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ORIGINAL RESEARCH

The Mediating Role of Patient Activation on the Relationship Between Social Support and Health-Promoting Behavior in Patients with Thyroid Cancer: A Cross-Sectional Study

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Purpose: This study aimed to explore social support on health promotion behavior among patient with thyroid cancer and to investigate the mediating effect of patient activation in this relationship.

Participants and Methods: This study used a cross-sectional correlational design. A convenience sample of 618 thyroid cancer patients from two hospitals in Hunan Province, China, was included in the study. Data were collected from April to November 2023. The survey tools include: the General Information Questionnaire, Patient Activation Scale, Health Promoting Lifestyle Scale Chinese Revised Version, Social Support Rating Scale. Structural equation modeling and bootstrapping were used to analyze the mediating effect of patient activation on social support and health promotion behavior.

Results: Social support was positively correlated with health promotion behavior (r= 0.360, P<0.001), social support was positively correlated with patient activation (r=0.293, P<0.001), patient activation was positively correlated with health promotion behavior (r=0.541, P<0.001). Patient activation partially mediated the impact of social support and health promotion behavior, accounting for 33.03% of the total effect.

Conclusion: Thyroid cancer patients' health behavior need to be improved. Medical professionals ought to devise an intervention strategy based on pathways that influence health promotion behaviors among thyroid cancer patients. This approach aims to improve social support and patient activation, in order to promote the improvement of health promotion behavior, ultimately reducing the burden of medical care.

Keywords: thyroid cancer, health-promoting behavior, patient activation, social support, health promotion

Introduction

Thyroid cancer (TC) is the most prevalent cancer of the endocrine system and the head and neck region, with an estimated 58,600 new cases diagnosed worldwide in 2020.[1] Surgery remains the primary and effective treatment for TC both in China and globally. Advances in medical technology have resulted in a five-year relative survival rate of 84.3% for TC patients in China, compared to 98.6% in developed countries such as those in Europe and the United States.[2] These disparities in outcomes are influenced not only by differences in medical technology, economic status, and cultural practices but also by behavioral habits and living environments.[3] Poor health lifestyles, including irrational diets and insufficient physical activity,[4] contribute significantly to the increasing incidence and prevalence of TC, adversely affecting patient prognosis and quality of life.[5,6] Effective health promoting behaviors are crucial for enhancing health-related quality of life and preventing cancer recurrence.[7,8]

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Health promoting behavior encompass actions aimed at maintaining and improving health, including health responsibility, self-realization, physical activity, nutrition habits, interpersonal relationships, and stress management.[9] Research indicates that TC patients can lower recurrence rates by adopting healthier lifestyles and adhering to health promoting behaviors.[10] However, many TC survivors continue to engage in unhealthy behaviors such as smoking, alcohol consumption, and lack of exercise, which significantly impact their quality of life and disease prognosis.[8] Understanding the factors that influence health promoting behaviors is essential for designing personalized interventions that enhance patient engagement in health-related behavior changes and reduce the burden on healthcare systems.

Health promoting behaviors are influenced by various factors, including cognitive-perceptual elements (eg, self-efficacy, perceived health status) and modifying factors (eg, demographic characteristics, biological traits, interpersonal relationships). Social support, defined as the assistance and protection provided to individuals, plays a critical role in mitigating stress, maintaining psychological well-being, reducing disease risk, and promoting healthy behaviors.[11,12] Despite its importance, there is limited empirical research on the relationship between social support and health promoting behaviors specifically among TC patients.[13,14]

Patient activation refers to a patient's readiness, willingness, and ability to manage their health, highlighting the importance of self-care and collaboration with healthcare providers.[15,16] As cancer is increasingly recognized as a chronic disease requiring self-management, patient activation has gained significant attention.[17] Higher patient activation is associated with lower healthcare and societal costs, better adherence to treatments, regular exercise, and healthier diets, leading to improved health outcomes.[18,19] In China, research on patient activation is still developing, with recent studies showing moderate activation levels among young and middle-aged postoperative TC patients influenced by education, 131I treatment, and disease acceptance.[20] Additionally, patient activation is positively correlated with social support, as supportive environments enhance self-esteem and confidence in disease management.[21,22]

The existing literature suggests that social support and patient activation are interconnected and both influence health promoting behaviors. However, empirical studies specifically examining these relationships among TC patients in China, particularly the mediating role of patient activation, are lacking.

