Clinical and Experimental Obstetrics & Gynecology

Clin. Exp. Obstet. Gynecol. **2022**; 49(12): 277
https://doi.org/10.31083/j.ceog4912277

Original Research

Health-Promoting Lifestyle of Breast Cancer Patients and Family Members in a Chinese Genetic Counseling Clinic: A Cross-Sectional Study

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Academic Editors: Andrea Tinelli and Luca Roncati
Submitted: 8 September 2022 Revised: 20 October 2022 Accepted: 28 October 2022 Published: 14 December 2022

Abstract

Background: Risk management strategies play a significant role in genetic counseling, which involves lifestyle modification with respect to nutrition and unhealthy living habits, enhanced screening imaging, endocrine therapy, and following the physician's advice etc. This study aimed to describe the health-promoting lifestyle of breast cancer patients and their family members in a Chinese genetic counseling clinic, and to explore its various levels encompassing different socio-economic variables. **Methods**: This was a cross-sectional study. The participants in this study originated from a genetic counseling clinic of a cancer center in Shanghai, China. Two hundred and fifty nine patients conforming to the inclusion and exclusion criteria were screened from November 2019 to March 2022. Participants agreeing to participate were sent a questionnaire web-link with an invitation to finish this survey. Two questionnaires were included in the link, one referring to socio-economic information and the other referring to the health-promoting lifestyle. Chinese Health-promoting lifestyle profile-II (HPLP-II) was used to evaluate the health-promoting lifestyle. **Results**: One hundred and forty participants were finally included in this study. The mean scores for health-promoting lifestyle was 141.22 ± 19.77, and multiple liner regression revealed monthly family income to be a statistically significant predictor of health-promoting lifestyle ($p < 0.05$). In the six subscales, health responsibility got the highest score (26.43 ± 4.40), and nutrition received the lowest score (17.81 ± 4.73). Self-actualization was 25.84 ± 4.19, physical activity 24.02 ± 4.97, interpersonal relationship 22.21 ± 4.42, and stress management 24.91 ± 4.39. **Conclusions**: A representative level of health-promoting lifestyle of breast cancer patients and family members in a Chinese genetic counseling clinic were acquired. More education and intervention should be tailored to enhance and encourage health-promoting lifestyle behaviors in participants with low monthly family income. Additionally, developing nutritional curriculum and strengthening the publicity of nutritional popular science are priorities for future improvement measures.

Keywords: health-promoting lifestyle; breast cancer; genetic counseling

1. Introduction

Breast cancer is one of the most prevalent malignant tumors in women globally [1]. It has been well-established that breast cancer is influenced by both genetic and environmental factors, such as family history of cancer, obesity, and certain female reproductive factors [2,3]. It has been reported that approximately 10% patients diagnosed with breast cancer are associated with pathogenic variants of genes [4]. *BRCA1* and *BRCA2* are the most common mutational genes in breast cancer [5]. Other mutations in genes such as *PALB2*, *TP53*, *BARD1*, *MSH2*, *MLH1*, *PMS2*, *RAD51C*, *RAD51D* may be potentially relevant to breast or ovarian cancer have also been suggested to be included in screening [6]. Genetic testing results with identification of a pathogenic variant can have a profound impact on patients' and their family members' health and risk management strategies. Therefore, in the consensus guideline from the American Society of Breast Surgeons on genetic testing for hereditary breast cancer, it is recommended that breast surgeons and other medical professionals such as genetic counselors and oncology nurses should educate and provide counseling information to the patient concerning genetic testing results [7]. Genetic counseling plays a significant role in enabling patients to acquire an understanding of the genetic testing results. Comprehensive genetic counseling should include pre-test counseling and post-test counseling. In the pre-test counseling, patients need to be told when the testing results become available and the implications that the results can have. In the post-test counseling, patients should be provided appropriate recommendations under the individuals' clinical context to help them make informed decisions. If the testing result is negative or noninformative (variant of uncertain significance [VUS]), the patients other risk factors for cancer need to be further evaluated to formulate the individual risk management plan, such as family history, medical history and age. Risk management strategies are designed according to the different level of risk t and may include enhanced screening imaging, endocrine

therapy, and lifestyle modification with respect to nutrition and unhealthy living habits [7].

