of hereditary disease represent core genetic counseling based on a patient-centered approach. In our opinion, increased patient understanding may lead to improved communication between family members who are at risk and may also increase adherence to screening and/or risk-reduction recommendations. If a patient's personal and/or family history is suggestive of a hereditary predisposition, referral to a genetics clinic and/or genetic counseling can provide an in-depth assessment of personal and family history in the context of hereditary cancer (Samadder et al., 2019). Based on the finding, we suggest clear integration of genetic counseling by communication and emotional specialists as well clinical psychologists to better manage the impact of genetic disclosure on patients' and relatives' lives. The influence of cancer worry on dysphoria traits was that patients/relatives who underwent genetic testing felt vulnerable.

Moreover, considering our preview study (Ranieri et al., 2023), in oncological patients dealing with a *BRCA* genetic result, the limited knowledge about the origin of their illness could impact their emotion regulation processes and then the long-term clinical pathway management; additionally, unexpectedly negative women with negative BRCA testing results showed high difficulties in emotion regulation, which mostly affected the maintenance of intentional behavioral control during stressful events. In previous studies, emotional regulation seemed to be involved in healthy/unhealthy adaptive behaviors and the related negative outcome for health (Di

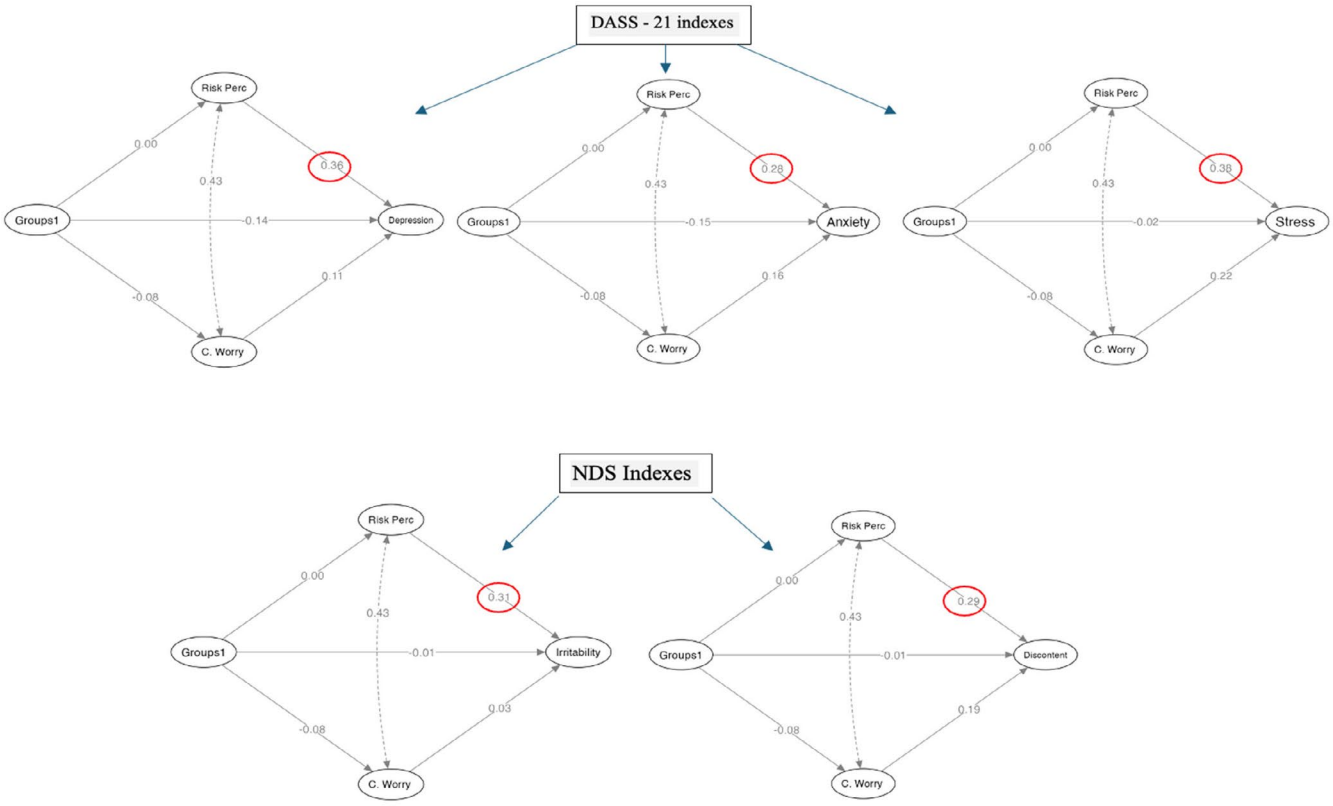

FIGURE 1 Statistical diagram of GLM regarding to the impact of Cancer Worry indexes on psychological dimensions. C. Worry, Cancer Worry; DASS – 21, Depression Anxiety Stress Scale – 21; NDS, Nepean Dysphorya Scale; Risk Perc, Risk Perception.

Giacomo et al., 2019; Ranieri et al., 2021; Wierenga et al., 2017); dispositional optimism as well as defensive responses to stressful life events could be related to the outcome of emotional dimensions (Akıncı et al., 2021). Additionally, clinical characteristics and personality traits in disease treatments appeared correlated to the coping strategies for emotional regulation (Blanchard-Fields et al., 2004; Wierenga et al., 2017).

GC could be a stressing step in oncological clinical practice featuring patients' psychological health; *BRCA*+/− results disclosure impact patients' emotion dimensions, paving the way for a tailored psychological setting towards reinforcing adaptive behaviors and coping strategies for improved accuracy of individuals' perceptions of their personal risk (Katapodi et al., 2004). As well defined by Hammer-Hansen et al. (2024), 'the care for patients with serious conditions is increasingly guided by genomic medicine, and genomic medicine may equally transform care for healthy individual if genomic population screening is implemented' (pag.1).

4.1 | Study limitations

Potential limitations of the study include the sample size, which could be expanded in future studies to provide more robust evidence, and the inability to establish causal relationships among the investigated variables in the network statistical analysis to exploit the research outcomes.