This study is grounded in the Health promotion Ecological Model,[23,24] which emphasizes the impact of individual attitudes, self-efficacy, and social support on behavior change. We hypothesize that TC patients with strong social support will exhibit higher levels of patient activation and engage more in health promoting behaviors. Furthermore, social support is expected to influence health promoting behaviors directly and indirectly through patient activation. Therefore, this study aims to assess the current status of social support, patient activation, and health promoting behaviors among TC patients and to elucidate the mechanisms by which social support affects health promoting behaviors through patient activation. The findings will provide a theoretical foundation for developing targeted nursing interventions for TC patients.

Methods

Study Design and Setting

This was a cross-sectional and descriptive correlation design. It was examined the effect of social support on health promoting behavior through the mediating effect of patient activation in thyroid cancer patient.

Participants and Procedure

Using a convenience sampling method, all participants were received either inpatient or outpatient care in two university hospitals in southern China. Data collection was conducted from April to November 2023. The inclusion criteria of thyroid cancer patients were as follows: (1) adults (≥18 years) who had undergone surgery to treat thyroid cancer; (2) able to understand and cooperate with the investigation; (3) willing to sign informed consent and voluntarily participate in this study. Patients were excluded if they (1) had been diagnosed with severe organ dysfunction or other malignancies; (2) had a history of mental illness, cognitive impairment, or communication impairment; (3) were unwilling to participate in our study.

Sample Size

The recommended minimum sample size for structural equation modeling (SEM) research is 200 cases in the model, and a dropout rate of 10%, the calculated minimum sample size was 220. We invited 632 cases; however, 14 patients did not complete the questionnaires due to exhaustion and physical discomfort. Finally, data for 618 patients were included in the analysis record. The response rate was 97.8%.

Measures

Demographic and Disease-Related Questionnaire

We designed a demographic questionnaire according to the theme of the study that collected patient information. Demographic data (eg, age, gender, marital status, education level, current residence, occupation, per capita monthly household income (RMB), residence status, medical expenditure pattern) and disease-related information (eg, pathological type, surgical approach, post-operative duration, complementary therapeutic modalities, recurrence of thyroid cancer after surgery, level of knowledge of the disease, combined with other diseases) were collected by a demographic and disease-related questionnaire.

Health Promoting Lifestyle Profile II, Revise, HPLP-IIR

Health promoting behavior was measured by the Health-Promoting Lifestyle Profile II (HPLP-IIR) developed by Walker et al.[25] The scale was translated and revised to the Chinese version by Cao in 2016,[26] which includes six dimensions: health responsibility (11 items), stress management (5 items), interpersonal relationship (5 items), nutrition (6 items), physical activity (8 items), and spiritual growth (5 items). The scale is scored using a 4-point Likert method, ranging from 1 (never) to 4 (always existing). The total scale score is 40–160, with a higher score indicating a higher health promoting behavior level. The Cronbach's α coefficient for this scale was 0.810.

Social Support Rating Scale

Social support was measured by the Social Support Rating Scale (SSRS) developed by Xiao in 1994,[27] including 3 dimensions: subjective support (4 items), objective support (3 items), and utilization of social support (3 items). The score ranges for each dimension: objective social support is score from 1 to 22, subjective social support is score from 8 to 32, and utilization of social support is score from 3 to 12, and the total scale score ranges from 12 to 66, with a higher score indicating better social support. The Cronbach's α coefficient for this scale was 0.890–0.940.

Patient Activation Measure

Patient activation was measured by the Patient Activation Measure (PAM) developed by Hibbard.[15] The scale was translated and revised to the Chinese version by Hong in 2018.[28] The scale was used to evaluate the extent of patients' awareness, knowledge, skills and confidence in managing their illness and health, with 13 items scored by Likert 5-grade scoring. The total score is calculated by adding up the scores of all applicable entries and converting them to a standardized score, with higher scores indicating higher levels of patient activation. Based on the scores, patients can be categorized into four levels of patient activation: PAM1 (first level, ≤47.0 points); PAM2 (second level, 47.1–55.1 points); PAM3 (third level, 55.2–72.4 points); and PAM4 (fourth level, ≥72.4 points). The Cronbach's α coefficient for this scale ranged from 0.81 to 0.84, and the content validity ranged from 0.87 to 0.92.

