[1]Effects of health education on Screening Rate of First Degree Relatives of Cancer Patients: A Systematic Review and Meta-analysis

Jiaxun Kang[1],Shanshan Wang[2],Jingna Yi[1],Qiushi Zhang[1]*

1 School of Nursing and Health, Zhengzhou University,Zhengzhou, China

2 School of Nursing, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong SAR, China

Abstract

Objective: To synthesize the effects of educational intervention on the screening rate of first-degree relatives of cancer patients.

Methods: A total of eight Chinese and English databases were searched (PubMed, Embase, Cochrane Library, CINAHL, Web of Science, Scopus, Medline and China Biology Medicine disc) from the time of library establishment to June 2023, for randomized controlled trials investigating the effects of educational intervention on screening rate of first-degree relatives of cancer patients.Two researchers independently screened and evaluated the quality of studies. RevMan 5.3 software was used to calculate the pooled effect size.

Results: Thirteen studies involving 5628 participants were chosen to include in the meta-analysis. The results revealed that health education can increase screening rate of first-degree relatives of cancer patients (RR =1.39, 95% CI =1.16 – 1.65, P= 0.0002). The effect shown after short-term follow-up (≤6 months) was insignificant in terms of improving screening rate(RR =1.46, 95% CI =0.94 – 2.26, P=0.09), but after long-term follow-up (＞6 months) the improvement was greater (RR =1.37, 95% CI =1.13 – 1.65, P=0.002).

Conclusion: Health education is effective in increasing the screening rate of first-degree relatives of cancer patients. The effect is more evident after long-term than short-term follow-up.

1. Introduction

Corresponding author：Qiushi Zhang

E-mail address:qiutiandeguozi@126.com

Cancer is predicted to become the leading cause of prematuredeath globally in the twenty-first.[1] According to the 2020 estimates from the International Agency for Research on Cancer (IARC), the global count of new cancer cases reached 19.3 million with almost 10.0 million cancer deaths. Lung cancer remained the leading cause of cancer death(18%), followed by colorectal (9.4%), liver (8.3%), stomach(7.7%), and female breast (6.9%) cancers.[2] The National Comprehensive Cancer Network (NCCN) Guidelines Version 2 recommended screening as a simple and effective approach to diagnosing cancer at an early stage and improving prognosis especially for people with a risk of inherited cancer.[3,4] In addition, the survival rate of cancer patients can be improved effectively and mortality decreased accordingly by implementing population-based cancer screening, and early diagnosis and treatment.[5] Research results show that the examination and early diagnostic rate of cancer, including breast,[6] esophageal,[7]and liver,[8] can be improved by screening. Timely screening can increase the survival rate of patients participating in treatment Actively.

The first-degree relatives (FDRs,included parents, siblings, and children only) of cancer patients was considered as the target population for screening[9, 10], some studies had shown that FDRs of patients with breast cancer[11], colorectal cancer[12], gastric cancer[13], skin cancer[14], etc. should be screened regularly. In the FDRs population of gastric cancer patient, the odds ratio for relative risk of FDRs gastric cancer development fluctuates between 2 and 10 in different races and regions [13],about 25 percent of CRC patients had at least one FDR of the same disease[15]. Standardized monitoring according to clinical guidelines was recommended for the FDRs of CRC patients due to their risk of CRC being 2–4times higher than that of the general population.[16] A biennial consultation with a total cutaneous examination was determined to be cost-effective for the FDRs of cutaneous melanoma patients in a computer simulation study conducted in the United States before the contemporary era of effective but expensive medical treatments for advanced cancer stages.[17] Currently, it is recommended that FDRs of CRC patients younger than 60 years old should undergo colonoscopy at age 40 or 10 years before the age of diagnosis of the first CRC patient in the family (e.g. the patient was diagnosed at 48 years old, so FDRs should undergo colonoscopy at 38 years old). The frequency of screening should not be less than once every 5 years.[18]

Although routine screening for FDRs has been recommended, compliance remains low. The screening rate of FDRs of CRC patients has been reported as only 14%– 40%,[19] and in an Australian study the self-reported lifetime screening adherence of FDRs at slightly above average risk was 47%.[20] Other studies[21,22] have suggested that compared to people without a family history, FDRs are more likely to consent to engage in screening, but they are not more likely to comply with testing. One explanation for this low adherence was that previous participants appeared to have insufficient understanding of appropriate risk-based screening intervals. Only 22% of those with hereditary non-polyposis colon cancer and 52% of individuals with a familial history of CRC were aware of the recommended colonoscopy screening frequency based on their family background.[23] There were other influencing factors, including fear of cancer, lack of screening information, discomfort of examination, radioactivity of examination, no time to wait, lack of health insurance, low level of income, etc.[11] Low screening participation rates are a global issue, and it is important to find an effective approach to facilitate the screening of FDRs. The World Health Organization promotes health education to improve the awareness and understanding of how to keep healthy and prevent disease, including information on available resources and the benefits of accessing services.[24] Health education should promote a healthy lifestyle and change unhealthy behaviour by changing people's cognition of disease, and thus improve health literacy.[25] It has been shown that health education can raise the aggregated demand of women for cervical cancer screening[26] and acceptance of the pap smear[27]; it can also as increasing the screening rate of CRC.[28] However, some studies have given different results, such that health education was not likely to positively influence screening behaviour for FDRs of breast cancer or CRC patients.[21,29]

