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Role of the Genetic Counselor in Familial Cancer

Technological advances in molecular genetics are revolutionizing the way medicine is practiced. The recent discovery of genes responsible for the inherited predisposition to hereditary breast, ovarian, and colon cancers will enable some high-risk individuals to receive more accurate information about their risk status. Because the ethical, legal, and psychosocial implications of testing and counseling for inherited cancer risk are substantial, adequate genetic counseling must accompany any genetic testing program.¹⁻⁴

Clinical investigations, supported by the Ethical, Legal, and Social Issues (ELSI) branch of the Human Genome Project, are underway, with the goal of determining how best to conduct the educational and counseling elements required in genetic testing for inherited cancer risk.⁵ Furthermore, standards are currently emerging for familial cancer risk counseling that can be conducted regardless of whether or not genetic testing is feasible or desirable in a particular situation.

The genetic counselor may provide a valuable service within an oncology practice that seeks to undertake familial cancer risk counseling. Presented here is an introduction to the genetic counselor as a member of such a team.

FAMILIAL CANCER RISK COUNSELING

Familial cancer risk counseling (FCRC) is a communication process between health-care professionals and an individual concerning the occurrence,

Increased knowledge about inherited susceptibility for cancer and the identification of genes associated with cancer risk has increased the need for individuals with training in genetics to work closely with oncology professionals in the familial cancer arena. Genetic counselors can provide a variety of useful services: They may function as clinical coordinators of a family cancer risk counseling (FCRC) program and serve as study coordinators on research teams. In the oncology practice setting, genetic counselors who are trained to do cancer risk counseling can help ascertain and evaluate familial clusters of cancers. In the context of FCRC, the genetic counselor can educate family members about risk factors for cancer and the significance of a positive family history, assess psychosocial functioning and provide psychosocial support and referrals. Genetic susceptibility testing should be offered only with appropriate genetic counseling.

or risk of occurrence, of cancer in his or her family.⁶ Familial cancer risk counseling is comprehensive in scope and includes a strong emphasis on the familial nature of cancers and the analysis of genetic and related risk factors.

A wide variety of activities may be included under the umbrella of FCRC (Table 1). Minimal elements that should be addressed are documentation of all cancer diagnoses in the family, provision of general cancer and genetic information, health promotion, supportive and/or grief counseling, determination

of suitability for genetic testing, and referral for further services as indicated. More detailed information on each of these elements can be found in the flowchart in Figure 1 and in the sections highlighting individual components of FCRC.

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Components of Familial Cancer Risk Counseling

Screening

Family history screening questionnaires

Tumor markers

Tumor registries

Brief Assessment, Interventions, and Triage

History and documentation

Genetic education

Health promotion

Supportive psychosocial counseling

Referral

Comprehensive Cancer Risk Assessment and Counseling

Full pedigree analysis

Genetic syndrome diagnosis

Risk calculation and communication

Genetic susceptibility testing

DNA banking

Psychosocial evaluation and counseling

Customized medical surveillance

Referral to and coordination with research studies

What Genetic Counseling Entails

Genetic counselors are increasingly joining, or offering consultation to, oncology practices that are interested in addressing the special needs of individuals at increased risk of developing cancer due to familial factors. Genetic counseling has been defined as "a communication process which deals with the human problems associated with the occurrence, or risk of an occurrence of a genetic disorder in a family."⁷ This process involves helping the individual or family to:

- 1) comprehend the medical facts;
- 2) appreciate the way heredity contributes to the disorder, and the risk of recurrence in specified relatives;
- 3) understand the alternatives for dealing with the risk of occurrence;
- 4) choose among alternative courses of action; and
- 5) make the best possible adjustment

risk of recurrence of that disorder.

Most persons who perform genetic counseling have professional training at the MD, PhD, or MS level, and are certified by professional organizations, such as the American Board of Medical Genetics and American Board of Genetic Counseling. Professional societies, such as the National Society of Genetic Counselors (NSGC) and International Society of Nurses in Genetics (ISONG), can be contacted for referrals. (NSGC Executive Office: 233 Canterbury Drive, Wallingford, PA 19086, telephone: 610-872-7608; ISONG: 3020 Javier Road, Fairfax, VA 22031, telephone: 703-698-7355).

