

论著·循证医学

中青年癌症生存者重返工作干预方案的系统评价

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[摘要] **目的**·系统评价中青年癌症生存者重返工作 (return-to-work) 干预方案的应用情况及其在改善癌症生存者工作相关结局中的效果。**方法**·计算机检索PubMed、Cochrane Library、Embase、中国知网、万方等8个电子数据库, 检索时限为建库到2022年8月2日, 纳入重返工作干预方案对癌症生存者工作相关结局的随机对照试验 (randomized controlled trial, RCT) 和类实验研究。由2名研究者一组独立对文献进行筛选、资料提取, 并采用JBI (Joanna Briggs Institute) 文献真实性评价工具进行方法学质量评价。**结果**·共纳入13篇原始研究, 涉及11套重返工作干预方案, 含2 045例癌症生存者; 其中7项为RCT研究。系统评价结果显示, 有10项干预方案为多学科干预, 干预内容包含疾病/心理健康教育、小组讨论、物理康复、工作能力锻炼、多学科团队会议和咨询等模块, 其中3项干预方案还将雇主纳入支持方案中。干预持续时间从7 d到1年不等。纳入的干预方案中有8项以重返工作率作为主要结局指标, 但仅3项报道了差异具有统计学意义, 而其中2项为未设置对照组的类实验研究设计; 纳入的干预方案在重返工作时长、工作改变情况、工作能力、工作意义等工作相关结局指标上并未呈现较明确的积极效果。**结论**·癌症生存者重返工作干预方案的内容、形式、强度、频次差异较大, 且干预对工作相关结局的效果尚不明确。国内在该领域的干预研究仍待开发和探索, 研究者应进一步挖掘癌症生存者重返工作的影响机制, 并基于此制定多学科协作的干预方案来帮助中青年癌症生存者重返工作, 回归社会。此外, 受研究质量和干预方案异质性的限制, 上述结论仍需更多高质量的原始研究做进一步验证。

[关键词] 癌症生存者; 中青年; 重返工作; 干预方案; 系统评价**[DOI]** 10.3969/j.issn.1674-8115.2023.03.009 **[中图分类号]** R492 **[文献标志码]** A

Interventions to enhance return-to-work among young and middle-aged cancer survivors: a systematic review

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[Abstract] **Objective**·To systematically evaluate the application of return-to-work intervention programs to young and middle-aged cancer survivors and its effectiveness in improving work-related outcomes in cancer survivors. **Methods**·An initial literature search of eight electronic databases, including PubMed, Cochrane Library, Embase, CNKI and Wanfang was conducted with a time frame from inception to Aug 2nd, 2022 to collect randomized controlled trials (RCTs) and quasi-experimental studies of return-to-work interventions on work-related outcomes among cancer survivors. Two researchers independently conducted literature screening, data extraction, and methodological quality evaluation using the JBI (Joanna Briggs Institute) Methodology Quality Evaluation Tool. **Results**·A total of 13 original studies were included, involving 11 return-to-work intervention programs, containing 2 045 cancer survivors. The results of the systematic evaluation showed that 10 of the intervention programs were multidisciplinary, with intervention modules on disease/mental health education, group discussions, physical rehabilitation, work capacity exercises, multidisciplinary team meetings and counselling. Among them, three interventions also included employers in the support program. The duration of the interventions ranged from 7 d to one year. Eight of the included interventions took return-to-

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work rates as a primary outcome, but only three reported that the difference was statistically significant, two of which were quasi-experimental studies without control group. Besides, no clear positive effects were found on work-related outcome such as length of return-to-work, change of work status, work ability, and work meaning. **Conclusion**·The content, format, intensity and frequency of return-to-work intervention programs for cancer survivors vary widely, and the effects of interventions on work-related outcomes are still unclear. Researchers should further explore the mechanisms that influence cancer survivors' return-to-work, and develop multidisciplinary intervention programs based on this to effectively help young and middle-aged cancer survivors return-to-work and society. In addition, due to the limitations of study quality and intervention program heterogeneity, more high-quality experimental studies are needed to further validate the above findings.