Information on cancer screening is delivered in various ways, which include telephone calls, educational brochures by post, peer education, counseling sessions, customized tutorials, face-to-face interviews, lectures, films, group discussion, etc.[24] Health education may be an effective way to improve screening acceptance among those at high risk such as FDRs of cancer patients. Although some scholars have begun to pay attention to this important group and carry out relevant research, difficulties are created in the screening management of FDRs by ambiguities in detailed strategy, intervention duration, etc., of the health education reported in these studies as well as the differences in results, and the strength of evidence is still not clear. Up to now, there has been no

relevant systematic review published. The aim of this study was to explore the influence of health education on the screening rates of FDRs of cancer patients by the method of systematic review and meta-analysis, so as to provide useful information as the basis for future research.

2. Methods

2.1 Registration

This systematic review was registered at PROSPERO(CRD42023464678).

2.2 Search Strategy

PubMed, Cochrane Library, Web of Science, CINAHL, Scopus, Embase, Medline, China Biology Medicine disc (CBMdisc) were systematically searched from establishment to June 17, 2023. The search strategy was set up by working with the librarian. The search adopted a combination of subject word and random word which included Neoplasms (i.e., neoplasms OR tumor OR cancer OR neoplas*), Screening (i.e., screening OR mass screening OR early detec tion of cancer), first degree relative* (i.e., first degree relative* OR relative OR family OR military family), and Randomized Controlled Trial (i.e., randomized controlled trial OR controlled clinical trial OR random*). A search alert was set to receive any updated studies after the search date.

2.3 Inclusion and Exclusion Criteria

The inclusion criteria included: (1) Participant: FDRs(only included parents, children, and siblings) of cancer patient with 18 years and older; (2) Intervention:the health education intervention contents were all general knowledge of cancer, risk factors, family history, screening methods, screening recommendations, solutions of common screening barriers, etc.The intervention methods included telephone calls, peer education, customized tutorials, face-to-face interviews, lectures, etc (the specific intervention methods are not restricted); (3) Comparators:they were the groups that received usual care；(4) Primary outcome indicators: the screening rate of cancer,the proportion of participants in cancer screening by the follow-up time, the main measuring method was self-report of FDRs with their inspection results; (5) Study type: randomized controlled trial; (6)Publication date: unlimited; (7)Publication language: English or Chinese.

The exclusion criteria included:(1)The study subjects included both FDRs and second-degree relatives(uncle,anut,cousin,et al), but the data were mixed; (2) FDRs themselves are diagnosed with cancer;(3) Books, editorials, comments, and meeting minutes without data.

2.4 Data Extraction

Endnote X9 was used for data management. The first author selected titles and abstracts of the study, and the corresponding author reviewed them. The full text review was completed by the first author and the third author independently, and was discussed and confirmed with the second author in case of disagreement occurring. The two reviewers of full text performed information extraction independently by using a unified custom information extraction table. The information extraction table includes first author, publication year,country, cancer types, mean age, sample size, intervention,comparison, theoretical model, implementer, follow-up duration and outcome indicators.

2.5 Quality Assessment.

The quality assessment of included studies was conducted independently by two reviewers using the Cochrane Collaboration Risk of Bias Tool for randomized controlledtrials.[30] Quality was appraised from seven aspects: random allocation, protocol concealment, blinding of subjects and researcher, blinding of outcome measures, selectivity reporting study findings, and other bias. The assessment levels included“low risk”, “possible risk” and “high risk”. Two researchers (the first author and the third author) discussed the evaluation.A third researcher (the second author) was consulted if there was a great discrepancy.

2.6 Statistical Analysis

The Review Manager Software (Revman 5.3) was employed to carry out the meta-analysis. Individual study effect sizes were calculated using relative risk (RR), and the same outcome variables were utilized in the meta-analysis. To calculate the pooled effect, the overall RR and 95% confidence interval (CI) were employed. The studies’ heterogeneity was evaluated using the Chi-square and I-squared (I^2) statistics.31 Data analysis should implement meta-analysis of fixed effect model if $I^2 < 50\%$; when $I^2 \geqslant 50\%$, it should find the source of heterogeneity by implementing subgroup analysis or sensitivity analysis, and it should implement meta-analysis of random effect model if the heterogeneity still cannot be reduced.