Genetic Education, Medical Advice, Genetic Counseling, and FCRC

Familial cancer risk counseling involves a combination of services, including genetic education, genetic counseling, and medical advice. Although the FCRC practice usually involves a seamless blending of these components, it may be helpful to consider the essence of these components individually before returning to the process in which they are combined.

• **Genetic Education**—Persons dealing with genetic diseases, such as hereditary cancer, must assimilate a great deal of new information that is complicated and abstract. The genetic counselor can simply and clearly explain principles of medical genetics, patterns of inheritance, and an appreciation of probability. General education can also be offered regarding cancer epidemiology, the multistep process of cancer, and the spectrum of disease presentation, diagnosis, and treatment.

The counselor can define and illustrate chromosomes and genes, show examples of chromosomal karyotypes, and review pedigrees demonstrating the different modes of inheritance and how Mendelian recurrence risks are derived from those inheritance modes. Environmental factors that interact with genetic factors in a non-Mendelian fashion can be discussed in the context of the multifactorial mode of inheritance. In teaching family members the language and concepts of cancer genetics, the counselor can help them formulate a conceptual framework that will pave

encourage them to become active participants in their health care.

• **Health Promotion**—Genetic counselors are joining physicians, health educators, and oncology nurses who have been actively providing health promotion information about cancer prevention and detection. Examples include promotion of healthy lifestyle with nutritional and exercise components, smoking cessation programs, and cancer screening programs, such as prostate, breast, skin, and cervical screening. As will be discussed later, the family with a hereditary cancer syndrome may require more information and encouragement than does the general population.

• **Medical Advice**—Helping the family comprehend the medical facts about hereditary diseases is one of the important tasks of the genetic counselor. Although giving medical advice is generally outside the scope of practice of the genetic counselor, there are instances in familial cancer risk counseling in which the genetic counselor may be the person to convey or clarify medical facts.

The counselor working as part of the medical genetics team can also assist the family in implementing specific medical recommendations. For example, the counselor may relay and discuss standardized medical recommendations for surveillance and treatment, explain them to the family members in lay terms, help the family prioritize and implement these recommendations, provide input into developing new guidelines, actively promote healthy behaviors, coordinate medical appointments, and facilitate referrals.

• **Counseling** is a word that has very broad and multidimensional uses in the medical setting. Sometimes "counseling" is the umbrella term used to refer to all communication processes with the patient. However, in genetic counseling, the term has specific content and process. Several selected areas in which the genetic counselor incorporates active counseling include patient psychosocial assessment, anxiety reduction, grief counseling, enhancing adaptation to current medical stressors, facilitating decision-making about ge-

cal recommendations.

The modern genetic counseling process generally involves a nondirective approach to discussing, in a nonjudgmental fashion, the use of genetic information for reproductive decisions. This tradition emerged after World War II in response to the strongly eugenic policies and practices of genetics professionals earlier in this century, which lent support to forced sterilization and stigmatization of the "genetically unfit." Nondirective genetic counseling is used in situations in which options are similar in risk and benefit, or are considered experimental, controversial, or without adequate empiric evidence of benefit. Genetic susceptibility testing and prophylactic surgery are controversial issues in FCRC for which a nondirective approach may be still appropriate.

Recently, the appropriateness of the nondirective approach to genetic counseling has come under scrutiny.^{7a} Generally, the nondirective approach seeks only to assist the patient in recognizing how his or her own values fit with a particular decision. In certain areas of FCRC, the counselor takes a more directive stance than in reproductive counseling because available screening, prevention, or early detection options may be clearly superior to other options. For example, it would be inappropriate to present colonoscopy screening as optional for a person at high-risk for hereditary colon cancer. Rather, this would be presented as a medical recommendation from an appropriate specialist. The counselor may then work with the individual regarding following through with these recommendations.

FCRC IN THE ONCOLOGY CLINIC

A FCRC program assumes a preventive focus, since it is directed at persons who have not yet developed cancer. Identification of high-risk individuals enables the oncologist to target this population for specific prevention and early detection programs, and thus, has the potential to advance the oncology goals of reducing disease morbidity and mortality.

