Review Article

Non-directive Genetic Counselling – Respect for Autonomy or Unprofessional Practice?

Wei Shieng Chieng,[1] *BSc Hons*, Noreen Chan,[1] *MBBS, FAChPM, FAMS*, Soo Chin Lee ,[1] *MBBS, MRCP, MMed*

Abstract

Historically, genetic counselling was developed in the West and in the field of neonatal medicine, and a non-directive approach has been its central ethos since the 1950s to 60s. In today's changing world, the question of whether non-directive genetic counselling with its emphasis on patient autonomy may in some occasions be perceived as unprofessional practice. Through these 4 case studies in cancer genetic counselling, we seek to highlight the conundrums, dilemmas and various other considerations of patients and their families faced during the genetic counselling process. We also address the pitfalls of a 'one-size fits all' approach of non-directive counselling and how we could best practice cancer genetic counselling in the Singapore context, taking into consideration respect for patient autonomy and healthcare professionalism.

Ann Acad Med Singapore 2011;40:36-42

Key words: Cancer genetics, Hereditary cancer

Introduction

About 5% to 15% of all cancers are hereditary and due to germline mutations in cancer predisposition genes.[1] With the human genome project and its impact on molecular medicine today, we are now able to clone key cancer predisposition genes and better characterise major hereditary cancer syndromes. This has led to the development of cancer genetics as a subspecialty in the field of oncology. Genetic testing for common hereditary cancer syndromes such as hereditary breast and ovarian cancer due to the *BRCA1/2* genes,[2,3] Lynch syndrome due to mutations in the mismatch repair genes[4-6] and familial adenomatous polyposis due to mutations in the *APC* gene[7] are now clinically available in commercial testing laboratories. With such specialised information made available as public information and healthcare service, genetic counselling programmes are being integrated in clinical care to provide assessment and management of high-risk cancer families. A non-directive approach has been the central ethos to genetic counselling since the 1950s and 1960s.[8]

History of Genetic Counselling and Its Association with the Non-directive Approach

Historically, the work of genetic counselling was initially not carried out by genetic counsellors. In fact, the work of genetic counselling was first provided by research medical geneticists who were non-physicians. Being primarily trained to be research-oriented and being affiliated with academic institutions rather than a hospital setting, they were not instinctively paternalistic or directive in their approach to 'genetic counselling' or interaction with patients, compared to conventional doctor-patient interaction in those days.[8] Rather, they understood their role to be neutral transmitters of genetic information to individual families.[9] Interestingly, the term 'genetic counselling' was only coined in 1947 by Sheldon C Reed, American pioneer of genetic counselling and behavioural genetics. This term sought to dissociate from the eugenics movement, which was strong in the early part of the twentieth century. Reed feared the practice of genetic counselling would have been rejected if perceived as another technique of eugenics. Rather, he described genetic counselling as a kind of 'genetic social work', and stressed the psychosocial aspect of genetic counselling.[9,10]

With the first amniocentesis done in 1967, the earliest kind of genetic counselling was predominantly focused on foetal diagnosis of risk of congenital diseases, based on Mendelian genetics. It involved reproductive decisions such as deciding whether to keep the foetus or aborting it

[1] Department of Haematology-Oncology, National University Health System, Singapore
Address for Correspondence: Dr Soo Chin Lee, Department of Haematology-Oncology, National University Health System, Singapore, Level 7, Tower Block, 1E Kent Ridge Road, Singapore 119228.
Email: csilsc@nus.edu.sg

and other family planning issues.[8,11]

The introduction of non-directiveness in genetic counselling began when, at least in the United States, psychologists and social workers who were trained in humanistic psychology, started to work in the field of human genetics. This growing understanding of the psychosocial aspects of genetic counselling led to the concerns of supporting the values and decision-making process of the patient.[9] With the founding of post-graduate training programmes in genetic counselling, efforts to find a more organised theory and education in genetic counselling led to the adopting of Carl Roger's theory of client-centered, non-directive counselling, beginning with the Sarah Lawrence College in 1969.[8] Roger's theory states that the non-directive approach is one in which the client defines the problem and selects life objectives with the counsellor helping the client to find ways to achieve the stated goal.[9] During this period, the support of non-directive genetic counselling was also shaped by various other factors, such as society giving greater recognition to human rights, abortion rights, patients rights, disability rights and feminists movements.[8]