3. Results

3.1 Search results and study selection

A total of 5,749 studies were retrieved , 1,184 studies are deleted through EndNote and manual duplicate checking, 4,540 studies were deleted through reading the titles and abstracts preliminary, 12 studies were excluded through full text reading, 13studies were included in the end [14, 32-43]. The detailed screening process was shown in Figure 1.

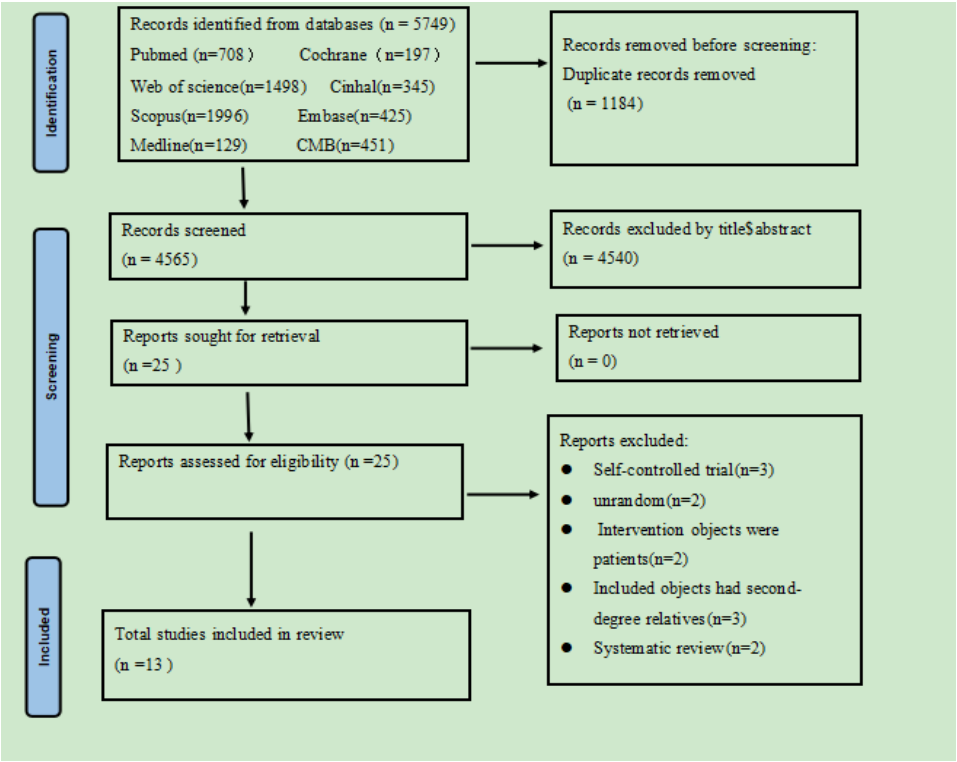

Fig. 1.The PRISMA flow chart of this review

3.2 Characteristics of Included studies

A total of 5,628 cases of FDRs of cancer patient were included in the 13 studies, which contained 2,825cases in the experimental group and 2,803cases in the control group. All included studies were published during the period of 2006 to 2022, and the cancer types were mainly involved in the studies which include breast cancer [32], CRC [33-41] and melanoma [14, 42, 43]. The trials were distributed in Australia,[37] China,[40] France,[14,39] Iran[33] and USA.[32,34–36,38,41–43] The intervention content contained general knowledge of related diseases, risk factors, family history, screening methods, screening recommendations, solutions of common screening barriers, etc. Intervention

approaches included telephone interventions,[32,33,36,41] individualized print intervention,[35,37] face-to-face health consultation,[34] mail (letters) interventions,41 network interventions,[38,40,43] nurse-led interventions,[39] etc. The theories or models adopted included: Precaution Adoption Process Model (PAPM),[34] Health Belief Model (HBM),[35,40] Transtheoretical Model/ Stages of Change Theory (TTM),[35] Motivational Interviewing (MI),[33] Social Cognitive Theory,[42] Theory of Planned Behavior.42 Detailed information is shown in Table 1.