[Key words] cancer survivor; young and middle-aged; return-to-work; program evaluation; systematic review

随着癌症早期筛查的开展和治疗技术的发展, 癌症发病率和生存率同步提升, 患者年轻化趋势明显。预计到2030年, 全球将有7 500万癌症生存者^[1]。据我国肿瘤控制中心报告, 我国癌症生存者每年新增超140万人^[2]。在上海, 虽然癌症发病率逐年上升, 但死亡率却呈现持续下降的态势^[3]。同时美国癌症协会报道, 在年轻群体中几乎所有癌症类型的发病率都在增加^[4]。可见, 中青年癌症生存者已成为居民健康管理中不容忽视的庞大群体。身为家庭的中坚力量和社会发展最主要的劳动力, 中青年承担了工作、赡养老人等诸多社会责任。但在长期抗癌过程中, 中青年生存者及其家庭面临巨大的经济负担。数据^[5]显示, 21~60岁的癌症生存者每人每年的经济损失为16 213美元。因此, 促进他们作为社会劳动资源重返工作对实现个人价值、减轻家庭负担具有重要意义。目前, 有限的证据显示中青年癌症生存者正面临着重返工作需求强烈、现实情况却受限的尴尬局面^[6-7]。目前, 国际上针对促进癌症生存者重返工作的干预方案已有广泛探索, 但干预内容差异较大, 且干预效果并不明确。因此, 本研究旨在系统评价重返工作干预方案的应用情况和实施效果, 为临床研究和康复实践提供循证依据。

1 资料与方法

该系统评价实施方案已在PROSPERO平台注册审核, 注册号为CRD42022360198。

1.1 检索策略与方法

检索中国知网、万方数据库、维普数据库3个中文数据库, 以及Cochrane Library、PubMed、Embase、Web of Science、CINAHL 5个英文数据库, 检索时限从建库到2022年8月2日。中文检索词为“肿瘤”“患者”“重返工作”“复工”, 以及“干预”“随机对照”“类实验”

等。英文检索词为"neoplasms" "cancer" "cancer survivor" "cancer patient" "return-to-work" "back-to-work" 以及 "randomized controlled trial" "intervention study" "clinical trial"等, 采用主题词与自由词相结合的方式进行搜索, 同时追溯纳入研究的参考文献。

1.2 纳入与排除标准

纳入标准: ①研究类型为任何旨在提升/改善癌症患者重返工作相关结局的干预性研究 [包括随机对照试验 (randomized controlled trial, RCT) 和类实验研究]。②研究对象为中青年癌症患者 (年龄18~60岁)。③结局指标至少报告1个以上工作相关结局, 如是否重返工作、重返工作时长、工作能力等。

排除标准: ①非中英文文献。②重复发表文献。③无法提取数据的文献。④仅报告干预方案构建过程, 无方案的效果评价。⑤文章发表类型为会议摘要、干预草案、预试验、可行性研究等。

1.3 文献筛选、资料提取与质量评价

文献分为3组, 每组均由2名接受过循证方法学培训的研究者独立进行文献筛选和资料提取, 并进行交叉核对 (本文第一作者至第六作者), 如有分歧则邀请第3名研究者进行讨论。资料提取内容包含第一作者、发表年份、研究对象等。采用JBI (Joanna Briggs Institute) 循证卫生保健中心对RCT和类实验研究的真实性评价工具进行质量评价, 如有分歧请第3名研究者 (本文第一作者) 协同裁决。