Lifestyle modification implies maintaining a health-promoting lifestyle, which is crucial for a person to prevent chronic diseases (such as cancer, cardiovascular and cerebrovascular diseases, diabetes etc.). Health-promoting lifestyle is defined as a multidimensional pattern, which includes self-initiated actions and perceptions to maintain or enhance wellness and self-actualization [8]. It has been emphasized as a major way for improving health and preventing related diseases [9]. Additionally, a health-promoting lifestyle is believed to improve the quality of life [10]. Our genetic counseling clinic is included in our clinical cancer center and research institution, which consists of one breast surgeon and two breast oncology nurses. There is a detailed and rigorous genetic counseling process within the clinic, including evaluating medical history, cancer history, pre-test genetic counseling, signing informed consent, drawing genetic map, genetic testing and recording contact information (telephone number or Wechat social network app). When the genetic testing results become available, specialized nurses will notice the patient through telephone or Wechat. If it's not feasible for them to receive post-test genetic counseling in person, they will be provided remote post-test genetic counseling. Whatever the testing results demonstrate, patients or their family members can get a detailed dated screening form. For those carrying *BRCA1* or *BRCA2* pathogenic variants, it is suggested that they consider risk-reducing bilateral salpingo-oophorectomy between ages 35–45 years. In addition, all patients are educated to modify their lifestyle and initiate a health-promoting lifestyle. To date, no study has been conducted to explore the health-promoting lifestyle of breast cancer patients and family members in Chinese genetic counseling clinics. In this study, by investigating their health-promoting lifestyle, we sought to understand the factors and barriers contributing to positive health-promoting lifestyle and provide a roadmap in order for medical staff to help them rebuild a healthy lifestyle.

2. Methods

2.1 Study Design

This was a cross-sectional study with a convenience sample recruited. Study invitations were sent through mobile phone messages or new social media application "Wechat".

2.2 Participants

In this study, 259 participants were recruited from November 2019 to March 2022. All participants originated from a genetic counseling clinic of a cancer center in Shanghai, China. Two hundred and fifty nine participants were contacted and among them, 158 participants agreed to participate and complete the survey. Eleven surveys lacked a valid name. In total, 140 survey results were qualified for further study. The inclusion criteria were: $\geq$18 years; diagnosis of breast cancer or having a family history of breast cancer; the first time to undergo genetic testing; Eastern Cooperative Oncology Group (ECOG) $<$2; adequate performance status. The exclusion criteria included being diagnosed with psychiatric or intellectual impairment; having a previous history of genetic testing (Fig. 1).

2.3 Data Collection

Participants who have agreed to participate in this study were sent a questionnaire web-link through short messages or Wechat to be invited to finish this survey. Two questionnaires were included in the link: one referred to demographic information and the other one involved the health-promoting lifestyle. In the demographic information, the genetic test results were not requested to be written, but the participants needed to answer whether they understood the results. Finally, data from the questionnaires were matched up with the participants' genetic testing results.

2.4 Measurements

2.4.1 Chinese Health-Promoting Lifestyle Profile-II (HPLP-II)

The HPLP-II is a scale instrument used to evaluate a person's health-promoting lifestyle behaviors, contains 52 items and has been translated into Chinese in 1997 [11]. It contains 6 subscales: self-actualization, health responsibility, physical activity, nutrition, interpersonal relationships and stress management. A Likert 4-scale is used to measure each item. The total score ranges from 52 to 208. Higher scores mean better health-promoting behaviors. It can be further divided into four levels: 52–90 (poor), 91–129 (moderate), 130–168 (good), 169–20 (excellent) [12]. Lee *et al.* [13] has tested the reliability and validity in Hongkong university students in 2005, with a Cronbach's alpha of 0.94 of the total scale, and 0.79–0.87 of the six subscales. In 2011, Xiaopei Zhang *et al.* [14] revised the nutrition items in HPLP-II according to Dietary Guidelines for Chinese Residents (2007), and identified its content validity (0.85) and Cronbach's alpha of the total scale (0.93).