The association of non-directive genetic counselling was emphasized with the influential and often quoted definition of genetic counselling, which was formulated by the American Society of Human Genetics committee in 1975. It states in part that genetic counselling seeks to "help the individual or family… choose the course of action which seems appropriate to them".[12] The Code of Ethics of the National Society of Genetics Counselors also states that genetic counsellors "respect their clients' beliefs, cultural traditions, inclinations, circumstances and feelings" and "enable their clients to make independent decisions, free of coercion, by providing or illuminating the necessary facts…".[13] In addition, the "Code of Ethical Principles for Genetics Professionals" states that genetics professionals "provide counselling that is non-directive… and respect the choices of patients and families".[14] Hence, the emphasis on avoiding coercion and supporting the patient's decision came to be associated with non-directive genetic counselling to protect the autonomy of the patient, giving him or her the rights to non-interference in decision making.

Cancer Genetic Counselling in Singapore - A Local Context

Cancer is the leading cause of morbidity and mortality in Singapore.[15] Cancer genetics and cancer risk assessment programmes as a subspecialty in oncology has been established in Singapore since 2001, and serves as the primary prevention arm of oncology. Since the Cancer Risk Assessment clinic's inception at the National University Hospital in January 2001, 611 high-risk families have been evaluated in this clinic, of which 25% of index patients were cancer-free. Patients with hereditary breast and/or ovarian cancer syndrome (51%) and Lynch syndrome, also known as hereditary non-polyposis colorectal cancer (29%) form the majority of the cases (Table 1). To date, 88% of patients have been assessed with at least 10% chance of having a hereditary cancer syndrome and offered genetic counselling and testing. Of these, 37% underwent genetic testing, and 23% of those tested were found to carry a deleterious genetic mutation (Table 2). Apart from the common *BRCA1/2* hereditary breast and ovarian cancer syndrome, Lynch syndrome, and familial adenomatous polyposis, other rare cancer syndromes that were tested for in our clinic include Li-Fraumeni syndrome, Cowden syndrome, Von Hippel Lindau syndrome, hereditary paraganglioma, as well as hereditary leiomyomatosis and renal cell cancer (HLRCC).

Table 1. Characteristics of Patients Evaluated in the Cancer Risk Assessment Clinic (n = 611)

Age	
Median (Range)	42 (14-83)
Ethnic Group	
Chinese	75%
Malay	10%
Indians	5%
Others	10%
Gender	
Male	19%
Female	81%
Index patient affected with cancer	75%
Categories	
Breast cancer related cases	51%
Colorectal cancer related cases	29%
Lynch syndrome	26%
Familial adenomatous polyposis	2%
Oligopolyposis/Hyperplastic polyps	1%
Others	20%
Familial cancer clustering not distinctive of known hereditary cancer syndrome	12%
Hereditary diffuse gastric cancer	3%
Li Fraumeni syndrome	2%
Von Hippel Lindau syndrome	1%
Cowden syndrome	1%
Other rare syndromes[1]	1%

[1] Multiple endocrine neoplasia/ Hereditary paraganglioma syndrome/ Familial clustering of pancreas cancer/ Hereditary leiomyomatosis and renal cell cancer syndrome/ Turner Syndrome

Table 2. Genetic Testing in the Cancer Risk Assessment Clinic

Patients who underwent genetic testing (n = 198)	
Test Category	%
BRCA1/2	44
MLH1/MSH2	44
APC Protein Truncation Test	4
Others	8
Hereditary diffuse gastric cancer (*CDH-1*)	3
Von Hippel Lindau syndrome (*VHL*)	1
Cowden syndrome (*PTEN*)	1
Li-Fraumeni Syndrome (*P53*)	1
Hereditary Leiomyomatosis and Renal Cell Cancer (*FH*)	1
Hereditary paraganglioma (*SDHD*)	0.5
Turner syndrome	0.5
Patients identified with deleterious germline mutation (n = 46)	
Test Category	%
BRCA1/2 mutation	50
MLH1/MSH2 mutation	33
APC mutation	11
Others	6
Hereditary Leiomyomatosis and Renal Cell Cancer (*FH*)	2
Hereditary paraganglioma (*SDHD*)	2
Turner Syndrome	2