2 结果

2.1 文献筛选流程及结果

初步检索文献共计5 604篇, 最终共纳入13篇进行系统评价^[8-20], 其中2篇由参考文献列表中获取。筛选流程见图1。

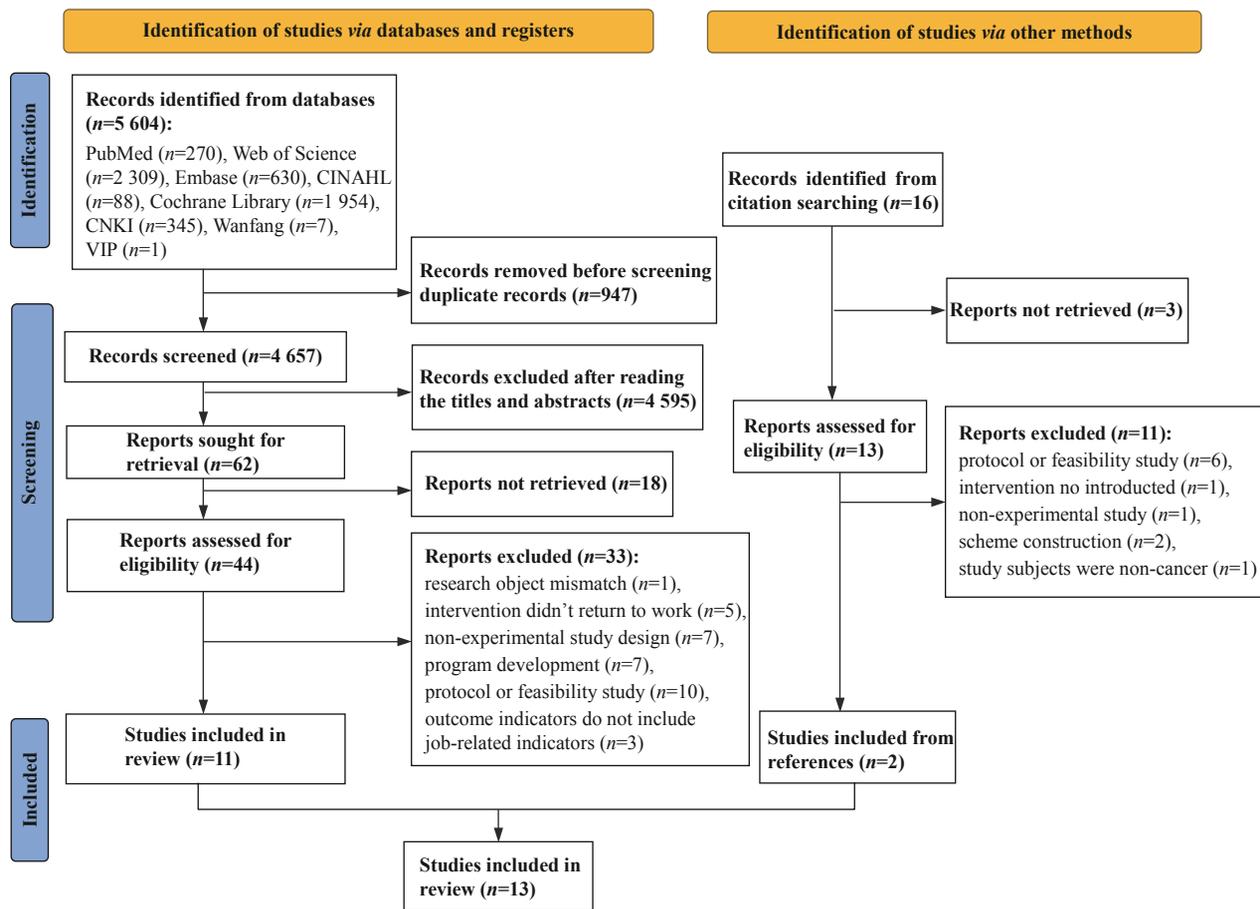


图1 文献筛选流程
Fig 1 PRISMA flow diagram

2.2 研究设计和对象特征

纳入研究的基本特征见表1, 13篇研究均来自欧洲国家, 共2 045例癌症患者, 涉及11种干预方案; 其中6项干预方案来源于7项RCT研究^[8-10,13,15-17,20]; 9项干预项目纳入的女性癌症患者超过70%^[8-11,13,15-19], 而乳腺癌患者占比最多(31.4%~100%)。干预组样本量从34~229例不等, 其中有9项研究小于100例^[11-18,20]。

2.3 纳入文献的质量评价情况

文献质量评价结果显示文献质量总体一般, 其中RCT研究普遍未做到对研究对象和干预者的盲法, 但这与重返工作干预的特点有关; 在结果测评者盲法上, 仅有1篇研究^[20]明确表示对结果测评者实施了盲法, 其余研究均未报告。其余5篇类实验研究的评价结果显示, 除3篇未设置对照组的类实验研究^[11,14,19]在“各组基线可比”“各组干预措施相同”和“各组结局指标测评方式相同”3个评价条目上并不适用, 其余条目均在文献中有所报告。