Procedure

This study was conducted after obtaining approval from the Research Ethics Review Committee of the Hunan Normal University. Participants were recruited from both inpatient wards and outpatient departments. For outpatients, data were gathered during their waiting periods before treatments and examinations, while for inpatients, data collection occurred during their hospital stay. Participation was voluntary, with individuals expressing their willingness to join the study and providing written consent prior to data collection. The researcher personally explained the study's background and objectives to each patient. A standardized set of instructions was provided to guide participants through the questionnaire completion process. To ensure data integrity, the electronic questionnaire required responses to all items before allowing

submission. Paper-based questionnaires were distributed and collected immediately, with each being reviewed for completeness upon return. Completing the survey took approximately 10–15 minutes, and all participants received small gifts as a token of appreciation for their participation.

Statistical Analyses

Data were entered using Epidata software and analyzed via SPSS25.0 and AMOS26.0 software. The general characteristics, disease- related characteristics, health promoting behavior, patient activation, and social support of the participants were identified using descriptive statistics. For normally distributed data, independent sample *t*-tests and ANOVA were employed for univariate analysis. Correlation among health promoting behavior, patient activation and social support were analyzed using *Pearson* correlation analysis. Structural equation modeling was used to verify the model's fit with social support as the independent variable, patient activation as the mediating variable, and health promoting behaviors as the dependent variable. Following fit indices were used to evaluate the model's goodness of fit: $\chi^2/df < 5$, RMSR and RMSEA < 0.08, GFI and AGFI > 0.90, CFI, NFI, and IFI > 0.90. The non-parametric Bootstrap method was used to the test mediating effect of patient activation between social support and health promoting behaviors. The corresponding impact was significant if the bootstrap 95% CI for the estimated mediating effect did not contain 0. A two-tailed *P* value<0.05 was considered statistically significant.

Results

Demographic and Clinical Characteristics of the Sample

A total of 618 patients with thyroid cancer participated in this study. Most were female (77.7%), the mean age was 40.7 years (SD=11.2). A large percentage of patients were married (82.9%) and a per capita household income of more than 5000 RMB monthly. Most participants were diagnosed with papillary thyroid cancer (96.9%). A majority of participants (78.3%) were undergoing endocrine therapy (take levothyroxine sodium tablets). Details are presented in Table 1.

Table 1 Demographic and Disease-Related Characteristics of the Sample (N=618)

Variables	Categories	n	%
Age (years)	18~44	403	65.2
	45~59	183	29.6
	≥60	32	5.2
Gender	Male	138	22.3
	Female	480	77.7
Marital status	Married	509	82.4
	Single	109	17.6
Educational level	Junior high school and below	141	22.8
	High school or technical school College	140	22.7
	Junior College	125	20.2
	Bachelor degree or above	212	34.3
Residence	City	462	74.8
	Countryside	156	25.2
Living conditions	Living alone	74	12.0
	Live with your spouse	148	23.9
	Live with children	33	5.3
	Live with spouse and children	313	50.6
	Other	50	8.1

(*Continued*)

Table 1 (Continued).

Variables	Categories	n	%
Occupation	Workers	48	7.8
	Farmers	66	10.7
	Public institutions	144	23.3
	Separation/retirement	33	5.3
	Freelance	150	24.3
	Other	177	28.6
Monthly per income	<3000($410.80)	126	20.4
(RMB and equivalent in US $)	3000~5000($410.80~$684.80)	223	36.1
	>5000 ($684.80)	269	43.5
Medical expenditure pattern	Medical insurance for residents	177	28.6
	Employee with medical insurance	316	51.1
	Self-paying	34	5.5
	Other	91	14.7
Pathological type	Papillary thyroid carcinoma	599	96.9
	Follicular thyroid cancer and others	19	3.1
Operation	Thyroidectomy	438	70.9
	Secondary (partial) excision	180	29.1
Postoperative duration (months)	<3	204	33.0
	3~6	87	14.1
	>6	327	52.9
Adjuvant treatment	Endocrine therapy	484	78.3
	Iodine-131	14	2.3
	Endocrine therapy + Iodine-131	120	19.4
Thyroid cancer with or without recurrence	No	597	96.6
	Yes	21	3.4
Level of knowledge of the disease	Unknown	58	9.4
	Partial understanding	331	53.6
	Understand completely	229	37.1
Combined with other diseases	No	468	75.7
	Yes	150	24.3

Descriptive Statistics of Health Promoting Behavior, Patient Activation and Social Support

Table 2 shows the mean scores for health promoting behavior, patient activation, and social support. The mean score of health promoting behavior was 105.67±15.63, the total scores for patient activation was 76.95±10.14, and social support was 38.41±7.24.