Table 1 The characteristics of included studies (n = 13)

Number	Author, Year, Country	Cancer type	Mean age/years	Sample size （T/C）	Intervention	Comparison	Theoretical model	Implementer	Follow-up duration (months)	Outcomes
1	Lipscomb et al.,[33] 2020, USA	breast cancer	45-56	35/48	(a)Education brochure; (b)telephone counseling:financial and physical hurdles to screening were evaluated, highlighted how important it was to be screened for breast cancer,FDRs were also urged to speak with doctors.	Active control: Education brochure	Not mentioned	graduate research assistants, study coordinator	12m	The rate of mammography screening
2	Salimzadeh et al.,[34] 2018, Iran	colon cancer	T:47.9± 11.0 C:46.5± 12.8	120/120	Phone-based motivational Interviewing :(a) introduced the risk of hereditary CRC and the preventive measures that can be taken;(b) discussed the willingness or intention of participants to undergo colonoscopy; (c)tailored additional information;(d)motivated research objects and strengthened the sense of self-efficacy;(e)helped the research subjects to overcome the barriers	Active control: standard educational information	MI	trained oncology nurse or a physician	6m	The rate of colonoscopy screening
3	Glanz et al.,[35] 2007, USA	colorectal cancer	T:52.9± 10.5 C:55.8± 12.2	85/91	(a) Individual face-to-face health education:a tabletop flip chart was utilized by the nurse/health educator to convey information on CRC, risk factors, screening recommendations.,customized print materials (b) phone calls: evaluation of action plans and their status, reiteration of risk information, choices for risk reduction, and further obstacles counseling about further obstacles if needed.	Active control: Education brochure	PAPM	a nurse educator or trained health educator	12m	The rate of colorectal cancer related tests

4	Rawl et al.,[36] 2008, USA	colon cancer	≥40	61/79	Tailored print intervention:based on information from the baseline telephone survey, messages were chosen and put together in a personalized intervention booklet for each participant. The intervention development process was guided by theoretical concepts derived from the HBM and TTM. These concepts encompassed the perception of susceptibility, the perception of benefits and of obstacles, and self-efficacy with regard to each screening test.	Active control: Education brochure	HBM TTM	trained interviewers	3m	The rate of colonoscopy screening
5	Lowery et al.,[37] 2014, USA	colorectal cancer	≥25	322/310	Tailored telephone intervention: (a) trained interviewers provided tailored information based on baseline surveys; (b) interviewers engaged in appropriate conversations with participants to discuss their perceived risk of CRC, guidelines for appropriate screening based on individual risk levels, the advantages and disadvantages of CRC screening, perceived barriers	Active control:a mailed packet with general information about screening	Not mentioned	trained interviewers	24m	The rate of colonoscopy screening
6	Carey et al.,[38] 2016, Australia	colorectal cancer	T:51.0± 13.9 C:51.0± 13.7	203/252	Provided recommendations for screening based on their risk levels	Active control: general information about CRC screening	Not mentioned	health professionals	12m	The rate of colorectal cancer related tests
7	Paskett et al.,[39] 2020, USA	colorectal cancer	T:52.1 ±13.6 C:51.4 ±12.8	515/528	Website plus patient navigation intervention: navigators assessed screening obstacles, provided consultation to eliminate these obstacles, and assisted participants requiring colonoscopy with scheduling issues; periodic follow-up conducted by the navigators ensured that participants received continuous support and assistance throughout the screening process	Active control: general information about CRC screening	Not mentioned	study staff and Navigators	14m	The rate of colonoscopy screening

8	Ingrand et al.,[40] 2016, France	colorectal cancer	T:52.4 ±6.5 C:52.3 ±7.0	160/144	Nurse-led tailored intervention:Tailored interventions were designed to increase awareness among siblings about the benefits of colonoscopy, considering their specific psychosocial environmental profile.	Active control: general information about CRC screening	Not mentioned	Digestive surgeons ,gastroenterologists,nurses	12m	The rate of colonoscopy screening
9	Bai et al.,[41] 2022, China	colorectal cancer	T:48.65 ±9.18 C:50.59 ±9.02	94/94	A WeChat tailored communication intervention: (a) to assess health beliefs, an online tailored assessment tool was developed; (b) this tool had the capability to automatically present a corresponding tailored message based on the assessment; (c) additionally, a summary of the tailored message was sent to the participant with the aim of reinforcing their perception of CRC risk	Active control: e-brochure standard information	HBM	a registered nurse who had 1 year's experience in CRC screening education	3m	The rate of colonoscopy screening
10	Bastani et al.,[42] 2015, USA	colorectal cancer	40-80	670/610	Targeted mail plus telephone intervention:(a) an ethnically targeted and individually tailored print intervention was mailed to participants. This utilized information from the baseline interview; (b) participants who were not screened during the 6-month telephone follow-up received a brief obstacles counseling session immediately after completion of the interview; (c) the counseling session, which consisted of standardized scripts, aimed to explain the mailed risk assessment, remove obstacles, remind participants of their intention to undergo screening, address other related issues, provide information about the provision of CRC screening services by local clinics	Inactive control: waiting list control	Not mentioned	trained counselors	12m	The rate of colorectal cancer related tests