2.4 癌症生存者重返工作干预方案系统评价结果

如表2所示, 纳入的13篇研究中仅有1篇研究报告了理论框架, 即STAPELFELDT等^[15]指出应用“癌症和工作模型 (the cancer and work model)”^[21]作为构建重返工作方案的理论框架。而从干预类别上看, 10种干预方案^[8-17,19-20]均为多学科团队介入的干预, 干预内容包含疾病/心理健康教育、小组讨论、物理康复、工作能力锻炼、多学科团队会议和咨询等模块, 且肿瘤科护士、肿瘤科医师、物理康复治疗师、职业康复治疗师、心理治疗师、艺术治疗师等多角色参与。干预频次从每日1次到间隔数月1次, 干预持续时间从7 d到1年不等。FAUSER等^[9-10]的方案中仅对各模块需要的最少时长进行了规定。4项干预方案^[14-17,20]根据患者的个体化需求来确定模块的内容和频次。

对重返工作干预效果的测评指标主要包括重返工作率、重返工作时长、工作能力、角色功能等。纳入的13篇研究中有10篇研究^[9-11,13-18,20]测评了随访时间段内的重返工作率, 但仅有3篇研究^[11,13-14]报道了

该指标具有显著差异。其中, LEENSEN 等^[11]和 RUSBRIDGE 等^[14]的研究为无对照组的类实验研究设计。4 篇研究测评了癌症生存者的工作能力^[11,13,16-17], 其中 LEENSEN 等^[11]采用无对照的类

实验研究发现, 研究对象在接受多学科干预后 6、12 和 18 个月的工作能力显著提升。除工作能力结局指标外, 部分研究还纳入了工作意义、工作限制、重返工作自我效能等相关结局指标。

表 1 纳入文献的一般特征

Tab 1 Basic characteristics of included studies

Study	Country	Design	Participants, characteristics in intervention group				Participants, characteristics in control group			
			Sample size (at allocation) /n	Age/year	Gender	Cancer type	Sample size (at allocation) /n	Age/year	Gender	Cancer type
BJÖRNEKLETT et al, 2013 ^[8]	Sweden	①	191	57.8 (30–84)	Female: 100%	Breast: 100%	191	58.7 (38–83)	Female: 100%	Breast: 100%
FAUSER et al, 2019 ^[9-10]	Germany	②	229	50.8±7.1	Female: 71.2%	Breast: 31.4%, digestive tract: 14.4%, lymphatic/related tissue: 15.3%, female genitalia: 15.3%	255	50.3±7.9	Female: 63.1%	Breast: 28.2%, digestive tract: 18.4%, lymphatic/related tissue: 14.9%, female genitalia: 10.6%
LEENSEN et al, 2017 ^[11]	Netherlands	④	93	47.9±7.4	Female: 90.3%	Breast: 83.9%, colorectal: 8.6%, non-Hodgkin's lymphoma: 5.4%, other: 2.2%	–	–	–	–
OLDERVOLL et al, 2013 ^[12]	Norway	③	56	51 (37–66)	NR	Breast: 91%, gynecological: 9%	60	50 (32–67)	NR	Breast: 55%, gynecological: 45%
MOURGUES et al, 2014 ^[13]	France	①	85	51.9±8.5	Female: 100%	Breast: 100%	67	51.9±10.3	Female: 100%	Breast: 100%
RUSBRIDGE et al, 2013 ^[14]	UK	④	34	46±11	Male: 59%	Brain: 100%	–	–	–	–
STAPELFELDT et al, 2021 ^[15]	Denmark	①	83	48.2 (44–56)	Female: 91.6%	Breast: 78.3%, colonrectal: 13.3%	264	50.0 (43.7–54.6)	Female: 92.8%	Breast: 85.2%, colonrectal: 10.2%
TAMMINGA et al, 2013 ^[16]	Netherlands	①	65	47.5±8.2	Female: 99%	Breast: 64%, cervix: 23%	68	47.6±7.8	Female: 100%	Breast: 60%, cervix: 22%
TAMMINGA et al, 2019 ^[17]	Netherlands	①	49	47.1±8.2	Female: 98%	Breast: 61%, cervix: 22%	57	47.8±7.6	Female: 100%	Breast: 61%, cervix: 23%
THIJS et al, 2012 ^[18]	Netherlands	③	72	49±8.3	Female: 88.9%	Breast: 70.8%, lymphoma: 13.8%, colorectal: 6.9%	38	49±9.2	Female: 76.3%	Breast: 68.4%, lymphoma: 18.5%, colorectal: 13.2%
THORSEN et al, 2016 ^[19]	Norway	④	106	48.8±8.6	Female: 100%	Breast: 60.4%, gynaecological: 31.1%	–	–	–	–
ZAMAN et al, 2021 ^[20]	Netherlands	①	42	54±7.7	Male: 64%	Colonrectal: 88.1%	46	56±6.6	Male: 67%	Colonrectal: 84.8%

Note: NR—not reported. ①RCT; ②cluster-RCT; ③quasi-experimental study with control; ④quasi-experimental study without control.