Formation of a FCRC service may serve as a basic building block for many

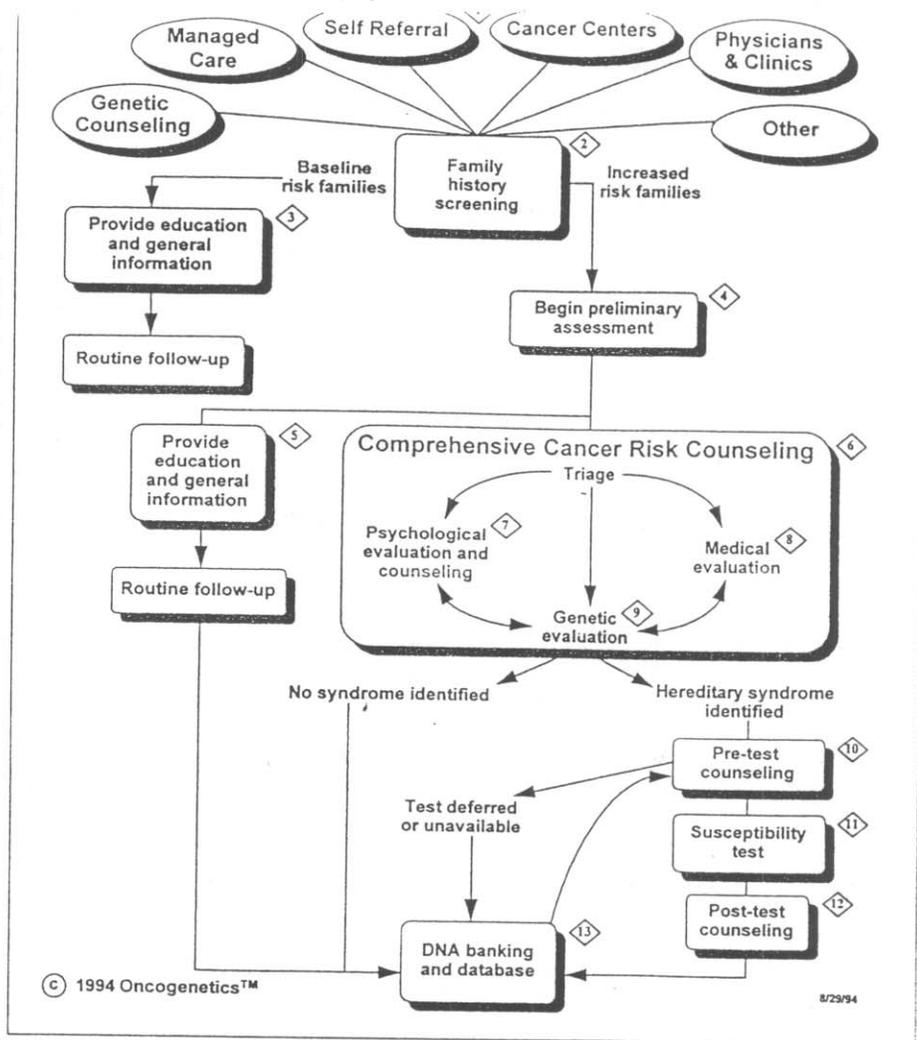


Figure 1: Cancer Risk Assessment and Counseling Protocol

of the technological advances to follow molecular advances in hereditary cancers. For example, family members of oncology patients may not be eligible for susceptibility testing without a FCRC program or clinical research protocol in place. Furthermore, FCRC may minimize liability due to negligence in several specific aspects of medical care. One of the hazards of not having an adequate FCRC program is that suboptimal advice regarding adequate risk assessment, screening, and testing may result if diagnoses of hereditary cancer predisposition syndromes are overlooked or risk assessment is provided in a haphazard, noninformed, or superficial way.

It is worthwhile to consider how an

FCRC program can be organized and run in order to fully understand the role of the genetic counselor. A more complete description of the process of forming a FCRC can be found elsewhere.⁶ The following sections deal briefly with components of FCRC in clinical practice.