In this study, we utilized the Chinese edition HPLP-II according to the Dietary Guidelines for Chinese Residents (2016) [15], which has been authorized by Xiaopei Zhang *et al.* [14]. In the revised HPLP-II, the item "Choose low-fat, low cholesterol food" was changed to "For an adult, salt does not exceed 6 g per day, 25~30 g cooking oil per day"; the item "Limit the consumption of sugar or foods containing sugar (e.g., candy)" was changed to "No more than 50 g sugar per day, preferably under 25 g"; the item "Eat 250–400 g cereals a day (such as flour, rice, corn flour, wheat, sorghum, etc.)" was changed to "50~150g grains and miscellaneous beans, 50~100 g potatoes"; the item "Eat 200–400 g fruit per day" was changed to "Eat 200~350 g fresh fruit a day, and they shouldn't be replaced by juice"; the item "Eat 300–500 g vegetables per day" was changed to

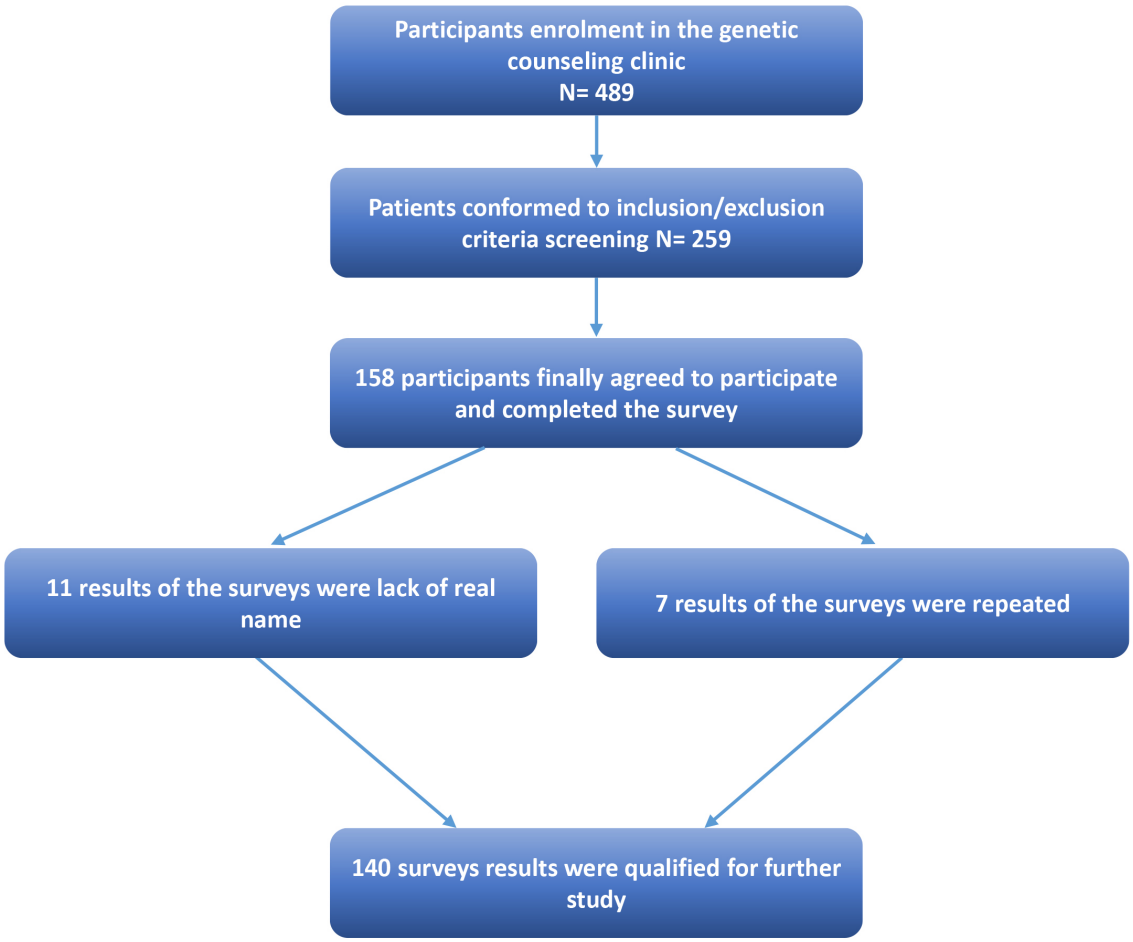

Fig. 1. The figure showed the flow chart of participants' selection. There were 489 participants enrolled in the genetic counseling clinic. Through selection, 140 survey results were qualified for further study.

"Every meal includes vegetables, and 300~500 g vegetables per day, with half dark vegetables"; the item "Eat 300 g milk and 30–50 g soybean or soybean products per day" was changed to "Eat a variety of dairy products, which should be equivalent to a daily intake of 300 g liquid milk. Eat soybean products, which should be equivalent to more than 25 g soybeans a day. Eat nuts moderately"; the item "Eat 125–200 g fish, poultry, meat or eggs daily" was changed to "Eat 280~525 g fish per week (40–75 g per day), 280~525 g livestock meat per week (40–75 g per day), 280~350 g egg per week (40–50 g per day). Average daily intake of 120~200 g fish, poultry, eggs and lean meat". The content validity of the scale was 0.85, and the Cronbach's alpha of the total scale was 0.872.

2.4.2 Socio-Economic Information Questionnaire

Participants' socio-economic information questionnaire consisted of 14 questions, including gender, age, education, marital status, employment status, monthly family income, residence and identity (breast cancer patient or person having a family history of breast cancer). Clinical related variables were collected, including genetic testing results, days since knowing genetic testing results, and understanding of genetic testing results. Family members' related information involved two questions: whether family members had taken genetic testing and whether test receivers were willing to recommend family members to take genetic testing.

2.5 Data Analysis

Data was analyzed using IBM SPSS version 25.0 (IBM Corp., Armonk, NY, USA). If continuous variables were normally distributed, then mean $\pm$ standard deviation was used to describe them, and frequency was used to describe categorical variables. When comparing group difference of normally distributed continuous variables between two or more groups, *t*-test or one-way ANOVA was employed. To analyze the relation between two normally distributed continuous variables, Pearson correlation was used; otherwise, Spearman correlation was used. Additionally, potential sources of bias may occur in the participants selection considering its non-random design. Therefore, liner regression was used in multivariate analysis. $p < 0.05$ was considered to be statistically significant.

Table 1. Health-promoting lifestyle based on socio-economic information (N = 140).