The Cancer Risk Assessment Programme at the National University Hospital runs a weekly clinic. A new case consultation typically lasts 45 to 60 minutes, while a follow-up consultation 15 to 20 minutes. Patients are usually evaluated and counselled individually or with their family members. During each new case consultation, the patient's cancer and family history is evaluated, and a clinical diagnosis of a possible hereditary cancer syndrome made if applicable. Patients who were assessed to have at least 10% chance of having a hereditary cancer syndrome are provided genetic counselling on the suspected syndrome, along with its lifetime cancer risk, the mode of inheritance and the option of genetic testing. Genetic testing is discussed with its potential advantages, disadvantages and implications. The cost of genetic testing ranges from S$1800 to S$2800 for comprehensive sequencing in an index patient, while that of predictive testing of a family member ranges from S$300 to S$500. Costs for genetic testing are all out-of-pocket expenses, and are not subsidised by the government or payable by Medisave.

We describe 4 case examples of how genetic counselling was carried out locally, using either the conventional non-directive approach, or the more directive approach in selected cases, to assist patients and their family make informed choices with regards to genetic testing.

Case Study 1 (Fig. 1)

Mdm C is a 33-year-old Chinese female who was recently diagnosed with young onset, stage II breast cancer. Her paternal aunt developed bilateral breast cancer in her 30s, and a paternal first cousin was diagnosed with breast cancer at 35. Mdm C is recently divorced with 3 young daughters. She came to see us with her new partner, whom she planned to marry the following year, to discuss genetic testing. She was informed that, given her personal and family history of cancer, she had 30% to 35% chance of carrying a *BRCA1/2* mutation that causes hereditary breast and ovarian cancer syndrome. Mdm C's partner was keen for her to undergo testing, expressing concern for their future children. Mdm C, however, was ambivalent about genetic testing, which she felt would not impact on her decision to have another child with her partner. She had in fact undergone tubal ligation following the birth of her third child 3 years ago, and was planning to reverse the procedure in a few months in order to conceive. Because of these plans, prophylactic mastectomy and/or oophorectomy to reduce her lifetime cancer risk, even when found to carry a *BRCA1/2* mutation, was out of the question. Mdm C's partner however, appeared hesitant to have children if Mdm C was found to carry a cancer-causing mutation, and preferred that she undergo genetic testing. While Mdm C felt that her reproductive decision would not be influenced by the genetic test results, she conceded that she would proceed with testing upon her partner's request. We encouraged them to take more time to consider their options and arranged for a follow-up session.

Mdm C is an example of a moderate risk individual who may benefit from genetic testing to further refine her cancer risks and strategise screening and preventive options. However, her case was complicated by her wish to have another child soon with her new partner, even though she had only recently recovered from cancer, may have a hereditary cancer predisposition, and already has 3 children from her first marriage. In the conventional paternalistic doctor-patient relationship, the physician may strongly advise her against pregnancy, at least in the next 2 to 5 years, given her recent cancer diagnosis. However, such a recommendation would be based predominantly, if not solely, on medical considerations, without much regard on the patient's social, family and cultural circumstances. Often, physicians, trained to focus on medical matters, may not appreciate or have too little time to appreciate the relevance of non-medical considerations that may be ranked highly by the patient. By adopting the conventional non-directive approach in this case, we encouraged the couple to discuss extensively the issue of genetic testing

in order to reconcile their expectations of having children based on genetic information. In this approach, we served as providers of medical information and facilitated open discussions to assist the couple in understanding the medical and social implications of genetic information in order to make an informed decision. One commonly used strategy is to pose 'what if' questions: 'If you are found to carry a gene mutation, will that affect your decision to have another child?'; 'If your partner does not wish to have another child because you have a gene mutation, how will you feel?' During the counselling process, we uncovered discrepant intentions between Mdm C and her partner with regards to how they might use genetic information in their reproductive plans. While Mdm C stated that she was prepared to try for another child regardless of her genetic status, her partner appeared hesitant. Often, several consultations may be required for the patient and her family to appreciate the ramifications of having or not having genetic information, before an informed decision may be made.

