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Abstract:

Background: Cancer genetic counselling allows the identification of a genetic component that increases the risk of developing a tumor. The psychological reactions are influenced by both the content of the information received, from both the subjetive perception of their own risk of becoming ill or being pruner of genetic mutation.

Materials and Methods*:* This study included 120 participants who underwent genetic counselling for breast and/or ovarian cancer. The aim of the study was to examine the relation between the Cancer Risk Perception and the Genetic Risk during genetic counselling before testing, considering the influence of psychological variables, in particular distress, anxiety and depression. The following tools were administered during the psychological interview: Socio-demographic and Medical Characteristics Data, Cancer Risk Perception (CRP) and Genetic Risk Perception (GRP), Hospital Anxiety and Depression Scale (HADS) and Distress Thermometrer (DT).

Result: The data seem to confirm our hypothesis. Positive and significant correlations were found between the variables observed. Moreover, the genetic risk perception determines an increase in depressive symptomatology and the cancer risk perception determines an increase in anxious symptomatology, specifically in subjects in treatment and with children.

Conclusions: The results presented suggest the importance of assessing the genetic and the cancer perception of risk, in subjects who undergo the cancer genetic counselling, to identify individuals who are at risk of a psychological well being decrease and at risk of developing greater psychological distress.

Keywords: BRCA 1/2, genetic counselling, genetic risk perception, cancer risk perception, distress

1. Introduction

In the last 15-20 years, genetic counselling in oncological settings has been greatly developed, thanks to the continuous and innovative studies in the field of molecular genetics, which helped identifying those genes responsible for a greater genetic susceptibility in the development of certain kinds of cancer, and the subsequent availability of predictive genetic testing for this type of risk. (1).

Genetic counselling enables to discover a hereditary component, which increases the risk of developing a tumour. Genetic counselling can be offered to people at risk for hereditary cancer as well as to cancer patients. Hereditary susceptibility to breast cancer (BC) and ovarian cancer (OC) accounts for less than 10% of all tumour cases. The BRCA1 and BRCA2 germline mutations are the two main known genes associated whith hereditary BC and OC. Women who carry a deleterious mutation in one of these genes have an increased risk of developing BC and OC and require an appropriate clinical management, currently based on intensive screening for the early delection of tumours and on surgical risk-reduction strategies for primary prevention (2). Today, in oncology, an integral part of the prevention and cure for cancer is the genetic counselling and genetic-testing for hereditary susceptibility to cancer. Germiline mutations in the tumour suppressor genes BRCA1 and BRCA2 predispose to familial breast and/or ovarian cancer (3). In addition, the siblings and offspring of an affected person each have a 50% chance of inheriting the cancer-predisposing mutation segregating in the family, consistent, in most cases, with autosomal dominant inheritance. It is important to encourage counselees and their relatives to undertake preventive measures based on their actual risk status (4).

Genetic counselling, is defined by the American Society of Human Genetics as *a communication process which deals with the human problems associated with the occurrence or risk of occurrence of a genetic disorder in a family* (our italics), *it involves one or more appropriately trained persons to help the affected individual or family* (5).

The National Society of Genetic Counselors (NSGC) Task Force defines genetic counselling as *the process of helping people understand and adapt to medical, psychological, and familial applications of genetic contributions to disease* (6).

As such, genetic counselors are faced with three important tasks:

1. To interpret family and medical histories to enable risk assessment;

2. To educate counselees about issues related to heredity, preventive options (e.g., genetic testing), and personal risk;
3. To facilitate informed decisions and adaptation to personal risk (7). The latter task may be considered the "core" (i.e., the desired outcome) of genetic counselling, with the former tasks in service of its fulfillment.

In Oncological settings, Genetic counselling (cancer genetic counselling) should also provide sufficient information to enable the user to make a fully informed choice of action, particularly as regards prevention, in case of identification of a mutation or of a familial cancer risk.

In Italy, where health care is mainly a public service, cancer genetic counselling is a relatively new concept and is almost invariably offered within the framework of research projects. The onset of cancer genetic counselling, which at first focused on genetic testing, coincided with a change in the physician/patient relationship as the Italian public became more aware of improvements in cancer treatment, in palliative care and in prevention. In recognition of this new reality, the Ministry of Research funded a research project entitled The Development of a National Network for the Study of Hereditary Breast Cancer. Five clinically oriented centres of this network (representing northern, central and southern areas of the country) are implementing a multistep model of cancer genetic counselling based on the experience initiated and promoted by the Naples Unit (8).

Given the highly technical expertise required for cancer management, and the need to provide updated information about diagnostic methods and treatment options, the oncologist seems to be the most appropriate professional figure for the role of counsellor. In fact, the oncologist is able to play a comprehensive role in assessing familial cancer risks and in the counselling process starting from risk identification to risk management, however communicating received information to at risk relatives has been reported to be emotionally overwhelming, potentially causing psychological and emotional difficulties, so the information about increased genetic risk can have consequences in the relations within the family. For this reason it is important to consider the multidisciplinary nature of cancer genetic counselling, where just as in our model, during the patient's educational process and as required counselling in the various steps, there is an equipe job among the different figures, such as the psychologist, geneticist, radiologist, oncologist and surgeon (9). It is fundamental that health professionals are aware of the psychological aspects triggered by genetic diseases and the ways in which these can be managed. In the field of human and medical genetics we are still living in a phase in which technical and scientific aspects

predominate, with little emphasis on the study of emotional reactions and people's processes of adaptation to these diseases, which leads to clients having a low level of understanding of the events that have taken place, with negative consequences for family life and for society (10). However, over the last few decades, psychosocial research has examined both motivations and decisions regarding genetic testing, focusing above all on the psychological impact of communicating a genetic risk, and its effects on the person's family and their interpersonal relationships.

By integrating psychological counselling with genetic counselling, it is possible to detect psychic risk factors, measuring the impact that the communication of risk has on the individual and their family. The 2014 FONCAM guidelines consider a pathway of psychological counselling where subjects and/or their families can fully understand the meaning of what it is introduced to them, the genetic/heredity factors, their options in risk management and the independence of choosing their own, most appropriate pathway. The most important oncological and genetic professional organisations describe genetic testing as a care process that includes a complete evaluation of cancer risk, genetic counselling pre- and post- testing and psychological counselling. (11).