Table 2 Correlation Among Social Support, Patient Activation and Health Promotion Behavior in Patients with Thyroid Cancer (N=618)

Variables	Scales	Mean ±SD	Patient Activation	Social Support	Health Promotion Behaviors
Patient activation	Patient Activation Measure	76.95±10.14	1	0.293**	0.541**
Social support	Social Support Rating Scale	38.41±7.24	—	1	0.360**
Health promotion behavior	Health Promoting Lifestyle Profile II	105.67±15.63	—	—	1

Note: **$P<0.001$.

Correlation Analysis Among Health Promoting Behavior, Patient Activation and Social Support

Pearson correlation analysis showed significant associations between health promoting behavior, patient activation, and social support. Specifically, social support was positively correlated with patient activation (r=0.293, P<0.001), and a positive correlation with the health promoting behavior (r=0.360, P<0.001). Furthermore, patient activation was positively correlated with health promoting behavior (r=0.541, P<0.001) (Table 2).

The Mediating Effect of Patient Activation on the Association Between Social Support and Health Promoting Behavior

A structural equation model was constructed to test the relationships between social support, patient motivation and health promoting behavior. Standardized results of each path in the model are shown in Figure 1. This study's analysis data of the structural model suggested that χ^2/df=4.161, RMSEA = 0.072, GFI = 0.958, AGFI = 0.930, CFI = 0.930, NFI = 0.910, IFI = 0.930. The indexes showed that the model was realistic and had a high degree of fitting.

As shown in Table 3, The structural equation model path analysis results that social support had a positive predictive effect on patient activation in thyroid cancer patients (β=0.413, P<0.001); patient activation had a positive predictive effect on health promoting behavior (β=0.444, P<0.001); social support had a positive predictive effect on health promoting behavior (β=0.371, P<0.001); There is a partial mediating effect of patient activation between social support and health promoting behavior (β=0.413*0.444=0.183) (Table 4). And a total effect of 0.554 (β=0.183+0.371=0.554), which accounted for 33.03% of the total effect. Bootstrap sampling test was used to investigate the mediating. The results showed that patient activation partially mediated the relationship between social support and health promoting behavior. The indirect effect of patient activation was 0.183, with a bootstrap bias-corrected 95% confidence interval of (0.217, 0.391) (P<0.001). The total effect of social support on health promoting behavior through patient activation was 0.554 (P<0.001) (Table 4).

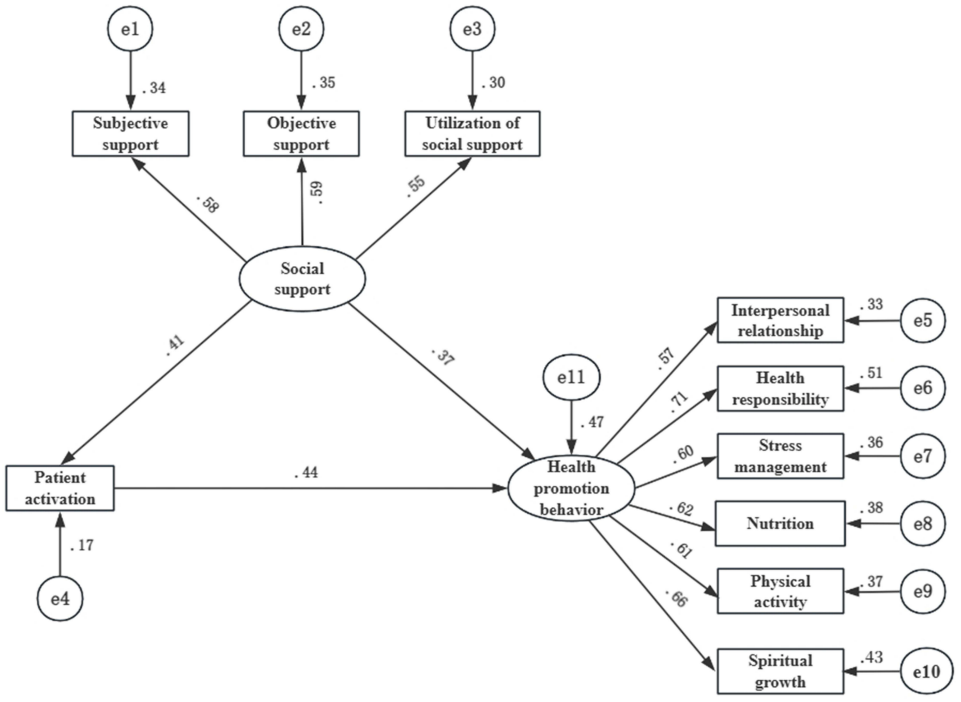

Figure 1 Structural equation model illustrating the mediating role of patient activation (standardized).