11	Marcé et al.,[14] 2022, France	Melanoma	T:52 ±17.0 C:50 ±18.0	166/114	(a)Participants were provided with the usual oral information and a tip sheet that explicitly informed them of the higher risk of cutaneous melanoma for FDRs;(b)The medical staff developed the tip sheet before the start of the trial and shared it with both cutaneous melanoma patients and their FDRs.	Active control: the usual oral advice	Not mentioned	dermatologists	12m	Professional skin screening
12	Geller et al.,[43] 2006, USA	Melanoma	≥18	237/257	Computer-generated tailored print materials and three telephone counseling:(a)Initial incentive and goal setting telephone meetings provided by health educators; (b)three sets of computers - specially generated materials based on baseline surveys;(c)Conduct three phone consultations with health educators, scheduled after receiving mailing materials;(d) Contact with free screening programs.	Inactive control: the usual care	Social Cognitive Theory, Theory of Planned Behavior	health educator	12m	Professional skin screening
13	Bowen et al.,[44] 2018, USA	Melanoma	51.32/19-91	157/156	(a)Participants in the study were provided with unique website links; (b) the website indicated the possibility of future melanoma based on their individual risk status and factors; (c) the website also provided information on how to prevent melanoma, perform self-screenings, request a skin screening from a healthcare provider; (d)participants were reminded to regularly utilize the website and pay attention to melanoma prevention behaviors	Inactive control: delayed intervention	Not mentioned	study staff	12m	Professional skin screening

T: treatment; C: control; CRC: colorectal cancer; FDR: first-degree relative; MI: Motivational Interviewing; HBM: Health Belief Model: PAPM: Precaution Adoption Process Model; TTM: Transtheoretical Model/Stages of Change Theory.

3.3 Quality Assessment of Included Studies

Of the 13 randomized controlled studies reviewed, 11 mentioned how the randomization was done and were rated as low risk of bias, but two studies[32,34] didn't expound the detailed generation methods of random allocation and so received an unclear risk of bias rating due to insufficient information. Only one study[40] gave information about the allocation concealment, which was indicated as having a low risk of bias; the remaining studies had an unclear risk of bias for this aspect. Only one study[37] mentioned how blinding of participants was implemented, and was rated as low risk of bias. Three studies[33,38,43] explained the blinding method for surveyors, and were rated as low risk of bias. Because the main measuring method was self-reporting by FDRs with their inspection results, the surveyors would then verify the results with related medical institutions; therefore, the effect on results collection was small, whether surveyors used a blinding method or not. All the studies report the number of cases lost, but most did not implementITT (intention-to-treat) analysis. All the studies report the outcome indicators in accordance with the proposal; the detailed results of quality evaluation are shown in Figures 2 and 3.