During the psychological evaluation, it is important to identify and explore possible issues and psychological concerns that might influence the subject's ability to manage important counselling-linked steps, such as undertaking the test, receiving the test's results and adhering to the recommendations of risk management.

Specifically, the psychological intervention intends to evaluate motivations, the cancer risk request for information, family and personal experiences regarding cancer, emotions, fears and concerns related to these experiences, beliefs about cancer causes, perceptions regarding the personal risk of developing cancer, general psychological issues, cultural and family background and finally, the available support systems (12).

As a consequence of the communication of the genetic diagnosis, both proband and family subjects show a serious change in the way they see themselves, with significant repercussions on personal identity and the sense of family belonging. Psychological discomfort generates some sort of indefiniteness, influencing the ability to tolerate anxiety, the feeling of losing control over life events, and the sense of ambiguity and ambivalence. By determining a genetic vulnerability in tumour development, the subject is arranged in a new situation in a continuum between health and disease: *the risk.* (13)

During the last 20 years, psychological research has established that the risk concept is multidimensional. There are often two elements in the concept of risk: probability and

consequence. When a person is informed about genetic risk, his or her perception and evaluation of that risk is specific to that individual. The amount of literature on emotional reaction related to genetic counselling has increased in recent years (14).

Cancer-related worry is often used as an outcome variable in these studies.

Brain, (2002) report a significant reduction in cancer-related worry after genetic counselling among women with low or moderate risk of developing cancer, but not for women at high risk for cancer. (15)

Therefore, the concept of risk is particularly important in this process. Genetic risk, as "predisposing condition", takes on a dual significance: objective on one side, i.e. quantification of the chances of developing the disease, subjective on the other, i.e. a purely individual perception of one's own vulnerability level. (16)

Despite the fact that genetic counselling provides information regarding objective risks, there is frequently a contrast between the perception of the risk of developing a tumour and being the carrier of a genetic mutation and the objective risk. (17)

These data imply that, apart from cognitive factors, the perception of risk is also influenced by various factors. Psychological reactions to the outcome of genetic tests are associated both to the content of the received information, and to the subjective perception of one's own risk of developing the disease. (18)

People requesting genetic counselling ask for more precise information on risks, because knowledge provides comfort. Of course, the conception of risk can be complex and difficult to understand for women requisting genetic couselling, particularly if the issues are discussed in terms of probabilities, frequencies of the event or proportion that can be confunsing (19). However, if the counselling team is able to convey the information in a descriptive manner, such as "an unlikely event" or "risk higher than average", the message about the difference between risk and reality is more easily understood, from discussing the real level of risk and also from making it clear that there is a specilised team than can help them lower the risk of an unfavourable outcome through specific monitoring and, if necessary, treatments.

Rantala (2009), also found that the benefit of counselling lies in the opportunity to discuss the real risk of becoming ill, helping the patients to have a realistic view of their personal risk of cancer development and reducing anxiety about cancer (20).

A review by Mills and Davidson (2002), found that effective cancer education increased patients' control and involment in their care, reduced psychological distress and improved adherence to treatment. Perception of cancer risk has been found to be theorically and

emphirically relevant in motivating cancer screening and risk reduction behaviours. (21) The people who underestimate their risk of developing cancer may be less likely to engage in health-protective behaviours, whereas those who overesimate their risk may worry excessively, overdo protective behaviours and burden the health care system. Cancer risk perception is associated with health-related quality of life, including psichological adjustment and health behaviours. (22)

Several studies have reported and focused on psychological states (psychological distress) in the field of the oncology genetic counselling, primarily states such as anxiety and depression (23). How these psychological states may influence an individual's decision to either accept or decline counselling has also been reported. However, there are only a few studies that have investigated psychological traits and their influence in the decision making process in attending or declining genetic counselling, and therefore further study is still needed. In actual fact, if an individual experiences a temporary state of anxiety during a counselling session, it does not necessarily mean that he/she experiences permanent anxiety in their daily life. (24)

Disress is a multifactorial unpleasant experience of a psychological (cognitive, behavioral, emotional), social and/or spiritual nature that may interfere with the ability to cope effectively with cancer, its phisical symptoms and its treatment. Distress extends along a continuum, ranging from common mormal feelings of vulnerability, sadness, and fears to problems that can become sesabling, such as depression, anxiety, panic, social isolament and existential and spiritual crisis. Disress is an unpleasant emotional state that may effect how you feel, think and act. It can include feelings of unease, sadness, worry, anger, helpessness, guilt, and so forth. Everyone whith cancer has some distress at some point of time. Distress is anything which impacts negatively upon your life and stops you from doing anything you enjoyed defore your diagnosis. (25)

As far as psychological distress is concerned (state anxiety, depression and worrying about cancer), some studies have reported no association between levels of this variable and non-compliance or early withdrawal from genetic counselling (26).

Instead, other studies have reported that psychological distress (particularly cancer-specific distress, that is anxiety and depression associated with worrying about cancer) was significantly associated with the refusal or the withdrawal from genetic counselling, whether levels were high or low. A moderate level of distress (general distress and cancer-specific distress) was found to facilitate the decision to undergo genetic counselling (27).

We found that a high-perceived cancer risk was associated with lower mental and physical health-related quality of life. (28) We observed that the perceived risk of breast cancer was affirmatively associated with depression, anxiety and worry about cancer. Despite the established importance of risk perception and the increasing number of educational interventions targeting risk perception for both cancer patients and people at risk of cancer, there is little research investigating the efficacy of these interventions. (29)

On the basis of the above, it is evident how risk perception, anxiety and psychic distress levels act as key factors that are involved in the patient's decision process throughout the counselling pathway, as well as in the decisions regarding preventive surgery and family-internal communication processes. Those psychological variables, in accordance with the literature reported in this paper, are considered modulator and/or predictive factors in the degree of compliance to the monitoring programmes of family-internal communication processes.

Identifying and working on such variables, i.e. on the emotional, cognitive and behavioral aspects, allows promoting adherence to the monitoring programmes, encouraging decision-making and empowerment. This is the primary object of this research. In order for it to be put into effect and to have consequences on clinical practices, this research took, as reference, the cognitive-behavioural theory model that considers emotions and behaviour strictly connected. In particular, our thoughts influence emotions and behaviour, thus it is not the actual event that causes psychological discomfort, rather the perception we have of the event. This means that our emotional and behavioural reactions are determined by the way we interpret different situations and by the significance we give to events. When we are worried, anxious or sad, it is not for the actual situation, rather for the way we interpret this situation and the relevance we give to it. (30).