Case Study 2 (Fig. 2)

Mdm D was diagnosed with ovarian cancer at the age of 55 and has strong family history of breast and ovarian cancer. Two of her sisters passed away from breast cancer in their 60s, a niece passed away from breast cancer in her 30s, and 2 nieces had ovarian cancer in their 40s. Mdm D underwent genetic testing for *BRCA1/2* and was found to carry a deleterious *BRCA2* mutation. Shortly after, Mdm D passed away from metastatic ovarian cancer. One of Mdm D's brothers underwent genetic counselling and was recommended to undergo predictive testing and to share the information with his 3 remaining siblings and their children. He initially agreed to gather his family members to come forward for genetic counselling but later changed his mind and never arranged the family meeting. He declined genetic testing and further follow-up. Mdm D's only daughter, Mdm E, who was in her mid 30s and who had been Mdm D's caregiver during her illness, was strongly recommended to undergo predictive testing. Mdm E was also initially reluctant to undergo testing because of the fear of knowing the results, but continued on our follow-up. We reiterated our recommendation over the next few years, and Mdm E finally agreed to undergo predictive testing, 3 years after her mother's death. She was found to have inherited the deleterious *BRCA2* mutation, and proceeded with prophylactic bilateral salpingo-oophorectomy but declined prophylactic mastectomy. Several years later, Mdm E brought her eldest daughter, Ms F, who just turned 21, to receive genetic counselling and undergo genetic testing. Ms F was found to carry the same deleterious *BRCA2* mutation and is currently on close surveillance and has been recommended to consider prophylactic surgery at a later stage.

Mdm D's family is a classical high-risk breast and ovarian cancer family with a causative gene mutation identified. Cancer-free family members can benefit from predictive testing to determine their mutation status and be enrolled in screening and/or preventive programmes with the goal of reducing cancer morbidity and mortality. While we followed the norm of a non-directive approach while counselling Mdm D and her family in the initial stages, the more aggressive and directive approach was adopted once a deleterious mutation was identified in the family to strongly recommend predictive testing among cancer-free family members. As significant cancer-related mortality has occurred in this family, predictive testing has the clear advantage of risk-stratifying family members to rationalise screening plans and reduce unnecessary anxiety. Notably, this 'directive' approach was still undertaken within the context of non-directive counselling, and it was 3 years before Mdm E could be persuaded to undergo testing. It was heartening that although she was initially reluctant to know her genetic status, she eventually appreciated the importance of the information and even encouraged her daughter to proceed with testing as soon as she turned 21. We were unfortunately not able to engage Mdm D's other family members in further discussions as they were unwilling to undergo genetic counselling and declined follow-up.

Case Study 3 (Fig. 3)

Mr B is a 21-year-old Chinese cancer-free man who presented with rectal bleeding at age 19 and was clinically diagnosed with familial adenomatous polyposis (FAP) when an evaluation colonoscopy showed hundreds of colonic polyps. Histology reported the polyps to be tubular and tubulovillous adenomas with low-grade dysplasia. He underwent genetic testing for FAP and was found to carry a deleterious mutation in the *APC* gene. He has a brother and a sister in their 20s who are both cancer-free. His father passed away recently from a road traffic accident, and his mother is now the main carer of the family. There is maternal family history of colon cancer. Mr B was strongly recommended both by his surgeon and by us to undergo proctocolectomy with ileopouch anal anastomosis, since FAP patients have virtually 100% chance of developing colon cancer. He was however reluctant to proceed due to the anticipated social inconvenience following the surgery. His mother also opposed to the idea of surgery, and wanted her son to seek traditional medical treatment. Even though the surgery was planned for August 2008, it has yet to take place. We also recommended that his mother and siblings come forward for predictive testing, but his mother repeatedly declined, wanting 'nature to take its course' as 'some things were better left not known'. Mr B, while knowledgeable about