Variable	Categories	n (%)	T, F or Rho, p						
			Health-promoting lifestyle	Self-actualization	Health responsibility	Physical activity	Nutrition	Interpersonal relationship	Stress management
Age	≤35	34 (24.3%)	–1.163†, 0.247	–1.464†, 0.145	0.327†, 0.774	–2.302†, 0.023*	–1.784†, 0.077	–0.002†, 0.998	–0.004†, 0.997
	>35	106 (75.7%)							
Education	Primary school	7 (5%)	3.413‡, 0.006*	1.188‡, 0.318	2.820‡, 0.019*	2.511‡, 0.033*	1.297‡, 0.269	3.339‡, 0.007*	2.663‡, 0.295
	Secondary school	26 (18.6%)							
	High school	17 (12.1%)							
	Junior college	23 (16.4)							
	Undergraduate	52 (37.1)							
	Master	15 (10.7)							
Marital status	Married	116 (82.9%)	2.226‡, 0.108	2.979‡, 0.054	2.891‡, 0.059	1.760‡, 0.176	1.770‡, 0.174	1.433‡, 0.242	–0.094‡, 0.910
	Unmarried	14 (10%)							
	Divorced	10 (7.1%)							
Employment status	Employed	82 (58.6%)	2.871†, 0.005*	2.064†, 0.041*	2.691†, 0.008*	1.783†, 0.007*	1.225†·0.223	1.602†, 0.111	2.385†, 0.018*
	Unemployed	58 (41.4%)							
Monthly family income	≤5000 yuan	30 (21.4%)	8.424‡, 0.000*	3.884‡, 0.011*	7.594‡, 0.000*	2.090‡, 0.104	2.319‡, 0.078	9.075‡, 0.000*	3.470‡, 0.018*
	5001–10000 yuan	46 (32.9%)							
	10001–30000 yuan	43 (30.7%)							
	>30000 yuan	21 (15%)							
Residence	Shanghai	73 (52.1%)	–0.198†, 0.844	0.410†, 0.682	–0.597†, 0.552	–0.998†, 0.320	0.906†, 0.366	–0.005†, 0.996	–0.413†, 0.680
	Not in Shanghai	67 (47.9%)							
Identity	Healthy person	14 (10%)	–1.244†, 0.216	–1.348†, 0.180	0.096†, 0.924	–2.128†, 0.035*	–1.955†, 0.053	–0.248†, 0.805	–0.013†, 0.990
	Breast cancer patients	126 (90%)							
Genetic testing results	Pathogenic variants	61 (43.6%)	1.703‡, 1.186	0.975‡, 0.380	0.777‡, 0.462	1.675‡, 0.191*	3.109‡, 0.048*	0.775‡, 0.463	1.221‡, 0.298
	Negative variants	63 (45%)							
	Variant of uncertain significance	16 (11.4%)							
Days of knowing genetic testing results	Range	1–1576							
	Mean (SD)	360.65 (336.88)	0.174§, 0.040*	0.071§, 0.406	0.093§, 0.273	0.110§, 0.194	0.038§, 0.656	0.242§, 0.004*	0.221§, 0.009*
Understanding of genetic testing results	Completely	110 (78.6%)	2.379‡, 0.096	0.669‡, 0.514	3.165‡, 0.045*	1.338‡, 0.266	0.238‡, 0.789	2.343‡, 0.100	3.727‡, 0.027*
	None	6 (4.3%)							
	Partially	24 (17.1%)							
Family members having undertaken genetic testing before	Yes	37 (26.4%)	1.837†, 0.068	1.627†, 0.106	0.933†, 0.352	1.635†, 0.005*	0.768†, 0.444	1.100†, 0.237	1.948†, 0.053
	No	103 (73.6%)							
Recommend family members to undertake genetic testing	Yes	101 (72.1%)	1.8144†, 0.072	0.843†, 0.401	1.557†, 0.122	1.663†, 0.099	1.393†, 0.166	1.114†, 0.267	1.276†, 0.204
	No	39 (27.9%)							
Ways of submitting questionnaires	Wechat	124 (88.6%)	–0.153†, 0.878	0.896†, 0.372	–0.195†, 0.846	–1.072†, 0.286	–0.222†, 0.825	0.619†, 0.537	–0.626†, 0.532
	Short messages	16 (11.4%)							

*$p < 0.05$, †t-test, ‡ One-way ANOVA, §Spearman correlation analysis.

3. Results

3.1 Health-Promoting Lifestyle Based on Socio-Economic Information

There were 140 participants included in this study. The socio-economic data are presented in Table 1. The mean age of the participants was 42.29 $\pm$ 8.92 years. There were 126 (90%) breast cancer patients and 14 (10%) healthy persons (having a family history of breast cancer) included. Genetically, 61 (43.6%) participants had pathogenic variants, while 63 (45%) participants had negative variants, and the rest 16 (11.4%) participants having VUS. Thirty seven (26.4%) family members of the participants had undertaken genetic testing before, and 103 (73.6%) family members had not. When asked whether the participants were willing to recommend their family members to undertake genetic testing, 101 (72.1%) agreed, while 39 (27.9%) disagreed. When exploring the univariate influencing factors of health-promoting lifestyle in Chinese genetic counseling persons, the total score of HPLP-II and the scores of the subscales were analyzed based on the socio-economic variables. Of all the socio-economic variables, significant difference was found between total health-promoting score and education, employment status, monthly family income and days since knowing genetic testing results ($p < 0.05$). Additionally, of the six subscales, there was significance difference between self-actualization and employment status and monthly family income ($p < 0.05$). Health responsibility was found significantly correlated with test receivers' education, employment status, monthly family income and understanding of genetic testing results. Physical activity was found to be significantly correlated with age, education, employment status, identity and whether family members had undertaken genetic testing previously. Nutrition was significantly correlated with genetic testing results. Interpersonal relationship was significantly correlated with education, monthly family income and days of knowing genetic testing results. Stress management was significantly correlated with employment status, monthly family income, days of knowing genetic testing results and understanding of genetic testing results (Table 1).

