



Psychological interventions in adolescents and young adults with cancer: a scoping review targeting protective factors of resilience

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Purpose of review

Psychological interventions are essential for adolescents and young adults with cancer (AYACs), who experience poor outcomes in their emotional health, social functioning, health behaviors, and cancer-related cognitive impairments (CRCI). This scoping review synthesizes and discusses recent interventions aiming to promote resilience in AYAs with cancer up to 39 years old. The aim is to identify effective intervention strategies and highlight gaps in current research.

Recent findings

Twelve studies were identified, covering interventions targeting physical health, cognition and behavior, social support, emotion regulation, and neurobiology. Most interventions focused on physical activity and cognitive-behavioral approaches, demonstrating positive effects on psychological distress, self-efficacy and quality of life. However, there is a lack of interventions addressing social support, neurobiological resilience, and emotion regulation, despite their well established role in fostering adaptation to adversity.

Summary

Findings underscore the importance of integrative, multimodal approaches for resilience-building in AYACs. Future research should prioritize interventions that incorporate social, emotional, and neurobiological dimensions while ensuring accessibility through digital health solutions. Additionally, early implementation of psychological interventions during the initial cancer treatment period could be critical for mitigating long-term psychological distress and cognitive impairments. Co-constructing interventions with AYACs through participatory approaches is essential to enhance their effectiveness.

Keywords

adolescents and young adults with cancer, psychological interventions, psychosocial support, randomized controlled trials, resilience

INTRODUCTION

Adolescents and young adults with cancer face unique medical and psychosocial challenges [1–3]. Cancer among adolescents and young adults (AYAs) disrupts normal developmental processes like the establishment of personal, social, and sexual identity, and the pursuit of educational or vocational goals [4]. Additionally, the challenges associated with cancer and its treatments may expose adolescents and young adults with cancer (AYACs) to recurrent episodes of uncontrollable stress, which, at this developmental stage, can heighten emotional, behavioral, and neurobiological reactivity to stressors, potentially impairing long-term adaptation to future adversity [5^{***}]. A recent review identified four primary poor psychological outcomes among

AYAC survivors when compared with individuals without a cancer history: poor emotional health, difficulties in social functioning, lower levels of engagement in recommended health behaviors,

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KEY POINTS

- Psychological interventions for adolescents and young adults (AYAs) with cancer rely on multicomponent approaches integrating behavioral change techniques, motivational interviewing techniques, acceptance and commitment therapy, peer support, and are theoretically grounded in social cognitive theory, self-determination theory, and emotion regulation theory.
- Future research should prioritize multimodal and integrative approaches, considering the cognitive, emotional, social, and neurobiological dimensions of resilience.
- There is a lack of psychological interventions specifically designed for adolescents and young adults with cancer (AYACs) at the beginning of their cancer trajectory. Developing early programs could enhance adaptation and prevent long-term psychological distress.
- Involving AYACs in the co-construction of interventions enhances their acceptability and relevance. Studies using participatory methodologies show better adherence and a more lasting impact on resilience.

and higher levels of cancer-related cognitive impairments (CRCI) [6[¶]].

Recent studies have distinguished three age groups, adolescents (15–18 years), emerging adults (18–25 years) and young adults (26–39 years), who face different challenges. Emerging and young adults, due to the challenges associated with their developmental stage, have been found to face additional stressors such as career development, relationships, parenting, and financial pressures [7], reporting worse symptoms and functioning than adolescents, with anxiety and depression being the most prevalent concerns [8[¶]]. As a result, ongoing efforts are being made to design cancer care strategies aimed at creating resources to tackle these challenges [3].

Developing interventions targeting factors associated with resilience to chronic adversity is essential to reinforce AYACs' ability to manage cancer-related stress [9[¶]]. Over the past year, a review examined psychosocial intervention trials among AYACs, focusing on resilience as an outcome [10[¶]]. This review, focusing on studies targeting AYACs up to 26 years old, pointed to the potential value of multicomponent programs that include strategies such as stress management, mindfulness, and positive reappraisal coping training [10[¶]]. For this paper, we used a similar search strategy to review and discuss recent interventions aiming to promote resilience in AYAs with cancer up to

39 years old. We chose to structure our review around the five resilience-promoting factors identified by Southwick and Charney (2012): physical health, cognitive-behavioral strategies, social support, emotion regulation, and neurobiology [5[¶]].