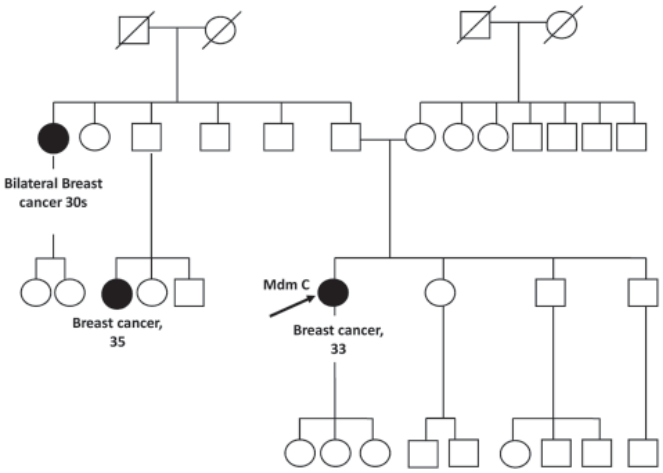

Fig. 1.

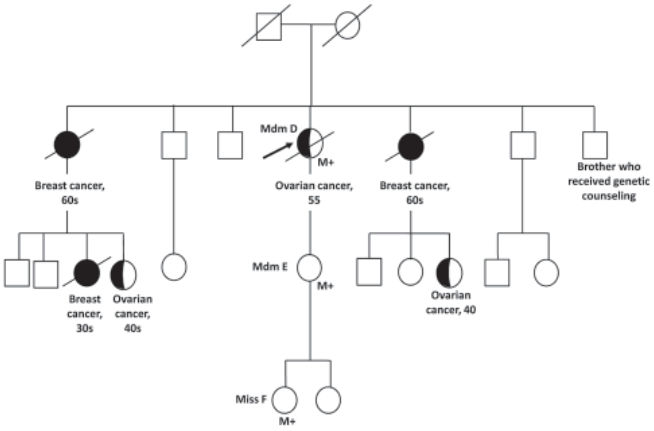

Fig. 2.

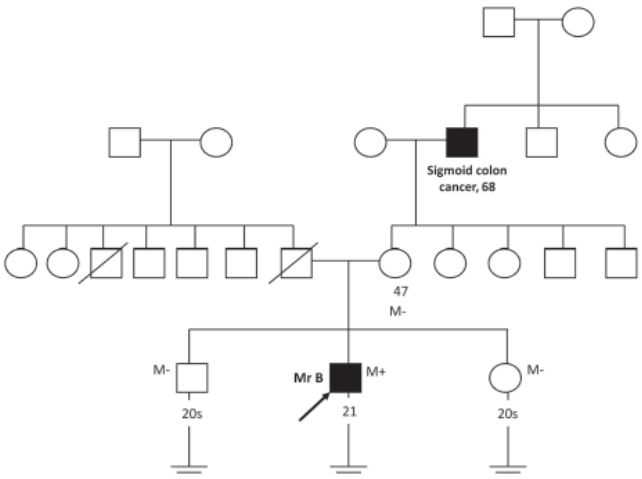

Fig. 3.

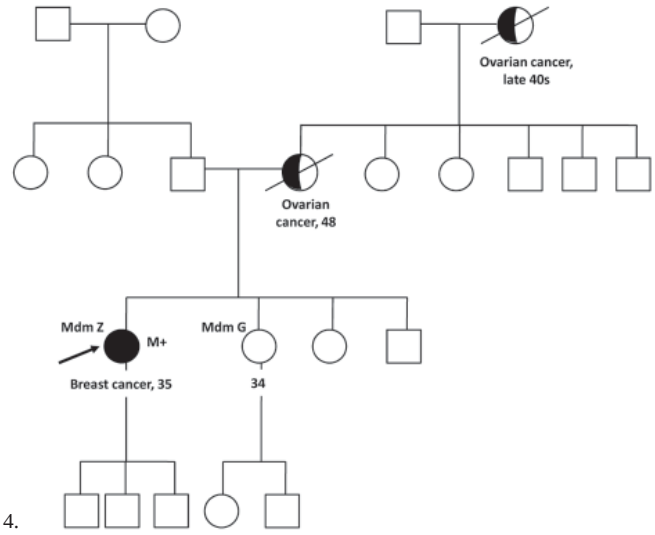

Fig. 4.