3.2 Total and Subscale Scores for Health-Promoting Lifestyle

Table 2 shows the possible and actual range of scores and mean scores for six subscales of health-promoting lifestyle. Total possible range of scores and actual range of scores for health-promoting life-style were 52–208 and 96–205 respectively. The mean scores were 141.22 $\pm$ 19.77. According to the 4 levels of health-promoting lifestyle, 16 (11.4%) participants had an excellent health-promoting lifestyle, 86 (61.4%) had a good one, 38 (27.1%) had a moderate one and no participants had a poor one.

3.3 Factors Influencing Health-Promoting Lifestyle

In order to find out the influencing factors of health-promoting lifestyle in Chinese genetic test receivers, a multiple linear regression was performed. All the statistically significant socio-economic variables conducted in the sing-factor analysis were included in the multiple regression, except for days of knowing genetic testing results, which was identified to have no linear relationship with health-promoting lifestyle. Finally, participants' monthly family income and constant were significantly correlated with the total score of health-promoting lifestyle (Table 3).

4. Discussion

The effectiveness and defectiveness of genetic counseling for breast cancer patients.

In this study, no participants had a poor health-promoting lifestyle and both breast cancer patients and their family members had good health responsibility and self-actualization. This illustrated the effectiveness of our pre-test counseling, which was owing to our standardized process and professional consultants in the clinic. In the pre-test counseling, the perceived benefits to patients themselves and their family members were delivered clearly. Meanwhile, the potential risks were also included. Once they were aware of the genetic testing result, it was impossible to ignore the psychological influences brought by the genetic testing result. In this study, although most test receivers were willing to recommend their family members to undertake genetic testing, there were some participants who were reluctant. Chris Jacobs found that pre-test communication did not increase anxiety, but in the post-test phase, when the testing results were disclosed, some patients experienced anxiety and distress, especially those who were unprepared or unsupported, such as those tested shortly after diagnosis [16]. In this study, 21.4% participants either partially understood and did not understand their genetic testing results. This may be due to the fact that some post-test genetic counseling was delivered by remote ways (Wechat or telephone). Just as it was referred in Chris Jacobs's study, pre-test counseling by methods other than face-to-face was acceptable to some patients, but it did not involve post-test genetic counseling [16]. This defect of genetic counseling in our clinic will be improved in the future.

4.1 Health-Promoting Lifestyle of Genetic Test Receivers was Satisfactory

HPLP-II has been verified to have good validity and reliability in Hongkong, China and Chinese mainland. In this study, the Chinese edition of HPLP-II has been adopted as an assessment tool and has shown excellent validity and reliability. The genetic test receivers in our clinic had good health-promoting lifestyle, which signified their compliance to post-test genetic counseling. This level of health-promoting lifestyle was better than that of mastectomized women in Tabriz-Iran [17]. In the health-

Table 2. Total and subscale scores for health-promoting lifestyle (N = 140).

Variable	Number of items	Possible range of scores	Actual range of scores	Mean ± SD
Health-promoting lifestyle	52	52–208	96–205	141.22 ± 19.77
Self-actualization	9	9–36	15–36	25.84 ± 4.19
Health responsibility	9	9–36	13–35	26.43 ± 4.40
Physical activity	8	8–32	15–36	24.02 ± 4.97
Nutrition	9	9–36	8–32	17.81 ± 4.73
Interpersonal relationship	9	9–36	14–32	22.21 ± 4.42
Stress management	8	8–32	16–36	24.91 ± 4.39

Table 3. Factors influencing total scores for health-promoting lifestyle (N = 140).