表2 重返工作干预方案的相关特征

Tab 2 Characteristics of return-to-work interventions

Study	Content	Intervention group				Control group	Outcome
		Type	Who	How long	Where		
BJÖRNEKLETT et al, 2013 ^[8]	Information-based support program: information about cancer illnesses, aetiology, risk factors, etc; physical exercise, relaxation training, qi-gong and nonverbal communication; social activities such as concerts, and visits to museums and restaurants	A	Oncologists (<i>n</i> =4), social workers (<i>n</i> =2), art therapists (<i>n</i> =2), masseuses (<i>n</i> =2), a person trained in qi-gong and mental visualization (<i>n</i> =1)	7 d followed by a 4-day follow-up 2 months after the initial visit	Resort	Standard follow-up routine	b
FAUSER et al, 2019 ^[9-10]	Work-related medical rehabilitation: work-related diagnostics (at least 60 min), and multiprofessional team meetings; work-related functional capacity training (at least 360 min), work-related psychosocial groups (at least 240 min), and intensified social counseling (at least 90 min)	A, B	Physician, psychologist, occupational therapist, physiotherapist, social worker	25 d in average	Rehabilitation center	Traditional medical rehabilitation program	a, c
LEENSEN et al, 2017 ^[11]	Multidisciplinary intervention: personal counselling on work-related issues (1–3 sessions), and supervised physical exercise (2 times per week, 12 weeks)	B	Oncological occupational physician, sport physician, physiotherapist	4 months in average	Hospital	Without control	a ^① , d ^① , e ^② , f ^① , g ^①
OLDERVOLL et al, 2013 ^[12]	Inpatient rehabilitation program: physical exercise (twice a day, 100 h during 4 weeks), patient education (each day), group discussion (each day). The focus of patient education and group discussion session: cancer treatment and side effect, physical activity, nutrition, economy and work situation, factors of return-to-work, partnership and sexuality, and psychological reaction	A	Multiprofessional team	4 weeks	Rehabilitation center	Outpatient rehabilitation program: delivered at an academic cancer hospital, lasted for seven weeks. The focus were the same	h
MOURGUES et al, 2014 ^[13]	Thermal water treatment: physiotherapy (2 h/d, supervised by physiotherapist), thermal water treatment (30 min/d), and basic dietary follow-up (each day)	A	Physician, nutritionist, physiotherapist	15 d	Resort	Standard follow-up routine	a ^③ , d ^④
RUSBRIDGE et al, 2013 ^[14]	Occupational rehabilitation program: patients-based symptom management (fatigue management, psychological support, and cognitive rehabilitation), work place intervention involving employers	B	Occupational therapist and/or neuropsychologist	11 h sessions over 5 months	Hospital	Without control	a ^⑤
STAPELFELDT et al, 2021 ^[15]	Early, individualized vocational rehabilitation intervention: return-to-work readiness and need assessment by social worker, tailored return to work plan development by social worker, coordinating the return-to-work plan with the participant's employer, assessing participants' rehabilitation needs other than vocational	B	Social worker trained by psychologist	Continued until the participants returned to work or for 1 year	Hospital	Municipal sickness benefit management by Danish Sickness Benefit Act	a