Therefore, in a genetic counselling setting, psychological reactions are connected both to the content of the information received, and to the subjective perception of the risk to develop the disease.

Working according to a cognitive-behavioural and psychoeducational approach allows probands to control anxiety and distress, enabling a more accurate understanding of information and risk perception, which also facilitates family-internal communication.

Most of the times, the responsibility to spread the knowledge about genetic risk falls on family rather than on the doctor. An appropriate psychological intervention can be useful in overcoming barriers in communicating to the family the information about risk (31). The proband, or the first person in the family who undertakes counselling, becomes the keeper of an important information about the family's health (32).

The impact of counselling processes and genetic testings can have clinical consequences, i.e. the need for an appropriate medical management; psychological consequences, i.e. the potential answers to distress; and social consequences, i.e. communicating the risk to the family. There can be an improvement in the quality of life and survival only through a multidisciplinary management (33).

2. Aims of the thesis

This project aims at quantifying subjective risk, in order to prevent or to intervene on psychological distress connected to such concerns.
Risk perception and distress baseline evaluation will allow us to understand if anxious and/or depressive symptomatology is influenced by genetic risk perception and cancer risk perception.
The goal of this research is to study the possible influence of risk perception (genetic and cancer) in a sample of subjects undertaking genetic counselling, considering some specific factor, such as: levels of anxiety and depression, distress, demographic and medical characteristics (i.e. with or without children). In addition, we propose to highlight some differences between the proband and family groups.

Our objectives are:

1. Investigate the levels of anxiety, depression, and cancer-relatives distress anxiety levels, depression and distress cancro-specific in partecipants. Several studies have reported and focused on psychological states (psychological distress) in the field of onco-genetic counselling, primarily state anxiety and depression. Given the complexity of hereditary and familial cancer, anxiety and depression variables are aspects of the psychological impact linked to the risk and susceptibility for genetic tumours (34, 29, 35).

2. Evaluate the psychological variables assessed in specific clinical phases (pre-treatment, in-treatment and follow-up) within the group of affected subjects (both proband and family);

3. According to the literature (36), the social variable with/without children can influence the genetic risk and tumour perception, and it is also possible to observe its connection with anxiety levels;

4. Understand if the genetic risk perception, and the tumour risk perception can be associated to the levels of anxiety, depression and distress within the whole sample. Based on literature (24), it is possible to speculate about finding significant correlations between the assessed variables, and specifically we expect to demonstrate how the genetic risk perception and disease perception can affect the arising of anxious and depressive symptoms.

5. Evaluate in the two proband and family groups the possible connection between risk perception (both genetic and cancer) and the assessed psychological variables, supposing that the subjects who are the first to undertake counselling and are presented with a diagnosis of oncological disease, have a share of family responsibilities that leads to a depressive symptomatology, while family, whose fear is facing the disease procedure, can show an anxious symptomatology.

3. Materials and Methods

3.1 Patients' selection

This research studies 120 subjects at the Oncology Section of the Regional Reference Centre for the Diagnosis and Cure of rare and hereditary tumours of Palermo, Italy.

The 120 subjects are divided into two groups of 60 people each, one is constituted of probands (younger members of a family affected from the disease, who first undertake genetic counselling), and the other is made of family members who undertake genetic counselling for hereditary breast and/or ovarian cancer, following communications regarding risk within the family.

Before administering the questionnaires, two psychologists of the clinic explained the aim and the methods of the present research to participants then they were asked to sign a consent form. Those who agreed were asked to complete a protocol containing paper pencil test self-report, the time for completion was about 30 min.
The self-report administration was conducted in premises that guaranteed confidentiality, before to deliver the results of genetic testing (Pre-test).

The choice of partecipants was made of the basis of the following inclusion criteria:

1. Subjects that perform genetic testing for breast and ovarian cancer is with at least one of the following criteria:
    - Breast cancer < 36 y;
    - Breast cancer plus ovarian cancer at any age;
    - Breast cancer in male patients at any age;
    - Ovarian cancer <45 y;
    - Bilateral breast cancer;
    - Patients with breast or ovarian cancer at any age and first or two-degree relatives with breast or ovarian cancer.
2. Families with ereditary breast and/or ovarian cancer within the family;
3. Age between 18 and 75 years.

We excluded from the research subjects who did not have an adequate level of understanding of the Italian language and those who had obvious psychiatric disorders that prevented them from understanding the goals of research and survey questions.

Five scales were used to investigate the following areas

- **Socio-demographic and medical characteristics data,** specially constituted and used during clinical interviews, which are useful both for the collection of socio-demographic and medical characteristics and for the comprehensive understanding of the information received under counselling. Finally, they are used to identify those problems the proband and/or their family consider very serious.
The test variables were; age, gender, place of birth, civil status, number of children, education, employment, number of relatives affected by cancer.

- **Cancer Risk Perception (CRP**), (30) one item taken from prior research, was to evaluate the possible risk of the subject developing cancer. "Mark with a cross on a scale of 0 to 100 what you consider to be your risk of developing, or redeveloping, breast and ovarian cancer". Reply was given on a Visual analogue scale of 0 to 100%: 0 representing the lowest risk, 100 the highest and a blank space "do not know".

- **Genetic Risk Perception (GRP),** (30), another item taken from prior research, was to evaluate the likelihood to be a carrier of the BRCA1/BRCA2 genetic mutation. "Mark with a cross on a scale of 0 to 100 what you consider to be your risk of being a carrier of the genetic mutation predisposing one to breast and ovarian cancer". Reply was given on a Visual Analogue Scale from 0 to 100%; 0 representing the lowest risk, 100 the highest and a blank space "do not know".

- **Hospital Anxiety and Depression Scale (HADS)**, (37, 38) The Italian version of the 'Hospital Anxiety and Depression Scale' is commonly used to evaluate ''situational'' psychological distress in non-psychiatric settings, that is, assessing a psychological state that may rapidly change based on the settings and circumstances (this test may be administered every 14 days). It is composed of two scales of fourteen items, seven related to anxiety and seven relate to depression.

This outcome is created for measure specifically to avoid reliance on aspects of these condictions that are also common somatic symptoms of illness. This, is was hoped, would crteate a tool for the detection of axiety and depression in people with phisical health problems.

Each item on the questionnaire is scored from 0-3 and 21 for either anxiety or depression. The HADS used a scale and therefore the data returned from the HADS is ordinal.