Variable	Unstandardized cofficients ß	Standard error	Standardized cofficients	t	*p*
Constant	119.205	10.284	-	11.591	0.000*
Education	2.242	1.404	0.165	1.597	0.112
Employment status	–0.513	3.952	–0.013	–0.130	0.897
Monthly family income	5.809	1.813	0.290	3.204	0.002*

$R = 0.404$, $R^2 = 0.163$, Adjusted $R^2 = 0.145$, $F = 8.843$, $p = 0.000^*$. $^*p < 0.05$.

promoting lifestyle of Iranian breast cancer patients, spiritual growth got the highest score, while physical activity got the lowest, which were consistent with the results of a study in the United States [18]. The genetic test receivers in our clinic had more physical activity than Iranian breast cancer patients. Fortunately, it is well known that physical activity plays a significant role in managing cancer risks. Another study conducted in Korean breast cancer patients showed that nutrition and stress management had the highest and lowest scores respectively, which was different from our study, and the total score for health-promoting lifestyle was lower than our participants [19]. These data confirm that the health-promoting lifestyle of genetic test receivers in our clinic was satisfactory.

4.2 Health-Promoting Lifestyle was Influenced by Monthly Family Income

In the univariate analysis of health-promoting lifestyle, participants who had a masters education got the highest score, and it was statistically significant compared with those of junior college, secondary school and primary school. Participants who had higher education may understand the genetic counseling more clearly, and follow the nurses' advice. Additionally, the employed participants had better health-promoting lifestyle than unemployed ones. The result of Monireh Hamed Bieyabanie's study showed that self-efficacy was the predictor of health-promoting lifestyle, and socioeconomic status (employment status, income, education and health insurance) was the significant indicator of self-efficacy in Chinese cancer patients [17,20]. Health-promoting lifestyle had a positive correlation with days of knowing genetic testing results. Just as it was showed in Chris Jacobs's study, participants may experience psychological issues if they knew the testing results shortly after diagnosis [16]. Therefore, they needed more time and support to accept the results. Finally, collecting these statistically significant influencing factors into the multiple regression, only monthly family income presented a significant difference. This was in accordance with Frank-Stromborg's study, in which they found that family income could be the influencing factor of a health-promoting lifestyle [21]. Another multicenter study conducted among Turkish medical students found that the economic status of families could lead to significant differences in the total score of HPLP-II [22]. Participants who had higher monthly family income tended to adopt better health-promoting lifestyles. This could also be attributed to the relationship between economic status and people's subjective happiness in developing countries [23].

4.3 The Significant Socio-Economic Variables of Six Subscales of Health-Promoting Lifestyle

Participants with higher monthly family income and those employed performed better in self-actualization in this study. This was consistent with previous research [24]. Family income and employment status were relevant. The specific items in self-actualization involve belief, need, motivation, strength, challenges and meaning. Participants with higher monthly family income and being employed can be freer to meet their needs [25]. Therefore, when patients finished their cancer treatments, they should be encouraged to return to work [26], which will benefit their recovery. Health responsibility got the highest score in this study. Socio-economic status correlated with quality of life, and health responsibility was the statistically significant predictor of quality of life [10]. Improving participants' socio-economic welfare would empower them to undertake more health responsibility. Just as the study by Annie Tsz-Wai Chu *et al*. [27] reported, a sponsored cancer genetic testing service was crucial to test receivers' decisional motivators for undertaking genetic testing and reducing their expense.