Table 3 Path Coefficient of Patient Activation on the Relationship of Social Support and Health Promotion Behavior

Structural path	B	S.E.	C.R.	*P*	β
SSRS→PAM	1.570	0.248	6.331	<0.001	0.413
PAM→HPB	0.074	0.009	8.222	<0.001	0.444
SSRS→HPB	0.234	0.046	5.087	<0.001	0.371

Note: C.R.=Estimate(B)/SE.
Abbreviations: SSRS, Social Support Rating Scale; PAM, Patient Activation Measure; HPB, Health promotion behavior; B, unstandardized coefficients; β, standardized coefficients; S.E., standard error; C.R., critical ratio.

Table 4 Mediating Effect of Patient Activation on the Relationship Between Social Support and Health Behavior

Effect Relationship	Estimate	Bootstrapping (BC 95% CI)	*P*
Indirect effect of X on Y	0.183	[0.217,0.391]	<0.001
Direct effect of X on Y	0.371	[0.330,0.621]	<0.001

Note: The indirect effect of X on Y: Social support →Patient activation → Health promotion behavior (X→M→Y).
Abbreviations: CI, confidence interval. M, Patient activation. X, Social support. Y, Health promotion behavior.

Discussion

This study examined social support, patient activation, and health promoting behaviors among thyroid cancer (TC) patients. Additionally, a mediation model was employed to evaluate how patient activation mediates the relationship between social support and health promoting behaviors. The mediation model accounted for 33.03% of the variance in health promoting behaviors.

The average health promoting behavior score was 105.67 ± 15.63 points, indicating a moderate level, which aligns with previous findings in TC patients.[4] Notably, 79.1% of the participants (489 out of 618) exhibited moderate health promotion behaviors, suggesting that there is significant potential for improvement in this area. Among the different dimensions of health promoting behaviors, nutrition scored the highest. Proper nutrition is essential for maintaining adequate energy and nutrient intake. This higher focus on dietary behaviors may be attributed to extensive dietary education by healthcare professionals and the relative ease with which patients can incorporate dietary changes into their daily routines.[29] Conversely, the physical activity dimension scored the lowest, indicating a lack of regular exercise among TC patients. This deficiency might be due to prolonged wound healing post-surgery and the lifelong use of levothyroxine sodium tablets, which can cause side effects such as drowsiness, fatigue, and weakness.

Health promoting behaviors were found to be associated with factors including occupation, monthly household income per capita, disease knowledge, medical expenses, and cancer recurrence. Patients with higher incomes, stable employment, comprehensive health care coverage, and greater awareness of TC are more likely to access extensive medical resources and treatment options. Consequently, these patients are more inclined to adopt and adhere to healthy lifestyles to prevent disease recurrence.

The study also revealed that higher patient activation is linked to enhanced health-promoting behaviors. Patient activation, a crucial strategy for disease management, serves as a significant predictor of health behaviors, relationships, and stress management.[30] The average patient activation score among the 618 TC patients was 76.95 ± 10.14, which is higher than previously reported scores for TC patients in Henan Province.[20] This discrepancy may be due to differences in age, survey locations, and sample sizes. Furthermore, 75.6% of the patients were at the highest level of patient activation, possibly because the participants were predominantly young and middle-aged, highly educated, cognitively capable, and well-informed about

their disease.[31] Additionally, most participants lived with their spouses and children, receiving substantial physiological and psychological support from their families.[32] Therefore, future interventions should be personalized based on patient activation levels, particularly targeting those with low or medium activation. Strategies should aim to boost motivation for medical decision-making, enhance patients' knowledge, skills, and confidence in disease management, and establish strong social support systems to improve patient activation.[33]