The two scores can be calculated separately giving an exact definition of what anxiety and depression caused by stress involve. The three cut-off points obtained from these two scales are: normal (0–7), borderline (8–10) disturbance (above 11). By calculating the sum of the two scales, it is possible to identify the presence of disturbance in adaptation (cut-off 13–18), or an episode of heavy depression (cut-off > 19). No psychological distress is evidenced if the sum of the two scores totals < 13.

In the present study, the HADS demonstrated a good internal consistency with a Cronbach's α value of .91 for HADS-A and .90 or HADS-D.

- **Distress Thermometer (DT),** (39), the DT has a rought initial single-item question screen, which identifies distress coming from any source evaluating the patient's subjective stress according to a visual analogue pain scale, where 0 means (no distress) and 10 (extreme distress) and “that best describes how much distress you have been experiencing in the past weeks including today”, and a problem list of five problem areas. The Distress Thermometer is the most widely used rapid screening tool for assessing psychological distress in people affect by cancer. Use of such tools to assess patients amotional and phicicial needs is a requirement of the NICE guidelines for supportive and palliative care. The cut-of of four or higher suggest a level of distress that has clinical significance.

Statistical analysis

Skewness and Kurtosis indices was used to verify univariate normality of distributions, after, to determine the internal consistency, Cronbach α was computed for scales.

Then, we calculated descriptive statistics for each considered variable. To examine differences between the average scores of the partecipants and value test (cut-off), One Sample T-test were conducted. To examine differences between the average scores of the patients with prole and these without, Student’s *t* index for independent sample were conducted

Pearson’s bivariate correlation coefficients between the different dimensions for both counselees and their relatives and between the variables of counselees and their relatives were examined.

In order to examine in depth the predictive role of subjective risk perception compared to anxiety and depression levels, a linear regression for the whole sample has been made.

The data processing was performed with the Statistical System Statistical Package for Social Sciences (SPSS 19.0).

4. Results

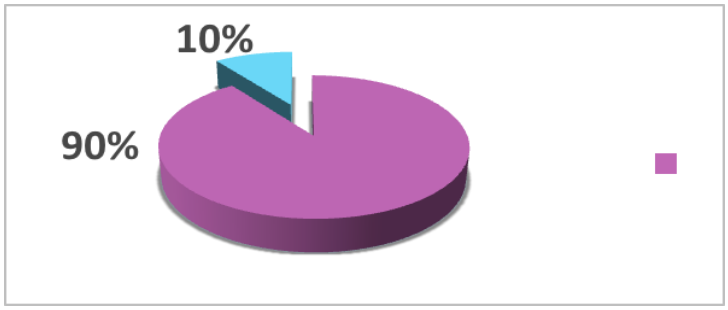
First, we checked the normality through univariate indices of Skewness and Kurtosis with acceptance threshold of ^1 and there aren’t variables that display violations of normality.

4.1 Descriptive statistics

Sociodemographic characteristics of Partecipants

The sociodemographic characteristics of partecipants are described following in the Tables. In our sample, 90% of participants are women and 10% men (Tab. 1).

Table 1: Distribution of partecipant (%) (n=120)



The average age of the participants is 44.95 with a DS of 11.81 (Tab. 2). All research participants were Italian. As described in table 2, 15% of the subjects in this research are single, while 76% is married, 4% is separated/divorced and 5% is widowed.

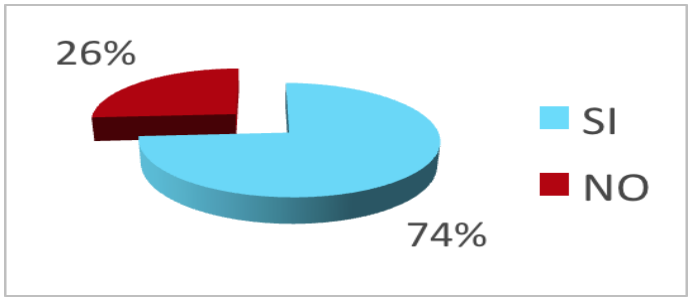
Table 2. Sociodemographic characteristics of participant (n= 120)

	Patients (n = 120)
	M (SD)
Age (years)	44,95 (11.81)
Civil status	***f* (%)**
Single	15 %
Married	76 %
Separated	4 %
Widowed	5%
Level of education	***f* (%)**
Primary school	10%
Junior high school	30%
High school	46%
Graduated	14%
Employment status	***f* (%)**
Intellectual and scientific professions, managers, entrepreneurs	10%

Skilled occupations in trades and services	16%
Employed	30%
Artisan, farmers,skilled workers, technical occupations	7%
Unemploye (e.g.:students, housewifes, unemployed, pensioners)	37%

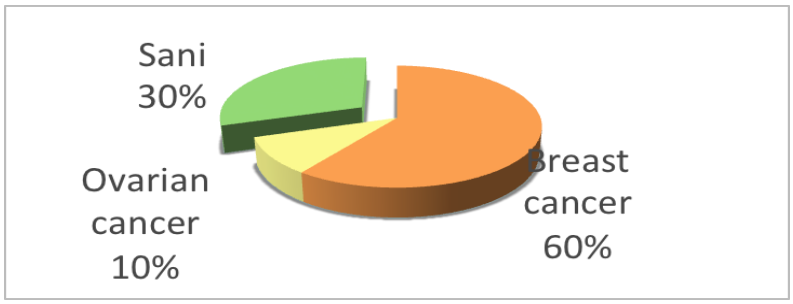
In 74% of the sample there is the presence of children, however 26% presents no children. (Tab. 3).

Table 3: Partecipant with children and/or without children (n=120)



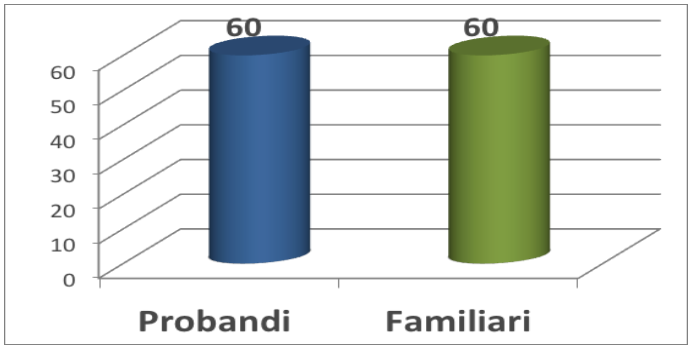
30% of the sample does not have oncological pathology, 10% have ovarian cancer and 60% of breast cancer (Tab.4).