PHASES OF FCRC

The oncologist may wish to consider implementing FCRC in several phases. These phases can then be combined or separated and carried out by several different professionals or primarily by one person who is designated the cancer risk counselor. The sections below are numbered to correspond to the flow diagram in Figure 1, which describes

General Feature of Hereditary Cancer Syndromes

- Cancer in two or more close relatives
- Bilateral cancer in paired organs
- Multiple primary tumors in same individual
- Earlier-than-usual onset of disease
- Specific constellation of tumors that comprise a known cancer syndrome

one possible triage system for implementing the phases of FCRC. These run the gamut from screening one's clinic population to various short interventions that could be undertaken in routine office visits to the more comprehensive cancer risk counseling, for which additional appointments will be needed.

1. Referral Sources

Referral sources may vary widely, initially being self-referrals generated by media or marketing exposure, requests from relatives of oncology patients in an oncology practice, or referrals from other specialists. Tumor registries could also be used to identify suitable individuals for cancer risk counseling following acquisition of detailed family histories.⁸ Contact of family members should always be done with the permission and cooperation of the index case to preserve privacy of family members and confidentiality of genetic and oncology information.

2. Family History Screening

A family history screening questionnaire can accompany a medical history form completed in the physician's office or be filled out by the participant and mailed back in advance of the appointment. Identification of both maternal and paternal cancer history is necessary. While such history-taking appears to be fundamental to sound practice, there is empiric evidence that it is frequently overlooked. Lynch and colleagues have demonstrated that a substantial portion of their oncology clinic had two or more relatives with cancer, and that medical records often did not adequately or correctly document family history of cancer, judging by a retrospective review of records.^{9,10}

Individuals with negative family histories and minimal family concerns can receive educational material and standardized information on cancer prevention and screening.

4. Preliminary Assessment

Initial screening can be performed by a nurse or other staff member. Families with a positive history for cancer should have their family history expanded to three generations. Documentation of all types of cancer is necessary, as some cancer susceptibility genes may predispose the person to a variety of cancers and other physical signs. For example, renal cell carcinoma, pheochromocytoma, retinal angiomas, and cerebellar hemangioblastomas are all associated with von Hippel-Lindau disease, a well-described familial cancer syndrome due to mutation of a single dominant susceptibility gene. Numerous other cancer associations are not yet recognized as defined syndromes.

It is important to augment documentation of cancer diagnoses with ages of onset, current ages, presence of bilateral disease, and occurrence of multiple primary cancers in the same individual. A genetic counselor can independently obtain and verify family histories that provide the basis for the genetic evaluation and all future DNA-based predictive testing. Collection and review of records is a time-consuming endeavor but is critical in ensuring the accuracy of a history on which a diagnosis is based.

Certain features of the family history should raise the suspicion of a familial cancer and indicate the need for comprehensive cancer risk counseling. General features of familial cancer syndromes are summarized in Table 2, while specific examples of known hereditary syndromes are given in Table 3.

5. Health Promotion

At this stage, some participants will request or require only general information based on a review of the family, medical, and psychosocial history. This may be an opportunity to incorporate genetic information into current health promotion programs regarding mammograms, Pap smears, prostate screening, lifestyle improvement, and breast self-examination (BSE). The benefits of knowing one's risk status should be

or she may partake in specialized surveillance programs that might not be offered to an individual with average cancer risk.

It is important for individuals with increased cancer risk to understand why and in what ways the recommendations for the general public may be inadequate for individuals in families in which hereditary risk is increased. For example, the current general population recommendations for colon surveillance by sigmoidoscopic examination are not appropriate for members of hereditary non-polyposis colon cancer (HNPCC) families. These individuals require colonoscopy to detect the majority of lesions that occur on the right side of the colon. Also, when there is a history of early-onset cancer in the family, such as a mother with premenopausal breast cancer, screening may be appropriately offered to individuals at earlier ages than standard general population guidelines suggest.

6. Comprehensive Cancer Risk Counseling

Selected individuals who desire further information about their personal risk factors for cancer, need specialized surveillance guidelines, and may be candidates for genetic testing protocols can be referred for comprehensive cancer risk counseling (CCRC). The CCRC team can identify and counsel families with significantly increased cancer risk, collect thorough medical and family history data, calculate and effectively communicate quantitative assessment of cancer risk, diagnose hereditary syndromes, coordinate cancer susceptibility testing, promote psychosocial well-being, and offer health education, as well as recommendations for prevention, early diagnosis, and management. This process has been described in detail elsewhere.¹¹⁻¹⁷

Generally, these activities require interdisciplinary expertise, minimally including professionals trained in genetics and oncology. The familial cancer risk counselor could be a genetic counselor,

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least a masters level training and professional certification/licensure.