4.2 | Practice implications

GCRA is defined as an interdisciplinary standard-of-care practice that employs genetic and genomic tools to identify individuals and families with inherited cancer risk (Capasso et al., 2024). GC encompasses both physical and psychological aspects of health. Resta et al. (2006) define it as assisting individuals to comprehend and adapt to both genetic information and the medical, psychosocial, and familial implications of hereditary disease. The role of a genetic specialist is to support individuals and relatives through an in-depth disclosure promoting the adaptative process to a genetic scenario (Resta et al., 2006; Skirton et al., 2015). To our knowledge, this is the first research protocol to evaluate emotion regulation (interaction between psychological dimensions) during genetic counseling based on the BPS model, which is oriented to the patient-centered approach and reinforces the need to tailor clinical practice to the integration of physical, mental, and social factors to patients' and relatives' well-being. An educational program based on the BPS model for GC professionalism could be reinforced and better spread out by this vision: in Italy, the only active Master (University of Siena) is on this pathway, and even more will be done.

5 | CONCLUSION

The need for an interplay between genetic and psychological specialists was identified in a recent investigation (Hartley &

Holmqvist, 2023) suggesting that increased skills are required in (a) the recognition and management of emotional patient reactions and (b) the recognition of adaptive and maladaptive behaviors to life-altering information. The key core of GC lies in applying multidisciplinary counseling and psychotherapy skills to explore emotions and concerns, usually in the context of patient education, and facilitating decision-making and adaptation. It is well documented that interprofessional collaborative care can improve patient safety, quality of care, and provider satisfaction and retention (Hartley & Holmqvist, 2024).

AUTHOR CONTRIBUTIONS

Dina Di Giacomo conceptualization; Eleonora Cilli recruitment and elaboration data; Dina Di Giacomo and Eleonora Cilli data analysis; Francesco Brancati supervision. All authors contributed to writing the paper. All authors gave final approval of this version to be published and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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CONFLICT OF INTEREST STATEMENT

All authors have no conflicts of interest to declare.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

Human study and informed consent: The study was approved by the Institutional Review Board (IRB) of the University of L'Aquila, Italy (Prot. No. 47/2022). It was conducted according to the guidelines of the Declaration of Helsinki (World Medical Association, 2008).

Animal studies: No non-human animal studies were conducted by the authors for this article.

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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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