Table 4: % of frequency distribution for type of pathology (n= 120)



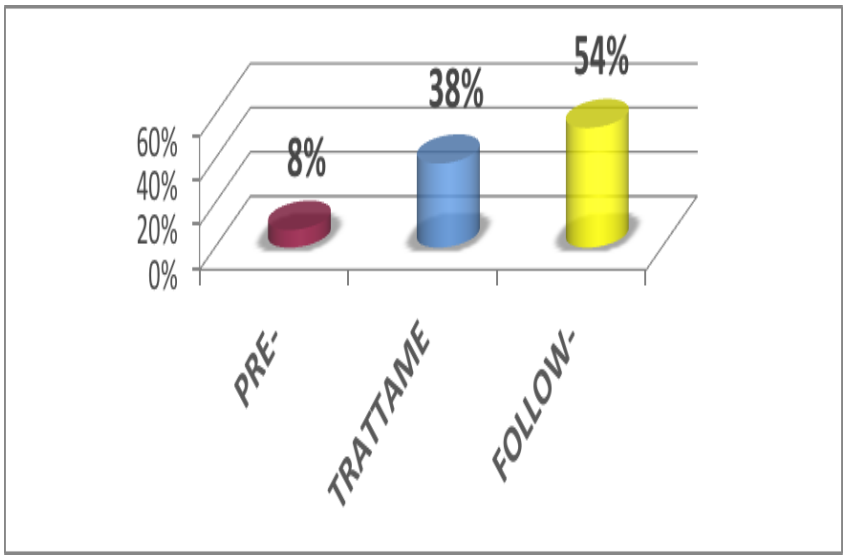
Users examined are 50% probands and 50% family (Tab.5), furthermore, 47% of them has cancer, while 53% is made of healthy family members.

Table 5: Proband and family subjects in the group (n= 120)



As for where in the clinical stage the subjects with cancer are standing, 38% of the sample is under chemotherapy, 54% in follow-up and 8% in pre-treatment (Tab.6).

Table 6: % of frequency distribution for type of clinical stage (n= 120)



Analyze levels of anxiety, depression and distress present in the partecipants

Regarding the first aim of this study, which was evaluating the cancer-related anxiety, depression and distress levels of the participants, a comparative analysis of the participants' average score was made (HADS_ANX M=14,17 SD=3,52; HADS_DEPR M=9,35 SD=5,69; DT M=7 SD=2,190) and the assessment instruments' threshold (cut-off) value through One Sample T-test.

Specifically, anxiety (t - 13, 094 p 0,000), depression (- 9,35 p 0,000) and distress (t 7,62 p 0,00) T scores are significantly different from the relative administered instruments (Table 7). This could indicate a possible anxious and depressive symptomatology that should be better attentioned. As the level above threshold stands, it is necessary to take care of participants at psychological level, in order to avoid for such symptoms to become chronic and to result in psychopathological clinical clusters.

Table 7: Comparison between the participants' average scores and the cut-off of HADS and DT (n=120)

	PARTECIPANTS			
	Mean	**SD**	t	*P*
HADS_Anxiety	14.17	3.527	-11.198	0.000
HADS_Depression	9.35	5.69	-9.33	0.000
DISTRESS THERMOMETER	7	2.190	7.62	0.000

Descriptive analyses of the psychological variables examined in specific clinical stages (pre-treatment, in-treatment and follow-up) regarding the group of subjects with pathology (both probands and families)

As for the second aim of this research, descriptive statistical analyses were made in order to better understand what psychological variables might arise during the different clinical stages that portray the cancer treatment pathway. In this respect, referring just to the group of cancer-affected subjects, belonging to both the probands and family groups, we chose to compare the average score of cancer-affected subjects via the Kruskall-Wallis test, that allowed us an analysis of the variables in the three stages.

The p-value of the Krushal-Wallis test is 0, so we can reject the idea that cancer-affected subjects' (n.91) score medians of psychometric tests, which are divided by clinical stage, are equal. Indeed, the score evaluation of tests is usually distributed differently according to the clinical stage.

Specifically, patients' scores are significantly different in the depression sub-scale of HADS test (M= 7,90 p 0,01) and in the DT (M 12,81 p 0,02), resulting - both of them - higher in the pre-treatment and in-treatment clinical stages. (Table 8).

Table 8: Comparison - via the Kruskal Wallis test - of the median scores of cancer-affected subjects' psychological variables in the specific clinical stages (n 91)

	Clinical stage	Mean	Chi sq	p-value
HADS_ANXIETY	STAGING	52.00		
	TREATMENT	46.36	,372	,830
	FOLLOW-UP	45.17		
HADS_DEPRESSION	STAGING	59.33		
	TREATMENT	54.98	7,902	,001
	FOLLOW-UP	39.92		
	Total			
THERMOMETER DISTRESS	STAGING	63.92		
	TREATMENT	57.03	12,81	002
	FOLLOW-UP	38.37		

** $p \leq 0,01$

*$p \leq 0,05$

Defining whether the social variable with/without children can affect the genetic risk perception, and observing the connection with anxiety levels

With regards to the third aim of the research, we compared the average genetic risk perception scores of the subjects with children group with the one without children. No significant differences arose between the two groups' average scores, which were analysed with the t-student statistics (Tab.9). This shows that having, or not having, children, does not affect the participants' Genetic Risk Perception.

Table 9: Comparison betw een average scores for genetic risk perception in subjects with or without children

	Prole	Mean	Std. Deviation	t	p
Genetic Risk Perception	0	41,91	27,629	-1,902	0,063
	1	58,21	26,643		

4.2 Bivariate Correlation Analysis

Outcomes of the correlative analysis showed that there are constant and significant correlations among almost all the variables we examined, confirming our supposition.
Moreover, in order to better understand how the genetic risk perception in subjects with or without children can be associated with anxiety levels, we used the Pearson correlation coefficient. Thanks to this analysis, it was possible to see how - in the subjects with children group - the Genetic Risk Perception is affirmatively correlated with anxiety levels (Tab.10). This indicates that a greater genetic risk perception corresponds to higher chances of observing anxiety levels.