7. Psychosocial Evaluation and Counseling

The emotional impact of cancer goes beyond the person diagnosed with the malignancy; family and friends also are deeply affected. Supportive or grief counseling can be important for unaffected relatives dealing with actual or potential losses of loved ones, practical matters of adjustment to changing family roles, or fears about their own health.

We cannot assume that every person with a positive family history of cancer in relatives will be similarly affected by their past experiences. Rather, there will be a range of both positive and negative responses to these experiences. The current reactions may be colored by past experiences, such as biologic proximity and emotional ties to affected relatives, beliefs and fears about cancer, history of childhood trauma, loss, or abuse, major life transitions, outcomes of cancer diagnoses, and family communication styles. Commonly, feelings of grief over the loss of a close relative become more poignant during pregnancy, at the time of a mammogram or yearly physical examination, or at the anniversary of the loss of a relative to cancer. Age of daughters during a mother's illness can be significant; often, adolescent daughters have the most difficult time later in life, especially in the resolution of sexuality issues.¹⁸ In contrast, some individuals become inspired by the courage shown by affected relatives. Others report increased family support and cohesion.^{18a}

Ability to process and retain new information also can be influenced by cultural beliefs, levels of intelligence, education, and psychological distress. Participants in FCRC need an opportunity to process new information and adjust to the feelings that arise when considering the implications of having an increased risk for cancer. Lerman and colleagues¹⁹ have demonstrated that "those women who had been most preoccupied with breast cancer were the least likely to improve their personal risk comprehension following the receipt of more accurate risk information." They conclude, "Efforts to counsel women about their breast can-

also addressed.

Some identified psychosocial tasks that can become part of FCRC include confronting the meaning of one's risk status; venting strong feelings; help in facing fears of harm, disfigurement, pain, or death; anxiety management; coaching in problem solving; facilitating decision-making strategies; teaching positive, active coping behaviors; and referral.²⁰

A valuable part of FCRC is to help the individual understand that survival after cancer is possible. Several investigators have observed that members of families in which relatives have succumbed to cancer equate cancer with death. The psychological benefits of distinguishing a cancer diagnosis from certain mortality can be immense. The benefits of instilling and supporting realistic hopefulness cannot be overestimated.

Psychological identification with the affected family member often is very strong among those at risk.^{20a} Resemblance to an affected relative, such as similar physical appearance, complexion, personality, or anatomic features, may become grounds for a person assuming that he or she will also develop cancer. Disabusing family members of this erroneous assumption can bring substantial relief and a sense of liberation.

Correct timing of offering FCRC is important psychologically. There are several situations in which emphasis on genetic risk may be counterproductive. For example, persons caring for an ill relative may be too overburdened or preoccupied to receive genetic information. Those individuals already immobilized by anxiety about cancer need support and anxiety management rather than more information. The risk counselor can validate "the right *not* to know" certain information at a particular time while also encouraging the person to return for further counseling at a more suitable future date.

Occasionally, outside psychotherapy or psychiatric referral is necessary. Indications for such referral include: an inability to make and implement health-care decisions; clinical levels of depression, guilt, or anxiety; unresolved grief; suicidal ideation; obsessive, intrusive thoughts; overzealous health vigilance;

function, satisfaction, and desire.

8. Medical Evaluation and Recommendations

The cancer risk counselor may be able to help the family understand and carry out medical recommendations by locating resources and removing barriers to health care. The genetic counselor or on the FCRC team may assist the oncologist in coordinating medical assessments and interventions for symptomatic patients, and in designing and implementing appropriate medical surveillance of asymptomatic persons at increased cancer risk.