The total social support score was 38.41 ± 7.24, reflecting a moderate level. This moderate score may be due to the favorable prognosis and high survival rate of TC, resulting in less community and family support. Additionally, patients may face challenges in accessing information, meeting emotional needs, and receiving assistance within the context of Chinese society.[34] Higher social support was positively associated with better health promoting behaviors among TC patients. This association likely arises because support and emotional care from family, friends, and medical teams enhance patients' health awareness and self-confidence, motivating them to adopt healthier lifestyles. Notably, support utilization was a significant predictor of health promoting behaviors, indicating that patients who effectively utilize support resources are more likely to develop health-promoting behaviors. A study highlighted that economic assistance, spiritual support, and life services from the community, family, and friends can significantly improve patients' self-efficacy and foster healthy lifestyles.[35] Consequently, healthcare professionals should encourage patients to build strong social networks, leverage available social resources, engage in meaningful interactions with peers and family members, and cultivate healthy lifestyle habits.

A mediating model was developed to explore how social support influences health promoting behaviors through patient activation. Patient activation accounted for 33.03% of the total effect, underscoring its significant role. Individual behavior is shaped by both intrinsic and extrinsic environmental factors, with social support being a crucial extrinsic factor that predicts health behaviors and manages psychological stress. The study emphasizes that a supportive social environment empowers individuals, enhancing their confidence in health management and motivating them to adopt healthy lifestyles.[36] Conversely, inadequate family and peer support undermines patients' confidence and skills in health management, necessitating long-term monitoring and lifelong medication for TC patients. This lack of support, coupled with the psychological distress caused by the disease and its treatment, further diminishes health-promoting behaviors.[37]

Moreover, the direct effect of patient activation on health promoting behaviors was found to be greater than the direct effect of social support. This suggests that healthcare professionals should prioritize enhancing patient activation alongside building a supportive social environment. Comprehensive and targeted intervention strategies that focus on both patient activation and social support are essential for improving health promoting behaviors in TC patients.

Implications for Practice

Our study findings showed that thyroid cancer patients have health promoting behaviors at a moderate level, suggesting that health professional should be able to target interventions based on factors influencing health promoting behaviors. Patient activation plays a partial mediating role between social support and health promoting behaviors among thyroid cancer patients. Hence, efforts should be taken to build a good social support system, including support from family, colleagues, friends and medical staff. On the other hand, focusing on patient activation and developing personalized intervention strategies for patients aims to enhance confidence and ability in self-health management, which helps to improve the efficiency of healthcare resources and promote the development of healthy behavioral habits, thus improving quality of life and increasing treatment satisfaction for thyroid cancer patients.

Limitations and Future Research

Our study has several limitations. First, this study employed convenience sampling from two university hospitals, which may affect the representativeness and generalizability of the findings. Second, health promoting behavior is a dynamic construct, and factors such as patient activation and social support are significantly influenced by geographic, economic, and socio-cultural contexts. To address these limitations, future research should consider expanding the sample size and incorporating qualitative approaches to gain a deeper understanding of the mechanisms through which patient activation affects health promoting behaviors. Third, although structural equation modeling was employed to validate the relationships between variables quantitatively, this study is based on cross-sectional data alone. Future research should conduct

longitudinal studies to explore the mediating role of patient activation on the relationship between social support and health promoting behavior in patient.

Conclusions

Our findings indicate that health promoting behaviors among thyroid cancer patients are influenced by factors such as occupation, monthly household income per capita, disease knowledge, medical expenses, and cancer recurrence. Future research should aim to design targeted health education programs that encourage healthy behaviors tailored to patients' individual characteristics and circumstances. Patient activation serves as a mediator in the relationship between social support and health promoting behaviors, providing deeper insight into how patient activation influences this dynamic. To enhance health promoting behaviors, healthcare professionals should implement strategies that build robust social support systems, boost patient activation, and encourage the maintenance of a healthy lifestyle.

Ethical Approval

This study was conducted in accordance with the Declaration of Helsinki. This study was conducted after obtaining approval from the Research Ethics Review Committee of the Hunan Normal University (IRB No.2023-281). Informed written consent was also obtained from each participant before study.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, acquisition of data, analysis and interpretation, or in all these areas: took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published: have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors declare that there is no conflicts of interest in this work.