Table 10: Pearson's correlations between anxiety levels and genetic risk perception in subjects with or without children groups

	HADS_ANX	GENETIC RISK PERCEPTION
SUBJECTS WITHOUT CHILDREN GENETIC RISK PERCEPTION	**0,72**	**1**
SUBJECTS WITH CHILDREN GENETIC RISK PERCEPTION	,479**	**1**

** p < 0.01

*p < 0.05

Understand if the genetic risk perception and cancer risk perception are associated with anxiety, depression and distress levels for the whole sample

The analysis of the correlations among the genetic risk perception, the cancer risk perception and the two HADS (anxiety and depression) and Distress Thermometer (DT) sub-scales, showed that the genetic risk perception, unlike cancer risk perception, is significantly correlated to both the psychological dimensions in exam, i.e. anxiety (r=,337 $p < .01$) and depression (r= ,254 $p < .01$), but also to cancer risk perception (r= .488 $p < .01$).

While the HADS test sub-scale of anxiety is affirmatively correlated with the other sub-scales in exam, i.e. with depression levels (r= .254 $p < .01$), and cancer risk perception (r= .445 $p < .01$), depression seems to be significantly correlated only with the genetic risk perception (r= .254 $p < .01$). As far as our fourth aim concerns, we can affirm that anxiety, rather than depression, is more influential (Tab.11).

Table 11: Pearson's correlation among genetic risk perception, cancer risk perception, anxiety, depression and distress levels in the group of participants (n= 120)

	GENETIC RISK PERCEPTION	CANCER RISK PERCEPTION	HADS_ANX	HADS_DEPR
GENETIC RISK PERCEPTION	**1**	**,488****	**,337****	**,254****
CANCER RISK PERCEPTION	**,488****	**1**	**,445****	**,137**
HADS_ANX	**,337****	**,445****	**1**	**,552****
HADS_DEPR	**,254****	**,137**	**,552****	**1**

*p < 0.05

* *p < 0.01

For our fourth aim we analysed the correlations between genetic risk perception and the cancer risk perception, and we examined the psychological dimensions within the whole sample. For our **fifth aim,** we worked towards a better investigation on how these correlations arise in the two groups objects of this study, i.e. probands and family.

Specifically, the correlative analysis made with Pearson's coefficient, allows us to observe how, in the probands group, genetic risk perception and cancer risk perception are significantly correlated only with depression ($r = .258$ $p < .01$; $r = .343$ $p < .01$), (Tab.12), while in the family group, genetic risk perception is significantly correlated with all the variables in exam, and cancer risk perception is correlated only with the genetic risk perception ($r = .607$ $p < .01$), anxiety ($r = .529$ $p < .01$) distress ($r = .411$ $p < .01$), (Tab.13).

Table 12: Pearson's correlation between genetic and disease perception and the psychological variables in the probands group (n 60)

	GENETIC RISK PERCEPTION	CANCER RISK PERCEPTION	HADS_ANX	HADS_DEPRESSION	DISTRESS THERMOMETER
GENETIC RISK PERCEPTION	**1**	**,330***	**,193**	**,258****	**- 0,36**
CANCER RISK PERCEPTION	**,330***	**1**	**,137**	**,343****	**,196**
HADS_ANX	**,193**	**137**	**1**	**,470****	**,468****
HADS_DEPR	**,258****	**,343****	**,470****	**1**	**,385****
DISTRESS THERMOMETER	**-,036**	**,196**	**,468****	**,385****	**1**

** p < 0.01

* p < 0.05

Table 13: Pearson's correlation between genetic and disease perception and the psychological variables in the family group (n 60)

	GENETIC RISK PERCEPTION	CANCER RISK PERCEPTION	HADS_ANX	HADS_DEPRESSION	DISTRESS THERMOMETER
GENETIC RISK PERCEPTION	**1**	**,607****	**,406****	**,329***	**,325***
CANCER RISK PERCEPTION	**,607****	**1**	**,529****	**,208**	**,411****
HADS_ANX	**,406***	**,529****	**1**	**,618****	**,656****
HADS_DEPR	**,329***	**,208**	**,618****	**1**	**,518****
DISTRESS THERMOMETER	**,325***	**,411****	**,656****	**,518****	**1**