OVERVIEW OF RESILIENCE PROMOTING INTERVENTIONS FOR ADOLESCENTS AND YOUNG ADULTS WITH CANCER

We conducted a comprehensive search of PubMed from January 1, 2021 to January 1, 2025, to identify resilience promoting interventions for AYACs. The following terms were used: “adolescent”, “adolescence”, “teen”, “boys”, “girls”, “teenagers”, “youth”, “young adult”, “young women”, “young men”, “young patients”, or “AYA”. Using PubMed's Advanced Search feature, we limited the condition or disease to “cancer”, “tumor”, or “malignancy” and restricted interventions to “behavioral”, or “device”, or “procedure” or “resilience”. Our initial search yielded 61 scientific papers. To refine the selection, we first screened for articles containing the term “young” in the title ($N = 42$). A subsequent manual screening retained only studies focusing on psychological interventions ($N = 25$) designed for AYACs. Studies focusing exclusively on AYACs younger than 25 years old were excluded as they were investigated in a recent review ($N = 12$) [10[¶]]. Only studies targeting participants aged between 15 and 39 years of age were included, resulting in a final selection of 12 studies [11–22] including two RCTs [19,22], five pilot RCTs [14–16,18], four study protocols [11–13,21], and one single-arm feasibility study [20]. The studies included varied considerably in terms of outcome measures (Table 1), therapeutic aims and techniques (Table 2).

INTERVENTIONS TARGETING PHYSICAL HEALTH

Physical health, through diet, exercise, relaxation, and sleep, enhances resilience by supporting neuroplasticity, hypothalamic–pituitary–adrenal axis regulation, and neurotransmitter balance while also improving stress adaptation, reducing inflammation, boosting cognitive flexibility, and lowering mood disorder risk [5[¶]]. Five different intervention programs have been developed and tested targeting physical health in the last four years [12,16–18,20–22]. These programs examined individual [12,16–18,20–22], dyadic, and group interventions [17,18], delivered online [12,16–18,20–22]. The number of sessions ranged from 6 [12] to 48 [21,22], and session durations ranged from 60 [12,20] to 180 min [17,18]. One study co-designed the intervention

Table 1. Summary of study characteristics

Authors, year [ref.]	Design	Therapeutic component/target	Population	Psychological intervention period	Sample size	Conditions	Main assessments and outcomes
Brock <i>et al.</i> , 2024 [11]	Protocol RCT	Cognitive/behavioral	18–39 years	Cancer diagnosis in the last 6 months	180	Peer2Me vs. one-time standardized 30-min psychological oncological consultation	Primary outcomes: Self-efficacy to improve coping behaviors (GSE, CBI-B) Secondary outcomes: psychological distress: anxiety (GAD-7), depression (PHQ-9), health literacy (HLS-EU-Q16), life satisfaction (FLZ-M), social support life (BSSS)
Brunet <i>et al.</i> , 2022 [12]	Protocol RCT	Physical health	18–39 years	Completed treatment within the past 5 years	30–40	ACCESS vs. usual care	Primary outcomes: PA behavior (ActiGraph DT9XBT) Secondary outcomes: patient reported outcomes (RAND, PANAS-SF, PHQ-9, GAD-7, ICIAYAM), putative mechanisms of PA change (Psychological Need Satisfaction in Exercise Scale, Behavioral Regulation in Exercise Questionnaire, Healthcare Climate Questionnaire).
Dorfman <i>et al.</i> , 2023 [13]	Development of a RCT	Cognitive/Behavioral	18–39 years	Completed treatment within the last 5 years	32	Behavioral symptom management intervention	Feasibility and acceptability Psychological distress (PROMIS – Depression and Anxiety), Fatigue (PROMIS – fatigue), Pain severity (BPI). Self-efficacy (Self-Efficacy for Managing Chronic Disease Scale) and (PROMIS – self-efficacy).
Hoyt <i>et al.</i> , 2021 [14]	Pilot RCT	Cognitive/Behavioral	18–39 years	Completed treatment within the last 2 years	44	GET vs. ISP	Diurnal Salivary Stress Biomarkers (cortisol) Plasma Inflammatory and Angiogenic Markers (Blood samples)
Hoyt <i>et al.</i> , 2023 [15]	Pilot RCT	Cognitive/Behavioral	18–39 years	Completed treatment within the last 2 years	75	GET vs. ISL	Primary outcomes: anxiety (HADS, $d=0.29$) and depression (HADS, $d=0.45$) Secondary outcomes: Goal navigation capacity (CAYA-T, $d=0.20$), career confusion (CTI, $d=0.41$), regulation processes: cognitive reappraisal and expressive suppression (ERQ, $d=0.35$)
Keadle <i>et al.</i> , 2021 [16]	Pilot RCT	Physical health	18–50 years (diagnosed with cancer 15–39 years)	Completed treatment more than 6 months ago	25	PA + Charity-based incentives vs. PA-alone	Feasibility, acceptability and fidelity Physical activity and sedentary behavior (activPAL, $d=0.36$), physical function (PROMIS), fatigue (PROMIS, $d=0.47$), depression (PROMIS), sleep disturbance (PROMIS), sleep quality (PSQI, $d=0.29$), motivational factors (BREQ-3, $d=0.48$)