References

1. Pizzato M, Li M, Vignat J, et al. The epidemiological landscape of thyroid cancer worldwide: GLOBOCAN estimates for incidence and mortality rates in 2020. *Lancet Diabetes Endocrinol*. 2022;10(4):264–272. doi:10.1016/S2213-8587(22)00035-3
2. Han L, Xu H. China anti-cancer association guidelines for holistic integrative management of thyroid cancer (2022 abridged version). *Chin J Clin Oncol*. 2023;50(07):325–330.
3. Huo S, Liu Y, Sun A, Zhang B. Environmental and social determinants of thyroid cancer: a spatial analysis based on the geographical detector. *Front Endocrinol*. 2022;13:1052606. doi:10.3389/fendo.2022.1052606
4. Park KA, Kim S, Oh EG, Kim H, Chang HS, Kim SH. Factors affecting the health-promoting behavior of thyroid cancer survivors: comparison by stage of cancer survivorship. *Support Care Cancer*. 2022;30(4):3429–3439. doi:10.1007/s00520-022-06799-9
5. Kitahara CM. Obesity, physical activity, and thyroid cancer risk: disentangling true associations from detection bias. *Thyroid*. 2023;33(3):276–277. doi:10.1089/thy.2022.0618
6. Mongelli MN, Giri S, Peipert BJ, Helenowski IB, Yount SE, Sturgeon C. Financial burden and quality of life among thyroid cancer survivors. *Surgery*. 2020;167(3):631–637. doi:10.1016/j.surg.2019.11.014
7. Nickel B, Tan T, Cvejic E, et al. Health-related quality of life after diagnosis and treatment of differentiated thyroid cancer and association with type of surgical treatment. *JAMA Otolaryngol Head Neck Surg*. 2019;145(3):231–238. doi:10.1001/jamaoto.2018.3870
8. Yoon J, Park B. Factors associated with health behaviors in thyroid cancer survivors. *J Cancer Prev*. 2020;25(3):173–180. doi:10.15430/JCP.2020.25.3.173
9. Murdarugh CL, Parsons MA, Pender NJ. *Health Promotion in Nursing Practice*. 8th edn ed. New Jersey: Pearson Education Inc; 2019:40–45.
10. Rogers SN, Mepani V, Jackson S, Lowe D. Health-related quality of life, fear of recurrence, and emotional distress in patients treated for thyroid cancer. *Br J Oral Maxillofac Surg*. 2017;55(7):666–673. doi:10.1016/j.bjoms.2016.09.001
11. Langford CP, Bowsher J, Maloney JP, Lillis PP. Social support: a conceptual analysis. *J Adv Nurs*. 1997;25(1):95–100. doi:10.1046/j.1365-2648.1997.1997025095.x
12. Poręba-Chabros A, Mamcarz P, Jurek K. Social support as a moderator between the perception of the disease and stress level in lung cancer patients. *Ann Agric Environ Med*. 2020;27(4):630. doi:10.26444/aaem/123099