In the present study, physical activity got the fourth highest score and older participants (>35 years) seemed

to perform more physical activity than younger ones (≤35 years). This may be relevant to our nurses' emphasis on physical activity in the post-test genetic counseling. In this study, nutrition had the lowest score in the six subscales, and it was significantly influenced by genetic testing results. Participants with VUS obtained highest score, and participants with pathogenic mutations obtained the second highest score. Finally, participants with benign mutation received the lowest score. In this study, nutrition has been stressed by nurses in the post-test counseling, however, participants with pathogenic mutations still received the lowest score. This suggests that more nutritional studies should be conducted in the future to improve a health-promoting lifestyle. This study demonstrated interpersonal relationship was better in participants with higher education and higher monthly family income. It had a positive correlation with days of knowing genetic testing results. Interpersonal relationship involved the relationship with other people, which would benefit from social support. A prior study showed that participants who had higher education and monthly family income tended to acquire more social support in their life [28]. Longer days since knowing genetic results leads to better interpersonal relationships which may be associated with participants' positive life changes after genetic counseling [29]. In this study, stress management was significantly correlated with employment status, monthly family income, days of knowing genetic testing results and understanding of genetic testing results. Participants with higher monthly family income and being employed could get more support from their family, work environment, friends and professionals, which could positively affect participants' stress, anxiety and depression [30]. Longer days of knowing genetic testing results can alleviate participants' stress and anxiety. This is consistent with the result of previous research [16]. This supports that during the genetic counseling, nurses had provided enough information to the test receivers. In addition, genetic counseling appeared to produce psychological benefits to breast cancer patients [31]. To date, this is the first study conducted in Chinese genetic testing receivers to explore their health-promoting lifestyle. Genetic testing has become an effective tool for risk management to identify persons who would benefit from its use [5]. The American Society of Breast Surgeons recommends that genetic testing should be available to all interested patients who are diagnosed with breast cancer and their family members [7]. Accompanying genetic testing, genetic counseling is extremely important. Risk management strategies and modification of lifestyle were two parts of post-test genetic counseling. Maintaining a health-promoting lifestyle could help raise survival rates and improve quality of life. Critical to this process is the increased use of genetic counseling nurses.

4.4 Limitations

There are several limitations to this study. First, a convenience sample in the genetic counseling clinic may restrict the applicability and generality of results of the study, and a random sampling may be needed in the future. Second, a cross-sectional design meant all the data were examined at one time point and on one occasion, and such design does not allow for observations of dynamic change. Third, the sample size was relatively small, and large-scale studies with multi-center design are strongly suggested. Finally, this study explored the health-promoting lifestyle based on socio-economic variables, however, psychological factors were not included, which should be considered in future studies.

5. Conclusions

The current study indicated that a good level of health-promoting lifestyle of breast cancer patients and family members in a Chinese genetic counseling clinic was present and it was significantly influenced by participants' monthly family income. Regarding the other influencing factors, more education and intervention should be tailored to enhance and encourage health-promoting lifestyle behaviors in those participants with low monthly family income. In the six subscales of health-promoting lifestyle, nutrition obtained the lowest score. As nutrition can change body composition and immune status, developing a nutritional curriculum and strengthening the publicity of nutritional popular science are priorities in future research studies.

Availability of Data and Materials

The datassets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Author Contributions

SH, ZL and YL—Made contributions to study conception and design; SH, LC, XL, CF, QY, TS, JQ—Participated in data collection; SH, LC and ZL—Dedicated to data analysis and interpretation; SH and LC—Involved in drafting of the manuscript. All authors read and approved the final manuscript.

Ethics Approval and Consent to Participate

The study was approved by the Scientific and Ethical Committee of the cancer center in Shanghai, Fudan University, and the approval number is 1810192-19. Participants who volunteered to participate in this study were invited to write informed consents.

Acknowledgment

The authors thank all the participants who volunteered to participate in the study. The authors thank all the nurses in the breast surgery department, who have undertaken more clinical work for us when we were doing the research.

Funding

This study was funded by Nursing Research Fund of Fudan University, and the fund number is FNF201830.

Conflict of Interest

The authors declare no conflict of interest. Zhenqi Lu is serving as one of the Guest editors of this journal. We declare that Zhenqi Lu had no involvement in the peer review of this article and has no access to information regarding its peer review. Full responsibility for the editorial process for this article was delegated to Andrea Tinelli and Luca Roncati.

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