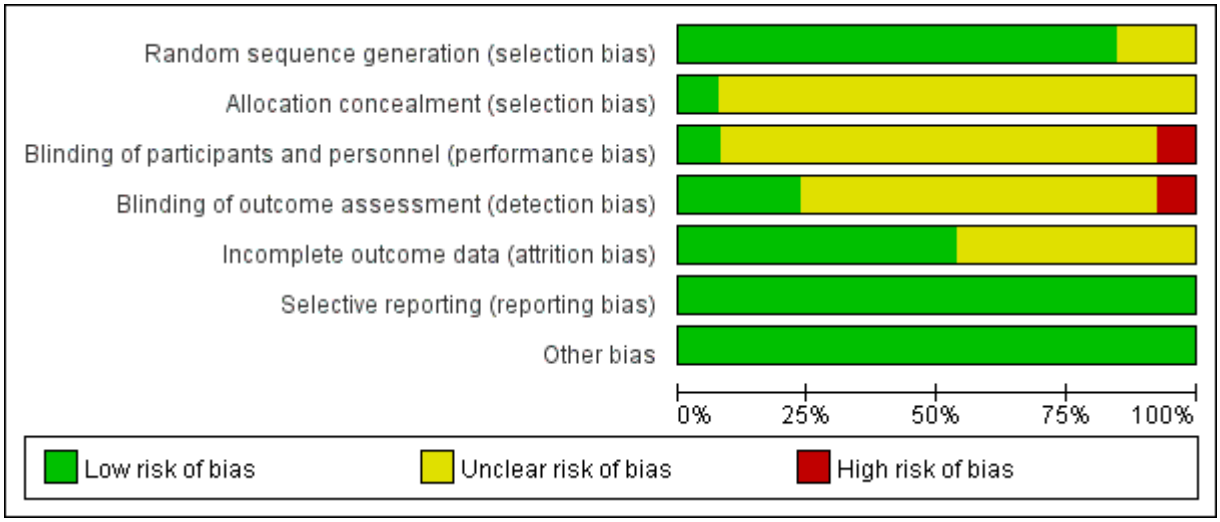

Fig. 2 Risk of bias graph

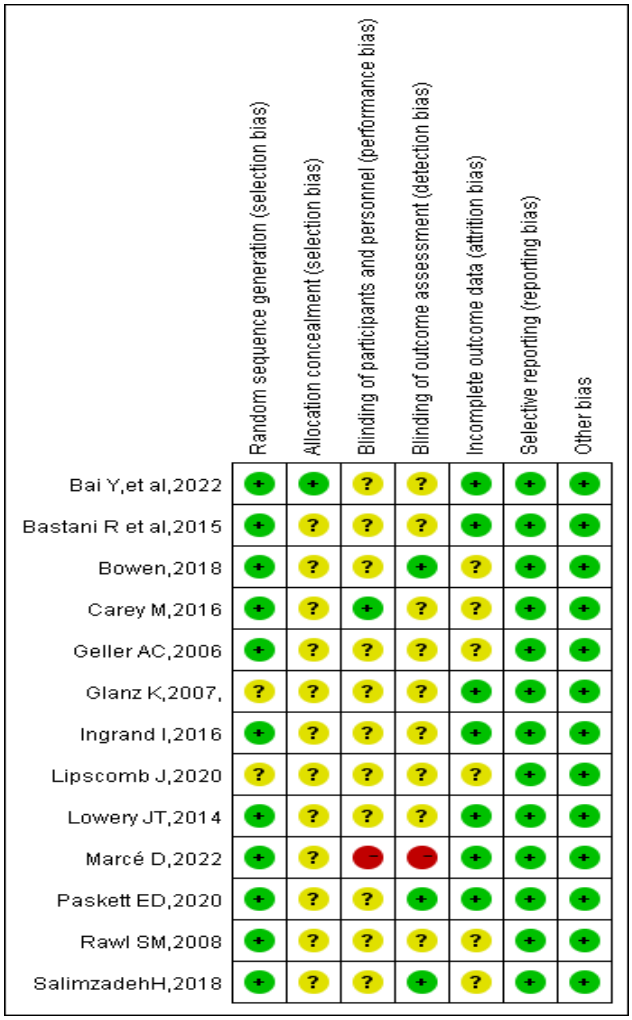

Fig.3 Risk of bias summary

3.4 The Effect of Health Education on FDR Screening Rate of Cancer Patients

The meta-analysis demonstrated a high degree of heterogeneity among studies in terms of screening rate (I^2=85%, P<0.001), random effects model was adopted.The findings indicated that health education had a beneficial effect on the screening rate of FDRs of cancer patients when compared to the control group.(RR=1.39, 95% CI: 1.16-1.65, P=0.0002). The results were shown in Figure 4.

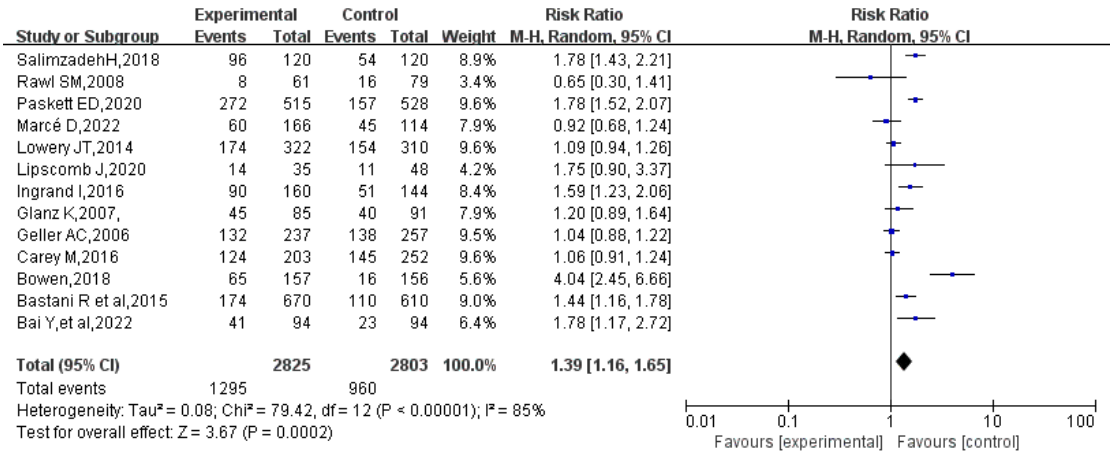

Fig. 4 Effects of Health education on the screening rate of FDRs

3.5 The Effect of Follow-up Duration on Screening Rate of FDRs of Cancer Patients

Considering that the duration of follow-up might be the reason for clinical heterogeneity, subgroup analysis was conductedseparately for short-term (⩽6months) and long-term (>6 months) follow-up. Random-effect analysis indicated that there was no effect after short-term follow-up (RR=1.46, 95% CI: 0.94-2.26, P=0.09). After long-term follow-up, the effect of promoting the screening rate was shown (RR=1.37, 95% CI: 1.13–1.65, P=0.002). Detailed results are shown in Figure 5.