13. Ashgar RI. Relationships between personal satisfaction, cardiovascular disease risk, and health promoting behavior among Arab american middle-aged women. *J Cardiovasc Nurs*. 2021;36(3):273–282. doi:10.1097/JCN.0000000000000690
14. Thoits PA. Mechanisms linking social ties and support to physical and mental health. *J Health Soc Behav*. 2011;52(2):145–161. doi:10.1177/0022146510395592
15. Hibbard JH, Mahoney ER, Stockard J, Tusler M. Development and testing of a short form of the patient activation measure. *Health Serv Res*. 2005;40(6 Pt 1):1918–1930. doi:10.1111/j.1475-6773.2005.00438.x
16. Tabernero C, Caprara GV, Gutiérrez-Domingo T, et al. Positivity and self-efficacy beliefs explaining health-related quality of life in cardiovascular patients. *Psicothema*. 2021;33(3):433–441. doi:10.7334/psicothema2020.476
17. Downie S, Shnaigat M, Hosseinzadeh H. Effectiveness of health literacy- and patient activation-targeted interventions on chronic disease self-management outcomes in outpatient settings: a systematic review. *Aust. J Prim Health*. 2022;28(2):83–96. doi:10.1071/PY21176
18. Jansen F, Coupé VMH, Eerenstein SEJ, Leemans CR, Verdonck-de Leeuw IM. Costs from a healthcare and societal perspective among cancer patients after total laryngectomy: are they related to patient activation? *Support Care Cancer*. 2018;26:1221–1231. doi:10.1007/s00520-017-3945-8
19. Regeer H, van Empelen P, Bilo HJG, de Koning EJP, Huisman SD. Change is possible: how increased patient activation is associated with favorable changes in well-being, self-management and health outcomes among people with type 2 diabetes mellitus: a prospective longitudinal study. *Patient Educ Couns*. 2022;105(4):821–827. doi:10.1016/j.pec.2021.07.014
20. Ma HL, Wang SJ, Gao YP, Zhao R. The self-management activation and associated factors in young and middle-aged patients with thyroid cancer after surgery. *J Nurs Science*. 2023;38(09):27–30.
21. Zhu Y, Song Y, Wang Y, et al. Relationships among patient activation, social support and online health information seeking of community-dwelling older adults living with coronary heart disease. *J. Adv Nurs*. 2023;79(1):161–169. doi:10.1111/jan.15428
22. Gleason KT, Tanner EK, Boyd CM, Saczynski JS, Szanton SL. Factors associated with patient activation in an older adult population with functional difficulties. *Patient Educ Couns*. 2016;99(8):1421–1426. doi:10.1016/j.pec.2016.03.011
23. Walker S, Sechrist KR, Pender NJ. The health-promoting lifestyle profile: development and psychometric characteristics. *Nurs Res*. 1987;36(2):76–81.
24. Shahabi N, Hosseini Z, Aghamolaei T, Ghanbarnejad A, Behzad A. Application of Pender's health promotion model for type 2 diabetes treatment adherence: protocol for a mixed methods study in southern Iran. *Curr Control Trials Cardiovasc Med*. 2022;23(1):1056.
25. Walker SN, Sechrist KR, Pender NJ. *The Health-Promoting Lifestyle Profile II*. Omaha: University of Nebraska Medical center, College of Nursing; 1995.
26. Cao WJ, Guo Y, Ping WW, Zheng JZ. Development and performance evaluation of the Chinese version of the Health-Promoting Lifestyle Profile-II (HPLP-II) scale. *Chin J Dis Control Prev*. 2016;20(03):286–289.
27. Xiao SY. Theoretical basis and application in research of social support rating scale. *J Clin Psychiatr*. 1994;2:98–100.
28. Hong Y, Zou YF, Wu J. Reliability and validity of the Chinese version of the patient activation measure. *Chin J Mod Nurs*. 2018;24(25):3009–3015.
29. Jung SK, Kim K, Tae K, Kong G, Kim MK. The effect of raw vegetable and fruit intake on thyroid cancer risk among women: a case–control study in South Korea. *Br J Nutr*. 2013;109(1):118–128. doi:10.1017/S0007114512000591
30. Ahn YH, Ham OK. Evaluation of the interaction model of client health behavior-based multifaceted intervention on patient activation and osteoarthritis symptoms. *J Nurs Sci*. 2020;17(2):e12306. doi:10.1111/jjns.12306
31. Newland P, Lorenz R, Oliver BJ. Patient activation in adults with chronic conditions: a systematic review. *J Health Psychol*. 2021;26(1):103–114. doi:10.1177/1359105320947790
32. Amireault S, Fong AJ, Sabiston CM. Promoting healthy eating and physical activity behaviors: a systematic review of multiple health behavior change interventions among cancer survivors. *Am J Lifestyle Med*. 2018;12(3):184–199. doi:10.1177/1559827616661490
33. Daud MH, Ramli AS, Abdul-Razak S, et al. The EMPOWER-SUSTAIN e-Health Intervention to improve patient activation and self-management behaviors among individuals with metabolic syndrome in primary care: study protocol for a pilot randomised controlled trial. *Trials*. 2020;21(1):311. doi:10.1186/s13063-020-04237-x
34. Zhu P, Zhang H, Wang W, et al. The challenges of returning to work for differentiated thyroid cancer survivors in China: a qualitative study. *Support Care Cancer*. 2023;31(10):582. doi:10.1007/s00520-023-08049-y
35. Oh JH. Factors affecting health-promoting lifestyle among older women with chronic disease. *J Gerontol Nurs*. 2019;45(10):29–38. doi:10.3928/00989134-20190912-04
36. Yang L, Li K, Liang Y, Zhao Q, Cui D, Zhu X. Mediating role diet self-efficacy plays in the relationship between social support and diet self-management for patients with type 2 diabetes. *Arch Public Health*. 2021;79(1):1–8. doi:10.1186/s13690-021-00533-3
37. Büttner M, Hinz A, Singer S, Musholt TJ. Quality of life of patients more than 1 year after surgery for thyroid cancer. *Hormones*. 2020;19(2):233–243. doi:10.1007/s42000-020-00186-x