** p < 0.01

* p < 0.05

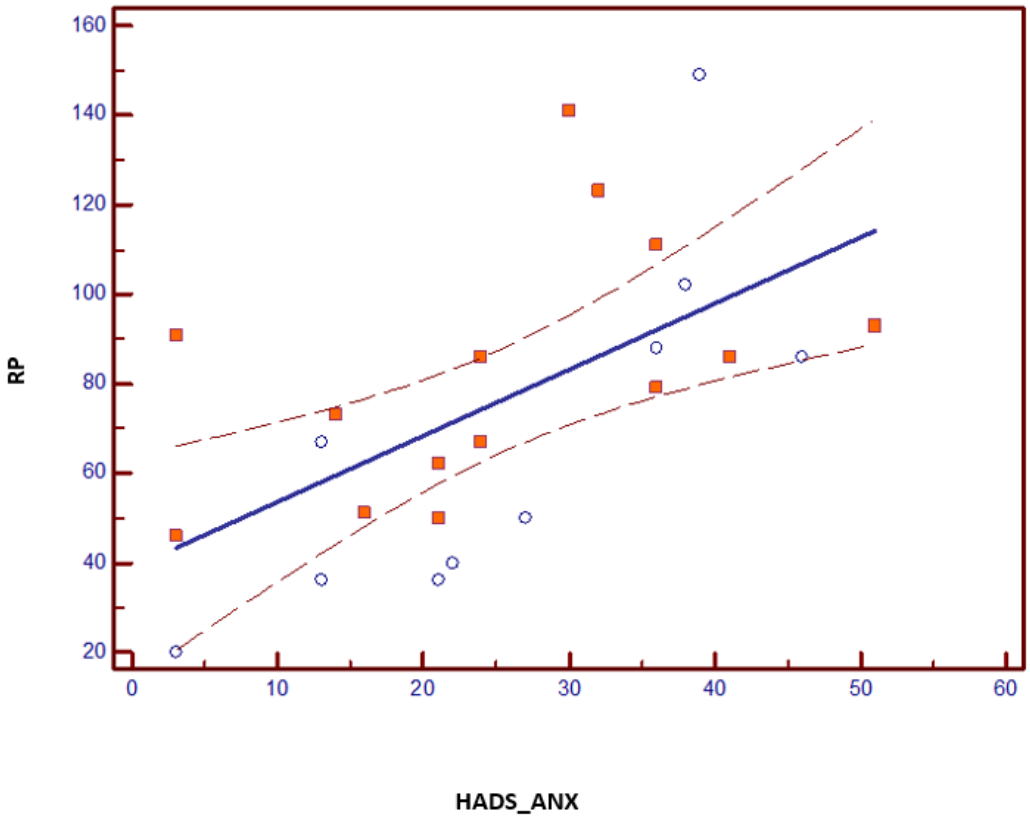
4.3 Regression Analysis

In order to examine in depth the role the (genetic and cancer) *Risk Perception* variable has in the arising of anxious and/or depressive symptomatology, and also following the fourth aim of this research, we applied a linear regression model on the whole sample. We started off with an analysis of the dependency link between the (genetic and cancer) risk perception and anxiety levels; later, we evaluated the association of the same independent variables with depression levels. The (genetic and cancer) risk perception represented dependent variable Y, while anxiety and depression represented independent variable X. Values of the coefficient of determination R^2 were examined (that represents the variability proportion between the Y observed values, as explained by the linear regression of Y over X), and also *slope* values (increase of Y at every increase of X unities). Data were represented via *scatter plot* and regression line. A 0.05 P-*value* threshold was used to evaluate the significativity of the obtained data.

The linear regression analysis between Risk Perception (RP) and anxiety levels, measured with the HADS_ANX sub-scales, revealed that RP is an important predictor of anxiety levels, showing an affirmatively correlation with the HADS_ANX sub-scale ($\beta = 0.377$, $p < 0.01$).

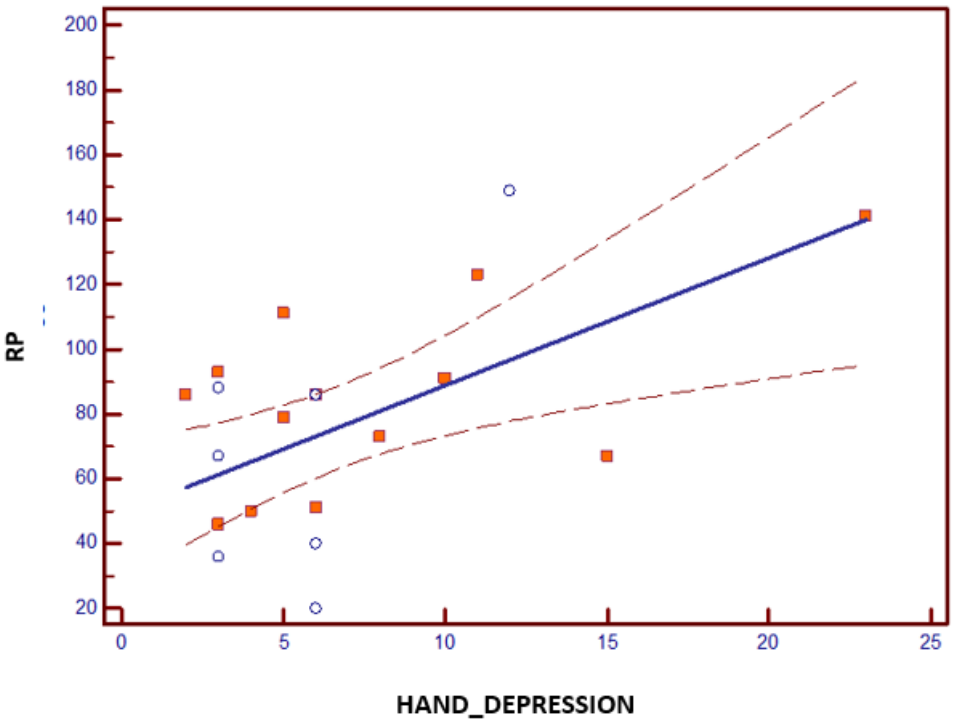
The variance, as explained by the variable in exam in this first analysis, is 40% ($R^2 = 0.40$) with a *slope* of 1.48 ($P = 0.0022$) (figure 1).

Figure 1: Regression analysis between Risk Perception and anxiety (HADS-Anx) (n=120)



On the contrary, the linear regression analysis between the same independent variable, i.e. risk perception (RP) and depression levels, showed a non-significant value, with a β value of 1.180 ($p<0.20$). The explained variance results in 14% with a slope of 1.97 ($P = 0.085$) (figure 2), which is a non-significant statistical data because the P value of < 0.05 was not reached.

Figure 2: Regression analysis between Risk Perception and depression (n=120)



Risk perception is then a modulatory and/or predictive factor in the development of psychopathological symptomatologies, and specifically affects more the anxiety levels than depression levels. (Tab. 14)

Table 14: Linear regression analysis (n=120)

	β	Confidence interval (nonstandard β)		*t*	*p*
		lower limit	upper limit		
HADS_Anx	, 377 **	0.201	1.067	1,04	0,001**
R^2 adjusted = 0.40	*				
ΔR^2 = –0.001	*				
HADS_Depr	,093	- 0.879	1.180	1,10	0,08
R^2 adjusted = 0.14					
ΔR^2 = –0.08					

*p<0.05 **p <0.01

5. Discussion

This study investigated on the existing relation between the Genetic Risk Perception and the Cancer Risk Perception in subjects under Oncology Genetic Counselling, considering it a predictive and/or modulatory factor in the arising of psychological symptomatologies, such as distress, anxiety and depression.

The results of the analyses confirm some of the hypotheses. Through the first baseline analysis of the whole sample, we noticed that subjects who are more concerned about inheriting and/or transmitting an hereditary-familial syndrome have, clinically speaking, more chances to develop an anxious/depressive symptomatology. Specifically, the greater is the genetic risk perception, the higher will be anxiety and depression levels, and the perception of developing a tumoral pathology.