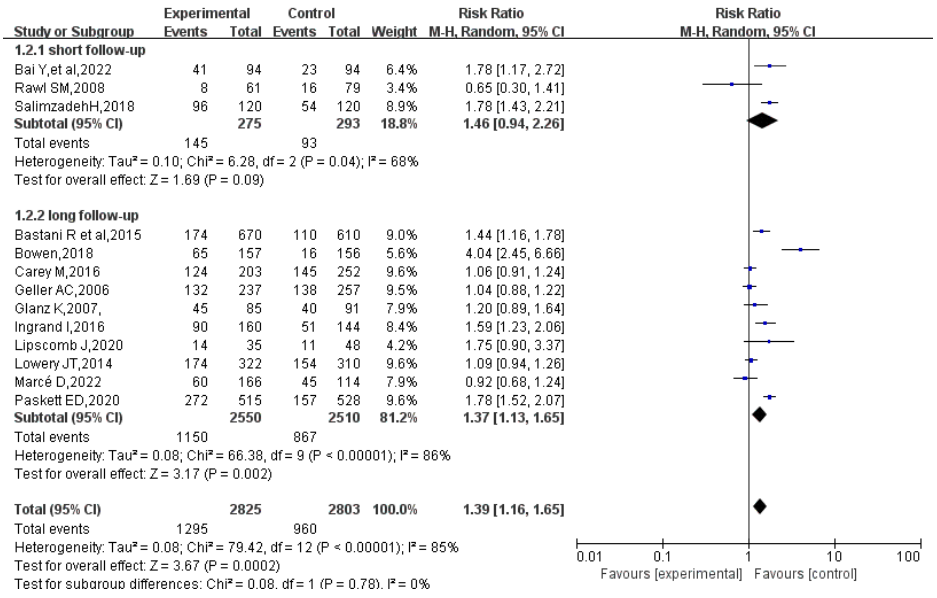

Fig. 5 Effects of follow-up duration on the screening rate of FDRs

4. Discussion

4.1 Characteristics of Included studies in Systematic Reviews

The 13 studies reviewed here were published between 2006 and 2022; three of them were published before 2010 and 10 after 2010. The increase is probably because more scholars started to pay attention to the issues of FDR screening in recent years, so more intervention strategies were used to improve screening rate. The main strands of health educational content were general knowledge of disease, risk factors, screening approaches, screening recommendations, the solutions of common screening barriers, etc. Most of the health educational methods were traditional, such as telephone interview, mail and print intervention, etc. Some studies had begun to implement intervention by adopting modern network technology; for instance, Bai[40] developed an online customized evaluation tool: after entering general demographic information, family history, health belief regarding examination of CRC and colonoscopy, and response of measuring instrument, this tool presents customized information automatically, so as to implement relevant health education for the individual participant. Lowery's study36 indicated that counselling was conducted using Computer Assisted Telephone Interview software at the University of Colorado Cancer Center. The use of new technologies provides fresh ideas for intervention in future studies. The intervention implementers used in four studies[33,34,39,40] gives an indication that nurses are the significant force in promoting early screening of cancer. This is consistent with previous research results,[44,45] that nurse-led intervening measures play a positive role in the aspects of increasing acceptance rate of early cancer detection, cancer knowledge, belief in early detection, finding of precancerous lesions, etc. The important role of nurses in cancer screening and as promoters of health management should be further exploited in the future.

4.2 Health Educational Can Improve FDR Screening Rate of Cancer Patients Effectively

There was no unified conclusion, among the studies reviewed, as to whether a health educational strategy can increase the screening rate of FDRs of cancer patients. Some studies[23,32,38,46] indicated that health education was beneficial in increasing the screening rate of FDRs, while other studies[11,21] reported that it had no effect on their screening rate. The results of meta-analysis showed that the screening rate of FDRs had increased, which was consistent with previous