Table 1 (Continued)

Authors, year [ref.]	Design	Therapeutic component/target	Population	Psychological intervention period	Sample size	Conditions	Main assessments and outcomes
Li <i>et al.</i> , 2022 [17]	Pilot RCT	Physical health and cognitive/behavioral	15–39 years	Cancer diagnosis in the past 5 years	143	PA vs. BA vs. Usual care	Sleep quality (PA group vs. usual care, $P = .020$)
Li <i>et al.</i> , 2023 [18]	Pilot RCT	Physical health and cognitive/behavioral	15–39 years	Cancer diagnosis in the past 5 years	143	PA vs. BA vs. Usual care	Physical activity group Primary outcomes: Salivary biomarkers (Cortisol, $d = 1.93$), anxiety and depression (HADS) Secondary outcomes: Physical Activity (IPAQ, $d = 1.47$), social support (SSRS, $d = 1.34$), self-efficacy (GSES), sleep quality (PSQI) Behavioral activation group Primary outcomes: Salivary biomarkers (Cortisol, $d = 1.71$), anxiety and depression (HADS) Secondary outcomes: Physical Activity (IPAQ, $d = 0.88$), social support (SSRS, $d = 1.26$), self-efficacy (GSES), sleep quality (PSQI)
Li <i>et al.</i> , 2024 [19]	RCT	Social	15–39 years	UN	90	Peer Support For You vs. Usual care	Psychological distress (DT, $P < 0.001$) Anxiety (HADS, $P < 0.01$) and depression (HADS, $P < 0.001$) Perceived peer support (CaPSS, $P < 0.05$) Readiness for return to work (RRTW, $P < 0.001$)
Price & Brunet <i>et al.</i> , 2022 [20]	Single-arm feasibility	Physical health	20–39 years	Completed treatment	7	Telehealth behavior change intervention	Physical activity group Primary outcomes: Salivary biomarkers (Cortisol, $d = 1.93$), anxiety and depression (HADS) Secondary outcomes: Physical activity (IPAQ, $d = 1.47$), social support (SSRS, $d = 1.34$), self-efficacy (GSES), sleep quality (PSQI) Behavioral activation group Primary outcomes: Salivary biomarkers (Cortisol, $d = 1.71$), anxiety and depression (HADS) Secondary outcomes: Physical activity (IPAQ, $d = 0.88$), social support (SSRS, $d = 1.26$), self-efficacy (GSES), sleep quality (PSQI)

Table 1 (Continued)							
Authors, year [ref.]	Design	Therapeutic component/target	Population	Psychological intervention period	Sample size	Conditions	Main assessments and outcomes
Valle et al., 2021 [21]	Protocol RCT	Physical health	18–39 years	Cancer diagnosis in the last 10 years	280	IMPACT vs. Self-help	Primary outcomes: accelerometer-measures of total PA min/week (ActiGraph, Pensacola, FL) Secondary outcomes: total PA at 12 months, sedentary behavior (Sedentary Behavior Questionnaire), weight, psychosocial measures (Medical Outcomes Study SF-36, FACT-G, POMS-BF, CES-D, PCI, FACT-Cog)
Valle et al., 2023 [22]	RCT	Physical health	18–39 years	Cancer diagnosis in the last 10 years	280	IMPACT vs. Self-help	Primary outcomes: accelerometer: total PA min/week (ActiGraph, Pensacola, FL) Secondary outcomes: total PA at 12 months (ActiGraph, Pensacola, FL), MVPA, light PA, steps, sedentary behaviors (Sedentary Behavior Questionnaire)

ACCESS, physical activity Counseling for young adult cancer Survivors; BA, behavioral activation; BSSS, Berlin social support scales; CBI-8, cancer behavior inventory – brief version; CCD, comprehensive cohort design; CES-D, Center for Epidemiological Studies Depression Scale; FACT-G, Functional Assessment of Cancer Therapy-General; FLZ-M, questionnaire of life satisfaction; GAD-7, generalized anxiety scale; GET, Goal-Focused Emotion-Therapy; GSE, general self-efficacy scale; HLEU-Q16, European Health Literacy Survey Questionnaire; IMPACT, Improving Physical Activity after Cancer Treatment; IPAQ, International Physical Activity Questionnaire; ISL, Individual Supportive Psychotherapy; ISL, Individual Supportive Psychotherapy; MVPA, moderate-to-vigorous PA; PA, physical activity; PANASSF, Positive and Negative Affect Schedule Short Form; PCI, perceived cognitive impairment; PHQ-9, patient health questionnaire; POMS-BF, Profile of Mood States-brief form; PSQI, Pittsburgh Sleep Quality Index; RCT, randomized controlled trial; SSRS, Social Support Rating Scale.