Figs. 1 to 4. Family pedigrees of case studies 1 to 4. Square represents male; circle represents female; shaded square and circle represent disease-affected family member; arrow points to the index patient; square or circle with a diagonal line across represents a deceased family member; M+ represents family member with a deleterious mutation; M- represents family member who is tested and found not to carry a deleterious mutation in the family.
(1) Pedigree of Mdm C (case study 1), a young breast cancer patient with family history of breast cancer and suspected to carry a *BRCA1/2* mutation. (2) Pedigree of Mdm D (case study 2), who was found with a *BRCA2* mutation and has family history of breast and ovarian cancer. (3) Pedigree of Mr B (case study 3) who has Familial Adenomatous Polyposis. (4) Pedigree of Mdm Z (case study 4), who has a *BRCA1* mutation.

his condition, had no strong opinions on medical decisions, and went along with his mother's views.

Mr B remained on close follow-up with us and we continued to broach the topic of prophylactic proctocolectomy at each follow-up session, as well as predictive testing for his mother and siblings, despite being aware of their reservations towards genetic testing and prophylactic surgery. After 2 years of counselling, Mr B's mother and siblings finally agreed to predictive testing, and fortunately none was found to carry the mutation. This critical information allowed us to categorise Mr B's mother and siblings as normal risk individuals for colorectal cancer, and excluded Mr B's maternal relatives as high-risk individuals for FAP. In the meantime, we continued to urge Mr B to consider prophylactic surgery, and he has currently scheduled the operation for the end of this year.

This case illustrates conflict between respect for autonomy and beneficence for the patient and his family members. We adopted a directive approach in this case with regards to recommendation of genetic testing and prophylactic surgery, a deviation from the norm in genetic counselling, since the central ethos is not to impose or persuasively coerce the patient against his wishes or inclination. However, given the virtually 100% chance of cancer risk in FAP patients and the availability of effective preventive surgery, we felt that beneficence to Mr B would outweigh the principle of respecting patient autonomy. The medical benefits of establishing his family members' genetic status and thus

their lifetime cancer risk also ranked important enough for us to strongly recommend predictive testing. As none of his family members was found to carry the mutation, they were spared unnecessary anxiety as well as early and rigorous surveillance.

Case Study 4 (Fig. 4)

Mdm Z, who was diagnosed with young breast cancer at age 35, and whose mother and maternal grandmother passed away from ovarian cancer in their late 40s, was found to carry a deleterious *BRCA1* mutation. She was estranged from her family, and although she has sisters who could benefit from predictive testing, was adamant not to share the information with them despite repeated counselling. After several visits, she declined further follow-up with our clinic as she felt that the genetic information was 'burdensome' and asked us not to contact her again. Several years later, her sister, Mdm G, a 34-year-old cancer-free female came to see us, as she was worried about her breast cancer risk, given her family history of cancer. There was added anxiety as she was found with 2 breast lesions, which were later proven to be benign on pathological examination. Mdm G was aware that her sister Mdm Z with breast cancer had undergone genetic testing but did not know the actual test results. She acknowledged that her sister refused to share the information due to a family dispute. Mdm G hoped to know her genetic status and was willing to consider prophylactic salpingo-oophorectomy if found with a deleterious mutation.

Mdm G may benefit from predictive testing to determine her risk status. However, predictive testing may only be undertaken with knowledge of genetic test results in an index family member with cancer. We provided genetic counselling to Mdm G and encouraged her to communicate with her sister with regards to her genetic test results. However, repeated attempts by Mdm G failed to persuade her sister to share the genetic result. Mdm G subsequently decided not to pursue the matter further as it was highly sensitive and created tension within the family.