studies.[23,47] The use of tailored health education attracted attention for its ability to enhance persuasiveness by conveying messages specifically targeted at individuals. This personally relevant approach increased the likelihood that the message would be read and cognitively processed by the participant. As a result, there was an increased chance of behavioural change with regard to screening.[40] Several studies[14,32,36–38,41–43] indicated that working with families had been identified as a promising health education avenue for encouraging behaviour change. One method of achieving this was by identifying a case in the family and assisting with contact of other family members. Therefore, it was important for further research to identify possible mechanisms and ways in which familial attention to the problem could be increased. Additionally, exploring accessible conduits for working with families would be beneficial. The main reasons why health education promotes the screening rate of FDRs may include: (1) the FDRs could be influenced by health-care professionals in regard to perceptions of health and disease, which could encourage them to change their behaviour; in addition, specific obstacles to screening should have been resolved during the implementation process, and screening promotion accomplished as well. (2) The reported theoretical basis of many of the studies included in this systematic review gives a scientific guarantee of the validity of the intervention implementation. The theoretical models favoured included HBM, TTM, PAPM, Social Cognitive Theory, Theory of Planned Behavior, etc. It has been shown[48,49] that these theories play positive roles in the aspects of health risk behaviour change, positive health behaviour adoption, and improved compliance with medical orders, and meanwhile can also improve the screening rate of cancer disease effectively.[50,51] HBM was the model most used for promoting positive health behaviour of cancer patients; however, the method that combined other models with TTM was more effective than the others due to TTM being based on the stages of behaviour change, while other models showed the mechanism of creating behaviour; therefore, cancer education and health behavioural counseling based on the TTM model were beneficial to promoting healthy lifestyles.[52]

4.2 The Effect of Follow-up Duration on Screening Rate of FDRs of Cancer Patients

No effect after a short-term follow-up (≤6 months) is observed. This might be related to the small number of studies with shortterm follow-up, being only three.[33,35,40] It is also possible that changing the health behaviour is a long-term process[53]; the studies of 3–6 months' duration were insufficient in changing screening belief and overcoming screening barriers of FDRs adequately.

Furthermore, 3 months may not be enough time to determine the level of screening participation adequately, with specialised screening methods such as colonoscopy.[35]Therefore, some researchers considered that the forward stage movement of TTM theory was an effective reference result beside the screening behaviour.35 As the effectiveness of long term follow-up has been proved,32,36,41 the expectation of future study is to implement short-term interventions with larger samples in order to verify its validity more accurately,as well as to provide strong evidence for subsequent intervention duration formulation.

4.4 Limitations

(1) The results of this study show considerable heterogeneity in spite of the implementation of subgroup analysis. Due to the commonality of screening experience, this study was not restricted to a specific type of cancer. The heterogeneity of the results is perhaps also related to the acceptability of different cancer screening requirements and the accessibility of resources. The outcome indicators for measurement were screening rates; however, different cancers require different screening programs. The screening requirement for FDRs of a melanoma patient was to implement a full-body skin examination by a professional, while the screening requirement for CRC was to implement colonoscopy, and mammography for breast cancer. Comparatively speaking, colonoscopy requires more mental and physical preparation, which would have a certain influence on screening rate. In addition, there are economic restrictions: the cost of colonoscopy was highest and the cost of mammography came second; however, the participants were allowed colonoscopy free of charge in one of the included studies, these factors perhaps contributed to the differences between the studies. Although agreement between studies was affected by many existing factors, the combined results still show that health education can generally promote the screening rate of FDRs of cancer patients. (2) Although the experimental data included in this study were all from randomized controlled trials, some of the studies didn't further describe the allocation concealment scheme and the method of blinding intervention implementers, which might have an impact on the research conclusions of the article. (3) Since the studies were all published in English, there may be a degree of language and publication bias.

4.5 Clinical implications

Firstly,There are only three types of cancer included in this study, which are breast cancer, CRC and melanoma, the future expectation is to pay more attention to the screening of FDRs of patient with other types of cancer, and to explore more interventions that can promote screening in the aspects of economical, scientific and efficient.Secondly,with the rapid development of social networking platforms, more and more people are using We-Chat, WhatsApp,Facebook, and others, Internet-based communication channels are increasingly perceived as more convenient and cost-effective alternatives to telephone and print. Therefore, future studies could explore the use of new channels like the Internet and mobile devices, combining verbal and written information communication systems, to suit different situations. Thirdly, it is recommended that future studies should develop more specific assessment tools and response systems to examine how the evaluation of personal data influences the communication outcomes.

5. Conclusion

Despite the limitations mentioned above,Our study still provides a preliminary reference for promoting the screening of FDRs.Our research revealed that the health education can improve the screening rate of FDRs of cancer patients, and the effect of long term follow-up is better than short term follow-up.Because of the importance of cancer screening, Further research is needed to explore more effective and convenient interventions that can improve the screening rate.

6. Authors Contributions

Jiaxun Kang, Jingna Yi, and Qiushi Zhang conducted the design of the entire study, Jiaxun Kang conducted the study retrieval and selection, and Qiushi Zhang reviewed the study selecting process. Jiaxun Kang and Jingna Yi conducted the selection of full text, Shanshan Wang took charge of the disagreements during the selecting process, Jiaxun Kang took charge of the article writing, Shanshan Wang, Jingna Yi and Qiushi Zhang revised the article repeatedly, and all authors confirmed the final draft.

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Declaration of competing interest

The authors confirm no conflicting interests.

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