The ability to triage appropriately is most important in determining a possible medical basis for self-referral. In the authors' experience, some people may be motivated to seek FCRC by the discovery of physical symptoms, which they fear may represent cancer. Although they may present the reason for FCRC referral as their positive family history of cancer, in actuality, they may be indirectly seeking to enter into the medical system to deal with a personal symptom. In general, this crucial information can be uncovered during a sensitive interview, whereas it might be missed if the oncology center took a strictly educational approach to risk counseling. Genetic evaluations should be delayed until symptomatic patients have received a complete medical evaluation.

Both symptomatic and asymptomatic persons also need to receive medical recommendations for cancer surveillance, customized for their situation. For example, women with inherited BRCA1 mutations are at risk for ovarian and colon cancers, as well as breast cancer. Furthermore, two women with the same risk for breast cancer may have differences in breast anatomy and density that would lead to different recommendations for effective surveillance.

• **Prophylactic surgery** as a means of cancer prevention is highly controversial. Genetic, medical, and psychosocial issues all come into play. In some hereditary conditions, such as familial adenomatous polyposis (FAP), prophylactic surgery has been shown to be effective in preventing mortality from

in the adenomatous polyposis coli (APC) gene, which is responsible for FAP, remain at risk for other serious health problems, such as multiple desmoid tumors.

Other diseases, such as breast and ovarian cancers, lack strong empiric evidence about the effectiveness of prophylactic mastectomy and oophorectomy in preventing mortality in those with a hereditary predisposition. Whereas prophylactic surgery may be the preferred option for some individuals, it is not without substantial physical and psychological hazards. These difficult situations call for multidisciplinary, multifaceted approaches that include accurate and comprehensive FCRC, along with medical and psychosocial management that fully explores all viable options for prevention and detection.^{14,22}

9. Genetic Evaluation and Risk Assessment

Because genetic cancer screening and risk notification can have adverse

health promotion, communicating cancer risk information should be done mainly within the context of a full risk counseling program or a clinical research protocol.⁷ Risk assessment refers to the process of quantifying the probability that an individual will develop cancer due to the presence of such variables as family history, environmental exposures, and lifestyle. This process has recently been reviewed.^{17,24}

Historically, risk assessment information has been derived from epidemiologic studies of associations between exposures to risk factors and disease states. The data from various studies have often been contradictory and presented in the form of relative risk, which is not clinically useful. Recent efforts have been made to design risk tables that are more easily interpretable to families.²⁵⁻²⁸ Depending on the putative mode of inheritance of cancer risk in a particular family, different risk assessment models for breast cancer and other cancers are currently in use. It is

a specific family in order to avoid gross overestimates or underestimates of risk.

• **Conveying Risk Information**—It is essential that risk information be communicated in a way that is meaningful to the participant. For example, some counselors use fractions, eg, one in five, while others describe risk in terms of percentages, eg, 20%. It also is customary to turn the risk figure around to state the individual's chance of *not* developing the condition; eg, a 20% risk of cancer means a 80% chance of *not* getting that cancer.

In certain situations, the numeric risk estimate should be presented as the best assessment possible, considering the limitations of using currently available data. The choice of specific language used to describe risk can also have a significant impact; eg, differentiating between *increased* risk and *high* risk. Two women, each of whom have a mother with breast cancer, may both have an increased risk; however, the risk of one may be only slightly increased above baseline, whereas the other may have a significantly increased risk approaching 50%, depending on other characteristics of the history.

It is also essential to realize that absolute risk is not the same as perceived risk. A risk of 50% may sound high to one person, but to another woman with the certain conviction that she will die from cancer at a young age, it may be a great relief to know that the risk is not 100%. This is one of the areas in which the training, experience, and skill of the risk counselor contribute to the "art" of cancer risk counseling.

• **Identifying Hereditary Cancer Syndromes**—At present, identification of hereditary cancer syndromes is based on clinical and family history criteria.^{29,30} The genetic counselor, working in conjunction with the oncologist, may identify a hereditary cancer syndrome in a particular family, leading to risk counseling based on Mendelian inheritance of genetic susceptibility. Predictions of developing cancer will vary with gene expression and penetrance, as well as chance and other synergistic factors.