Continued Tab

Study	Intervention group					Control group	Outcome
	Content	Type	Who	How long	Where		
TAMMINGA et al, 2013 ^[16] ; TAMMINGA et al, 2019 ^[17]	Hospital-based work support intervention: delivering patient education and support at the hospital, as part of usual psycho-oncology care; improving communication between the treating physician and the occupational physician; drawing up a concrete and gradual return-to-work plan in collaboration with the cancer patient, the occupational physician, and the employer	B	Oncology nurse, medical social worker, occupational physician	A few weeks to 14 months	Hospital	Standard program by Dutch government	1 year follow-up: a, b, d, g; 2 year follow-up: a, b, d, g
THIJS et al, 2012 ^[18]	High-intensity physical training: strength and interval training, home-based activities	B	Physiotherapist	18 weeks	Hospital	Standard medical care (without physical rehabilitation program)	a, b, i ^⑥
THORSEN et al, 2016 ^[19]	Rapid return-to-work program (a full day weekly): patient education (2 h), group discussion (1 h), and physical activity (60–120 min). The first two sessions covered the topics related to cancer treatment, side effects, partnership and sexuality, economy and work situation, nutrition, physical exercise and coping strategies	B	Relevant health professionals, physiotherapist	7 weeks	Outpatient	Without control	h (36% did not improve work status)
ZAMAN et al, 2021 ^[20]	Early tailored work-related support intervention: individual meetings of psychosocial work-related support (30 min each); work related support: fatigue, pain and lack of support from family and friends (support I); lack of support in work environment and neuropsychological problems (support II); a combination of factors (support III)	B	Support I: oncological gastrointestinal nurse; support II: oncological occupational physicians (OOP); support III: multidisciplinary team (including at least a oncology nurse, a physician and a OOP)	Maximum of 9 months	Hospital	Standard psychological care provided by oncological nurse	a, b

Note: A represents group intervention, B represents individualized intervention. a represents return-to-work rate, b represents time to return, c represents role function, d represents work ability, e represents meaning of work, f represents return-to-work self-efficacy, g represents work limitation, h represents work status, i represents weekly working hour reduction. ^① $P<0.001$, ^② $P=0.005$, ^③ $P=0.0025$, ^④ $P=0.033$, ^⑤ $P<0.01$, ^⑥ $P=0.03$.

3 讨论

3.1 重返工作的定义亟需进一步明确和统一

尽管全球范围内越来越频繁地提到“重返工作”一词，但定义尚未统一，这也可能是本系统评价中发现重返工作的干预效果并不明确的原因之一。YOUNG等^[22]在研究中指出，重返工作包括4个关键阶段，从

“离开岗位”，即从工人因残疾而离开工作岗位的第1日开始。这个解释得到了一些研究者^[11,15-17]的支持，认为研究对象的纳入标准应满足“在癌症诊断前或诊断时处于工作状态”。但本系统评价纳入的一些研究并不强调个人在诊断前或诊断时的工作状态，而是认为从没有工作的状态到治疗后再就业的过程均属于重返工作^[9-10,14]。因此，重返工作的概念需要通过概念分析进

一步明确,这也是未来在全球范围内更好地整合和比较重返工作相关研究的重要基石。

3.2 重返工作的构建和效果验证方法学质量有待进一步提高

GUO等^[23]指出,重返工作需要多维干预的同时介入。本研究中虽有10个干预方案为多学科协同设计,但仅有1篇报告了理论框架。这部分的缺失也在一定程度上造成了干预方案本身异质性较大。此外,有3种干预方案并非是直接针对工作相关的干预,即方案中未包含工作需求的了解、工作能力评估、工作能力提升等内容,而仅聚焦了疾病相关健康教育和体能训练等。研究^[24]表明,制定干预方案还应聚焦帮助生存者适应工作环境。因此,研究者需基于与重返工作相关的理论框架,构建相对标准化和更科学的重返工作干预方案来进行效果验证。

同时,结果显示纳入13篇研究的方法学质量评价结果一般。8篇RCT研究均无法对研究者和研究对象实施盲法。剩余的5篇类实验研究中,有3篇未设置对照组,有1篇基线资料不可比,这为本研究结果的科学性和可推广性上带来挑战。因此,未来仍需高质量的RCT研究来验证。

3.3 重返工作干预应更因时制宜、因人制宜和因地制宜

首先,干预内容的及时性和针对性是干预效果的重要保障。时机理论认为,患者在疾病不同阶段下的照护和支持需求是动态变化的,因此国内学者也将其译为“适时干预模式”^[25]。对于癌症生存者而言,重返工作的需求往往是建立在基本功能康复,具备一定重返工作条件以后的更高层次的需求。以往研究^[26]表明,癌症生存者在治疗完成后6个月左右开始重返工作。因此,若过早为生存者介入重返工作的干预,可能并不能达到预期的干预效果。而本研究结果显示,纳入的11项干预方案中有6项并未报告研究对象纳入研究时所处的诊疗阶段。因此,重返工作方案实施过程中应充分了解生存者所处的疾病阶段及其自身重返工作的需求和意愿,为其提供更具针对性的干预和支持。