This case illustrates an example of conflicting interest between beneficence for Mdm G and respect for autonomy for her sister, Mdm Z, to maintain confidentiality of her test results. This situation bears some similarity to the conflicting duty of care that may be faced by physicians managing HIV patients. If an HIV-infected man refused to divulge his HIV status to his spouse, does the physician have a duty of care towards the spouse to inform her so that she may take precautions to avoid infection? In Singapore, the law mandates that spouses of HIV-infected patients be informed. But what if the man is not legally married but has a steady girlfriend? How far does the physician's duty of care stretch? In any case, no similar law currently exists in Singapore with regards to hereditary diseases. While hereditary breast and ovarian cancer syndrome is associated with significant cancer risks, are the risks significant enough for the physician to justify breaching patient confidentiality to divulge sensitive genetic information in order to better define the cancer risk of a close family member? In Mdm G's case, we adopted the non-directive approach of genetic counselling. We respected Mdm Z's wish for confidentiality but also offered Mdm G some feasible, albeit less ideal, alternatives: (i) Mdm G may undergo the more costly comprehensive sequencing of *BRCA1/2* to detect a deleterious mutation or; (ii) she may start early screening for breast and ovarian cancer based on family history in the absence of genetic information. Mdm G was reluctant to pay for comprehensive sequencing, a test that is 8 times more costly than predictive testing, and opted for early cancer surveillance instead.

Conclusion

The 4 cases we have described illustrate the difficulty of using a 'one size fits all' nondirective approach of genetic counselling, and challenge the 'myth' of genetic counselling as a solely nondirective process. Inasmuch as this approach has been the central ethos of genetic counselling, there has been re-evaluation of what is at the expense of this nondirective approach for the sake of individual autonomy. Genetic counsellors often experience tension of not being able to practice nondirective counselling faithfully, even though they uphold its importance.[16-19] The discrepancy between the theory of nondirective counselling and the reality of medical and social complexities often encountered in cancer genetic counselling, as illustrated in our case studies, highlight the concern that to confine to the either-or choice of being directive or nondirective in cancer genetic counselling would be an overly simplistic and narrow view.

While respect for patient autonomy is clearly important, we must be mindful that 'autonomy' as we have inherited is developed predominantly and implicit in the American society.[16,20,21] Often in the Asian context, the cry for autonomy may not be understood or played out in the same way as in the West; doctor-patient relationship in Asia is still somewhat different compared to the West. Our patients' immediate concerns during genetic counselling may not be his or her autonomy and freedom from coercion in their decision towards genetic testing. Rather, they accord much respect and deference to medical professionals, and often appreciate a doctor's knowledge and advice on difficult decisions. Indeed, the knowledge gap between patients and health providers may be one barrier to effective execution of a non-directive approach in genetic counselling. While many western patients may already be well informed on the subject matter before they meet the geneticist or genetics counsellor, the situation is much different in Asia,

where most patients have limited medical knowledge and rely on their physicians to provide pertinent information related to their health. In our experience, after providing nondirective counselling, not infrequently, patients would ask directly whether we would recommend genetic testing for them. To continue to be nondirective in these cases may not be perceived by the patient as respecting their autonomy. Rather, it may be interpreted as unwillingness or nonchalance to involve oneself in assisting the patient in making important decisions. In the Asian context, overly adopting a nondirective approach may in fact be perceived as being unprofessional and unhelpful to the patient.

How then should we practice genetic counselling with both respect for patient autonomy and healthcare professionalism in mind? Firstly, it helps to recognise that, much as we would like it to be so, it is difficult for genetic counselling to be a strict affair of 'neutral, objective' dissemination of information to the patient. The process is influenced by the characteristics of the healthcare system, economics, socio-cultural norms as well as the personalities of the genetic counsellor and healthcare providers.[10] Bearing this in mind, counselling could be understood as a dialogue between the counsellor, healthcare provider and the patient and his/her family, since a dialogue is a common platform where people naturally make decisions, involving at least 2 "voices". The goal is to reach an informed and well-considered decision, bearing in mind values, beliefs, goals and culture since decisions are not made in a social vacuum.[16] Also, if genetic counselling is seen as a dialogue, and understood as a reciprocal-engagement communication process,[22] the genetic counsellor and healthcare provider actually play critical mediating roles, and may be encouraged to provide an opinion to assist the patient in the decision-making process. This should not necessarily be viewed as being coercive, provided that genetic counsellors and healthcare professionals observe the Hippocratic oath to 'be of benefit and do no harm' to the patients and their family. Rather than be beholden to a specific approach in cancer genetic counselling, we may benefit patients more by focusing not only on the medical aspect, but also pay attention to psychological, social, cultural and family concerns that are important to the patient in their decision-making process.