If pedigree analysis supports identification of a known hereditary syndrome, risk assessment can be

Table 3

Selected Hereditary Cancer Syndromes

Syndrome	Clinical Manifestations	Genetic Mutations	Mode of Inheritance
Breast-ovarian cancer syndrome	Breast cancer Ovarian cancer Colon cancer Prostate cancer	BRCA1 BRCA2	Autosomal dominant
Hereditary non-polyposis colon cancer (HNPCC)	Colon cancer Endometrial cancer Stomach cancer Ovarian cancer Other cancers	MSH2 MHL1 PMS1 PMS2	Autosomal dominant
Familial adenomatous polyposis (FAP)	Florid colonic polyps Colon cancer Desmoid tumors	APC	Autosomal dominant
Li-Fraumeni syndrome (LFS)	Breast cancer Brain cancer Sarcoma Leukemia Adrenocortical cancer	p53	Autosomal dominant
von Hippel-Lindau (VHL)	Renal cell carcinoma Hemangioblastomas of cerebellum, brainstem, spine Retinal angioma Pheochromocytomas	VHL	Autosomal dominant

Adapted from Schneider KA, Diller LR, Gärber JE: Overview of familial cancers. *Genet Resource* 8(1):33-34, 1994.

can be classified into two groups.¹⁶ The first group includes conditions in which cancer is the primary manifestation of laboratory-identified

germ-line mutation. For example, multiple types of cancer are directly attributable to germ-line p53 mutations in the Li-Fraumeni syndrome, and breast and ovarian cancer are due to BRCA1 germ-line mutations. The second group is comprised of genetic conditions with prominent physical manifestations in addition to an increased risk for cancer. For example, in neurofibromatosis, the hallmarks of which include café-au-lait skin spots and benign neurofibromas, there also is an increased risk of developing malignant tumors.

There will be a substantial subset of participants in many FCRC programs who appear to have familial clusters of cancer but in whom no specific syndrome can be identified (O. Ginsberg, S. Narod, personal communication, 1994). These could be due to chance, polygenes, small kindred, incomplete family history information, nonpenetrance, epigenetic phenomena, or the presence of an unrecognized syndrome. In these cases, it is suggested that the family consider DNA banking on affected relatives who may be elderly or in poor health. This could allow at-risk relatives to have appropriate samples of DNA available for testing when new gene discoveries are made.

10. Pretest Counseling for DNA-Based Cancer Susceptibility Testing

Frequently in medical practice, only minimal information is given to the patient about medical testing being performed unless and until there is an abnormal result. The situation differs for genetic testing because of the profound nature of the information obtained from the test. For those determined to be eligible and motivated for cancer predisposition testing, it is necessary to offer a pretest counseling session to obtain informed consent for test participation and follow-up. The genetic counselor can be highly effective in nondirectively assisting eligible persons in deciding whether or not to undergo a test being offered.

Informed consent traditionally includes a description of test procedures, specificity, and sensitivity, as well as

the nature of the sample's nature of genetic testing procedures and the nature of results the individual receives, informed consent for cancer susceptibility testing should include information

role of probability in cancer prediction, the familial nature of testing, and the possible effects of results on insurance, employment, economic status, mood, and family relationships.

In particular, individuals should clearly understand the difference between susceptibility and disease diagnosis to avoid serious misunderstandings. It has been demonstrated in other settings that some persons who test positive for a hereditary cancer gene mutation believe that they actually have cancer (P. Boyd, personal communication, 1994).

It is also important to inform participants that many genetic tests for cancer susceptibility are currently being performed under research protocols in which results may not be provided at all or may take months to years to become available. For some hereditary cancer testing protocols, a thorough discussion of both direct DNA testing by mutation screening or sequencing and indirect DNA testing by linkage analysis are required. It is especially important that families understand the advantages and limitations of both of these modalities of DNA testing.

11. Cancer Predisposition Testing

Genetic susceptibility studies have the potential for improving the accuracy of cancer risk estimates for family members at risk for cancer. Genetic counselors may be involved as clinicians making referrals for testing, as members of research teams coordinating such studies, or as representatives of private laboratories offering testing.

Initially, eligibility criteria for cancer predisposition testing may be strict, and will mainly include those families in which cancer is likely to be explained by a single susceptibility gene. Testing may be especially helpful for individuals within these families who are considering undergoing prophylactic surgery for cancer prevention and who may wish their risk status to be as accurate as possible before undertaking such an irrevocable step.