其次,要保证干预内容的针对性,还要关注生存者的个体特征,做到因人制宜。研究^[27]表明,

癌症生存者的性别、年龄、教育水平、癌症种类、心理特质、诊断时的工种等都会对重返工作产生不同需求,因此对干预方案的采纳和依从性也会有所差异。乳腺癌是生存率最高的癌症之一,本研究纳入的文献中女性乳腺癌患者居多,可能为本研究结果的推广带来一定局限性。因此未来还需要聚焦不同癌症生存者,制定以生存者为中心的特异性干预方案。

最后,重返工作干预方案还需考虑国家福利政策和文化这一重要因素对生存者重返工作的影响,做到因地制宜。研究表明,良好的政策和积极的文化氛围可以在宏观上影响生存者是否重返工作岗位。以头颈癌为例,中国台湾的研究^[28]指出,完善的福利制度可以减少患者的经济负担,可能使得头颈癌生存者能提前退休,而不是克服挑战重返工作岗位。发达国家如美国、丹麦、新加坡等的研究^[29-31]发现,尽管有一定福利政策保障,重返工作率也可达到80%以上。2020年中国癌症新发病例占比为全球第一^[5],癌症生存者群体也在日益扩大,但有关重返工作的机制探索和干预研究十分欠缺。因此,亟待探索我国本土化癌症生存者重返工作的影响机制和有效的促进方案。

3.4 重返工作干预应纳入利益相关群体并提高干预的延续性

来自家庭成员、朋友、同伴的社会支持和支持性工作场所对癌症生存者重返工作的积极作用在国外研究中得到了证实。FITCH等^[24]的研究指出,大多数管理者不知道如何支持癌症幸存者回归工作岗位。GREIDANUS等^[32]也强调,家庭照护者或工作场所的利益相关者是干预成功的关键。但本研究结果显示,仅3篇研究将雇主纳入到重返工作干预项目中。因此,在制定相应的促进重返工作干预方案时,应考虑到关键的利益相关者,如家庭照顾者、朋友、同伴、雇主、同事,以确保足够的社会支持,建立一个支持性的工作环境。

本研究尚存在一定的局限性。①存在一些较新的重返工作干预研究以方案(protocol)和预试验(pilot study)形式发表,但这些均未纳入此次系统评价中,可能会带来一定的结果偏倚。②由于研究方案本身和结局指标的差异性,本研究未采用meta分析来探讨干预方案的有效性。③纳入分析的文献均来自于欧洲国家,可能存在地域差异和种族差

异, 对研究结果的代表性和可推广性带来一定挑战。

综上所述, 本研究结果显示, 重返工作干预方案的内容、形式、强度、频次等差异较大, 且干预效果并不明确。但受干预方案异质性的限制, 上述结论尚待更多高质量 RCT 予以验证。后续应更加关注中青年癌症生存者重返工作领域的研究, 因时制宜、因人制宜、因地制宜地制定更有效的干预方案, 帮助更多具备重返工作条件的中青年癌症生存者回归社会、实现个人价值、减轻家庭负担, 甚至创造社会价值。

利益冲突声明/Conflict of Interests

所有作者声明不存在利益冲突。

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作者贡献/Authors' Contributions

张媛媛、章雅青和侯黎莉负责论文的构思和设计。张媛媛、吴安琪、吴捷、朱雅琪、李梦瑶、闫德修参与文献检索、筛选、资料提取以及结果分析。张媛媛、吴安琪进行论文撰写。章雅青和侯黎莉参与论文的修订与审校。所有作者均阅读并同意了最终稿件的提交。

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[本文编辑] 包 玲

学术快讯

上海交通大学公共卫生学院宋海云研究员合作团队开发基于肿瘤微环境脂质干预的新型肿瘤免疫代谢疗法

2023年1月13日, 学术期刊 *Advanced Materials* 发表了上海交通大学公共卫生学院宋海云研究员、化学化工学院樊春海院士与西安交通大学药学院张继业教授团队的题为 *Composite hydrogel for spatiotemporal lipid intervention of tumor milieu* 的研究成果。该研究构建了一种响应肿瘤微环境的智能型复合水凝胶, 靶向肿瘤组织内不同的细胞类型, 分别递送载药纳米粒子和游离药物, 并结合近红外光热治疗, 通过对肿瘤微环境的时空脂质干预开发了一种新的肿瘤免疫疗法。