REFERENCES

1. Trepanier A, Ahrens M, McKinnon W, Peters J, Stopfer J, Grumet SC, et al. Genetic cancer risk assessment and counseling: recommendations of the national society of genetic counselors. J Genet Couns 2004;13:83-114.
2. Miki Y, Swensen J, Shattuck-Eidens D, Futreal PA, Harshman K, Tavtigian S, et al. A strong candidate for the breast and ovarian cancer susceptibility gene BRCA1. Science 1994;266:66-71.
3. Wooster R, Neuhausen SL, Mangion J, Quirk Y, Ford D, Collins N, et al. Localization of a breast cancer susceptibility gene, BRCA2, to chromosome 13q12-13. Science 1994 30;265:2088-90.
4. Papadopoulos N, Lindblom A. Molecular basis of HNPCC: mutations of MMR genes. Hum Mutat 1997;10:89-99.
5. Peltomaki P, Aaltonen LA, Sistonen P, Pylkkanen L, Mecklin JP, Jarvinen H, et al. Genetic mapping of a locus predisposing to human colorectal cancer. Science 1993;260:810-2.
6. Miyaki M, Konishi M, Tanaka K, Kikuchi-Yanoshita R, Muraoka M, Yasuno M, et al. Germline mutation of MSH6 as the cause of hereditary nonpolyposis colorectal cancer. Nat Genet 1997;17:271-2.
7. Powell SM, Petersen GM, Krush AJ, Booker S, Jen J, Giardiello FM, et al. Molecular diagnosis of familial adenomatous polyposis. N Engl J Med 1993;329:1982-7.
8. Weil J. Psychosocial genetic counseling in the post-nondirective era: a point of view. J Genet Couns 2003;12:199-211.
9. Wolff G, Jung C. Nondirectiveness and genetic counseling. J Genet Couns 1995;4:3-25.
10. J Schmidtke IN, G Wolff. Genetic Counseling: Historical, Ethical and Practical Aspects. International Encyclopedia of the Social & Behavioral Sciences 6092-7.
11. Resta RG. Genetic counseling: Coping with the human impact of genetic disease. Center for Perinatal Studies, Swedish Medical Center, First Hill, Seattle, WA. Available at: http://www.accessexcellence.org/AE/AEC/CC/counseling_background.php. Accessed 13 September 2010.
12. Ad hoc Committee on Genetic Counseling (1975). Genetic counseling. Am J Hum Genet 1975;27:240-2.
13. National Society of Genetic Counselors Code of Ethics. Available at: http://www.nsgc.org/about/codeEthics.cfm. Accessed 13 September 2010.
14. Baumiller RC, Cunningham G, Fisher N, Fox L, Henderson M, Lebel R, et al. Code of ethical principles for genetics professionals: an explication. Am J Hum Genet 1996;65:179-83.
15. Seow AKW, Chia KS, Shi LM, Lee HP, Shanmugaratnam K. Trends in Cancer Incidence in Singapore 1968-2002. Singapore Cancer Registry Report 2004;6.
16. White MT. Decision-making through dialogue: reconfiguring autonomy in genetic counseling. Theor Med Bioeth 1998;19:5-19.
17. Biesecker BB. Goals of genetic counseling. Clin Genet 2001;60:323-30.
18. Brunger F, Lippman A. Resistance and adherence to the norms of genetic counseling. J Genet Counsel 1995;4:151-67.
19. Bartels DM, LeRoy BS, McCarthy P, Caplan AL. Nondirectiveness in genetic counseling: a survey of practitioners. Am J Med Genet 1997;72:172-9.
20. Hayry M, Takala T. Genetic information, rights, and autonomy. Theor Med Bioeth 2001;22:403-14.
21. Weil J, Ormond K, Peters J, Peters K, Biesecker BB, LeRoy B. The relationship of nondirectiveness to genetic counseling: report of a workshop at the 2003 NSGC Annual Education Conference. J Genet Couns 2006;15:85-93.
22. Veach PM, Bartels DM, Leroy BS. Coming full circle: a reciprocal-engagement model of genetic counseling practice. J Genet Couns 2007;16:713-28.