Results show that both the Genetic Risk Perception and Cancer Risk Perception are important elements that can affect the emotional and behavioural dimensions of the subjects. Thoughts about a possible oncologic disease or about carrying a genetic mutation that can increase the risk of developing a tumour, affect the emotional sphere. In particular, the linear regression analysis allowed us to observe that, in our sample, the subjective (both genetic and disease) risk perception affects more the arising of anxious symptoms then depressive symptoms. In agreement with the literature (40), those anxious manifestations are linked to specific emotions and behaviours, such as fear of diagnostic examinations, feeling of guilt for a possible transmission of the mutation to children, responsibility towards the partner and difficulties in making plans for the future. Those emotions and/or behaviours, have strong impact on the clinical-therapeutic stages; indeed subjects show different attitudes towards the monitoring programmes (41). Usually, subjects who underestimate their own risk, have a low compliance to monitoring programmes, risking an advanced cancer stage diagnosis. On the contrary, subjects who overestimate their risk tend to use unreasonably the health care system, i.e. tests and follow-ups done closely and excessively (16). This leads to psychological costs, i.e. distress, but also to economic costs for the health care system.

Furthermore, thanks to correlative statistical analyses, we obtained significant differences in the two groups, probands and family. In the probands group, there was a mood deflection leaning towards depression, typically linked to the guilt subjects feel, concerning the fear of transmitting the oncologic diseases to their children.

On the contrary, in the family group, there were high levels of anxiety, connected to the fear of facing the preventive and/or therapeutic procedures linked to a tumoral pathology, such as having to undertaking a genetic test and starting a monitoring pathway. There was an elevated state of anxiety in the subjects with children group, which was affected by the Genetic Risk Perception.

Questions concerning risk perception and about the effect of genetic counselling on risk comprehension are rilevant (42) because genetic testing has the potential to reduce the morbidity and mortality from breast and gynaecologic cancers. It as reported that, prior to counselling, 50% of individuals tend to overestimate their risk of cancer development (43).

The changed perception in risk after genetic counselling has been widely studied (44), and is known from previous studies that women who are very anxious about the risk are helped by counselling, reporting a dicrease.

With regards to the clinical stage, subjects affected from an oncologic pathology showed high levels of anxiety/depression symptomatology during treatment, possibly an adjustment disorder that should be taken into consideration. This reflects the literature (45, 46).

This study showed the importance to take into consideration, during the process of genetic counselling, not only the single variables but also the whole picture gathered from the cognitive and emotional aspects from both the individual and family spheres, in order to assure adequate care of the patient. Moreover, it appears necessary to provide information highlighting usefulness of early diagnosis, and information regarding how the process of genetic counselling can be helpful for this purpose.

6. Conclusions

The data allow some conclusions. In general, the perception of risk influences the distress. In a setting of Oncological Genetic Counselling, the Genetic Risk Perception and the Cancer Risk Perception are very important variables that need to be taken into consideration and that can affect the arising of anxious/depressive symptomatology. The perception we have of events, and the importance we give to them, affects our emotional state and our healthy behaviours.

In conclusion, genetic testing for cancer is becoming more common, however, due to the recent introduction of OGC (Oncological Genetic Counselling) in our country, and the few specialised centres, the literature studies regarding Italian subjects are still very little.

According to a recent Italian study (23) to investigate how to improve our messaging and attraction to genetic services so that information might help create less worry and concrete plan. The subjects referred to a genetics counselling service have a perception of their risk of cancer and death healthy.

Specifically, the results seem to suggest that the evaluation of Risk Perception may be fundamental already in a pre-testing stage, with the purpose of identifying pathways of psychological intervention, throughout the Counselling pathway.

Although genetic testing and genetic counselling can strongly influence prevention behaviors and well-being of the individuals and families who are at increased risk, they may also have adverse short-term effects on emotional well-being.

Psychological support and an empathic relationship between the counsellor and the counselee were seen as important elements of genetic counselling. Some stressed the importance of support, stating that it is at least as important as the informational aspect, and that responding to the patient's emotional reactions may even take priority. Providing support in genetic counselling was seen as essential to enable the counsellee to make informed choices and cope with the test result.
The guidelines also advised the counsellor to consider that a test result – whether 'positive' or 'negative' – may alter the patient's self-concept. Relatives and friends, as well as support groups, were mentioned as important sources of emotional support. In the guidelines, counsellors were encouraged to suggest patients bring a support person, particularly when the test result is disclosed, and to refer the patients to appropriate professionals for further support whenever needed.

Using a cognitive-behavioural model and adopting specific strategies as psychoeducation, may help subjects under OGC become aware of the information in hand, and also shape them in a purely functional sense.
This research shows that subjects, who underestimate their own risk, have a low compliance to monitoring programmes, risking an advanced cancer stage diagnosis (considering the already existing elevated risk they have due to mutation). On the contrary, subjects, who overestimate their risk, tend to use unreasonably the health care system, i.e. tests and follow-ups done closely and excessively. This leads to psychological costs, i.e. distress, but also to economic costs for the health care system.

Genetic information that is both personal and familial was seen as often rising questions about who the patient exactly is, and what the moral obligations of the professional are towards the relatives who are at risk of a genetic disease.
All agreed that a patient has a moral obligation to share the genetic information with family members who are at risk, and that if this is relevant to other relatives, the patient should be recommended and even persuaded to disclose it. It was seen as important that the genetic information is shared with the partner, especially if it affects the children or decisions regarding family planning. But, even when there are no plans to have children, the result of a genetic test was seen as having a considerable impact on the family life. (40)

OCG should help counselees understand the information concerning the genetic risk; the decisional process includes the adoption of possible preventive behaviours, such as

undertaking preventive surgery. Recent studies demonstrated that those subjects, who receive psychological support throughout the decision-making process, are able to involve their family in a more effective way, with less emotional stress (9). Furthermore, psychologic counselling brings psychological benefits and allows a more precise risk perception, enhancing empowerment through the recovery and usage of personal resources.

Cancer genetic risk assessment and genetic counselling is a multistep process (8). The process begins by collecting information about the client's personal medical history and family history to assess heritable cancer risk. A psychosocial assessment is also performed to determine the client's perception of risk and ability to cope with risk information. Once this information is collected, a counselling model is used to discuss risk, facilitate adjustment to risk, provide informed consent for genetic testing when applicable, and review options for medical management. Genetic counselling is an integral part of cancer genetic risk assessment that enhances clients' ability to cope with and understand the genetic information presented. (40)

A limit of this study is that it's impossible to generalize from the geographically non-representative sample to the general population. Future studies should use a sample that is more representative of the national population, to replicate the findings and extend the analysis.

One limitation may be that, although this study population contained the most prevalent hereditary cancer syndrome (BRCA), it is not clear whether these finding can be generalized to other, less common, forms of hereditary cancer.

Another limitation of this study is that the influence of social factors, personality and coping stile were not examinated.

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