In general, genetic testing usually begins with DNA analysis of a blood specimen on an affected relative. If he

found to have a cancer susceptibility gene, testing can then be offered to other unaffected relatives who express an interest. Population screening of those

with a family history of cancer is not yet feasible nor desirable.^{31,32}

Testing of minors for adult-onset diseases is generally discouraged unless clear medical benefit may result from such testing. Familial adenomatous polyposis (FAP) is a cancer susceptibility syndrome caused by inheritance of a germ-line mutation in the APC gene. In FAP, symptoms including polyps can be observed from adolescence onward and the disease confers a nearly 100% lifetime risk of colon cancer unless surgically prevented by colectomy. Since it has been recommended that medical surveillance of FAP be initiated between the ages of 10 and 12 years in individuals at 50% risk of inheriting a mutation in the APC gene,³³ it might be sensible to consider genetic testing at the same age. A major benefit of genetic susceptibility testing is that a minor who has tested negative for an APC mutation could be spared the attendant risks of repeated invasive medical surveillance procedures. In contrast, there would be no clear medical benefit to testing a much younger child (eg, at 2 years) well before medical surveillance would be initiated.

Because the implications of genetic susceptibility testing are so profound, the highest standards of quality control should be maintained in testing. In the United States, "clinical laboratories performing an examination of materials derived from the human body for the purpose of providing information for the diagnosis, prevention, or treatment...of human beings" must obtain certification from the Health Care Finance Administration (HCFA) under the Clinical Laboratory Improvement Act of 1988 (CLIA88).³³ Genetic counselors and geneticists may be helpful in choosing a laboratory for susceptibility testing, whether it be a research or clinical setting.

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any required to convey test results. This allows privacy and freedom from coercion from well-meaning family members. The participant is usually encouraged to bring a support person who is not at risk for the same disease. The counselor should begin the session by asking the person whether results are still desired. The results should be given as early in the session as possible to avoid drawing out the suspense. The implications and limitations of testing can then be explored in light of the result. Often, an individual may experience some emotional shock on the day that the results are given and the session may be brief, with follow-up planned by telephone or in person.

Medical advice is important for individuals carrying susceptibility mutations who are vulnerable to developing a variety of cancers. Medical recommendations regarding various combinations of surveillance, surgery, and other prevention measures are warranted.

Individuals who do not have the susceptibility gene running in their families may be psychologically relieved and freed of unnecessary medical procedures. Although they still have a chance of developing cancer due to non-hereditary factors, this risk is no greater than the population average.

Those who test negative, as well as positive, need follow-up because depression, anxiety, guilt, and other emotional reactions are equally likely to occur in both groups. Since the psychological effects of testing can endure for months or even years after receiving results, follow-up visits are essential. Survivor guilt has been reported in women from hereditary breast-ovarian syndrome families who learned that they did not inherit the germ-line mutation. Further counseling and support may assist individuals who experience these effects.

13. DNA Banking

DNA banking is available and is encouraged for families with familial clustering of disease. Specimens from affected individuals and other key family members placed in a qualified DNA bank can be kept indefinitely and ensure access to future tests as they become available.

Working with familial cancers has a number of advantages. Genetic counselors may function as clinical coordinators of an FCRC program, ensuring its overall smooth operation and comprehensive family approach. Genetic counselors also may serve as study coordinators on research teams, who develop and maintain ongoing relationships with research families that may endure for years. In addition, the genetic counselor trained to do cancer risk counseling can enhance clinical practice by helping to ascertain and evaluate familial clusters of cancers. This can be accomplished by obtaining family history information and constructing pedigrees and by confirming cancer diagnoses through retrieval of medical records. In the context of FCRC, the genetic counselor can educate family members about risk factors for cancer and the significance of a family history of cancer, offer psychosocial support, and provide counseling for genetic susceptibility testing when appropriate.

As knowledge about inherited susceptibility for cancer increases and additional genes associated with cancer risk are identified, there will be an increased need for individuals with training in genetics to work closely with oncology professionals in the familial cancer arena.

*This article is reviewed
on pages 175 and 176.*

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