Table 2. Summary of psychological intervention modalities for AYACs

Authors, year [ref.]	Format	Sessions	Therapeutic component/target	Therapeutic aims	Therapeutic approach and/or techniques
Brock <i>et al.</i> , 2024 [11]	Dyadic, Face-to-face or online	At minimum of 4 documented contacts	Cognitive/behavioral	Reducing psychological distress and improving health literacy and social support	Based on client-centered communication skills and MIT such as active listening, open-ended questions. Peer2Me including informational support, emotional support, mutual reciprocity.
Brunet <i>et al.</i> , 2022 [12]	Individual, Videoconference	Six 60 min sessions over 12 week period	Physical health	Promote physical activity	BCT, MBCT and MIT target SDT constructs by providing autonomy support, structure, and interpersonal involvement; increasing perceptions of autonomy, competence, relatedness; increasing autonomous motivation.
Dorfman <i>et al.</i> , 2023 [13]	Group, Face-to-face or online	8 sessions during 10 weeks	Cognitive/Behavioral	Promote self-efficacy for symptom management	Based on SCT including strategies from ACT, self-compassion and MCP including Behavioral symptom coping skills, home-based physical activity.
Hoyt <i>et al.</i> , 2021 [14]	Individual, In person	Six 60 min sessions over 8 weeks	Cognitive/Behavioral	Improve distress symptoms, emotion regulation, and goal navigation skills	Based on principles of Hope Therapy including goal navigation skill, identifying values-derived goals. Interventions techniques integrated Stress and Coping Theory and Emotion Regulation Theory and Self-Determination Theory (SDT)
Hoyt <i>et al.</i> , 2023 [15]	Individual, In person	Six 60 min sessions over 8 weeks	Cognitive/Behavioral	Improve distress symptoms, emotion regulation, and goal navigation skills	Emotion regulation components include basic cognitive restructuring skills, cognitive distancing, and coping efficacy skills. Based on principles of Hope Therapy including goal navigation skill, Stress and Coping Theory and Emotion Regulation Theory to underscore emotion-regulation components and SDT including agency and mastery.
Keadle <i>et al.</i> , 2021 [16]	Individual, Online	Weekly during weeks 1–5 Bi-weekly during weeks 6–12 (11 sessions over 12 weeks)	Physical health	Increase physical activity	SCT including behavioral determinants: self-efficacy, outcome expectations, facilitator/barriers, goal setting, self-monitoring. SDT including self-motivated or self-determined. The Fitbit One was used as an intervention tool for self-monitoring steps. Weekly newsletter contained goals and theory-based behavior change content. Charity-based incentives

Table 2 (Continued)

Authors, year [ref.]	Format	Sessions	Therapeutic component/target	Therapeutic aims	Therapeutic approach and/or techniques
Li <i>et al.</i> , 2022 [17]	Individual and group, at-home and videoconference	Physical activity group: Weeks 1–2, three times a week 20–30 min/time, Weeks 3–4, four times a week 30–40 min/time, Weeks 4–8, five times a week 30–40 min/time. 34 sessions over 8 weeks Behavioral activation group: Eight 120–180 min per session over 8 weeks	Physical health and cognitive/behavioral	Decrease psychological distress	Physical activity group: Walking exercises Smart sports bracelet: feedback, positive motivation through health consultation Behavioral activation group: Seminars based on the modified behavioral activation treatment to improve self-efficacy, sense of control, positive coping
Li <i>et al.</i> , 2023 [18]	Individual and group, at-home and videoconference	Physical activity group: Weeks 1–2, three times a week 20–30 min/time, Weeks 3–4, four times a week 30–40 min/time, Weeks 4–8, five times a week 30–40 min/time. 34 sessions over 8 weeks Behavioral activation group: Eight 120–180 min per session over 8 weeks	Physical health and cognitive/behavioral	Improve sleep quality	Physical activity group: Walking exercises Smart sports bracelet: feedback, positive motivation through health consultation Behavioral activation group: Seminars based on the modified behavioral activation treatment to improve self-efficacy, sense of control, positive coping
Li <i>et al.</i> , 2024 [19]	Group, Online or face-to-face	One a week, 90–120 min over 8 weeks	Cognitive/behavioral	Improving anxiety and depressive symptoms, sense of peer support, and readiness for return to work	Based on Collaborative Peer Feedback, attributes of peer support and ACT.
Price & Brunet <i>et al.</i> , 2022 [20]	Individual, Online	Twelve 60 min sessions over 12 week	Physical health	Increase PA and FV consumption	Autonomy support and MIT include fostering perceptions of autonomy, competence, and relatedness, and facilitating autonomous forms of motivation. BCT includes education on PA and FV consumption, goal setting, barriers assessment and management, social support from others, self-monitoring, modification of the external environment.

Table 2 (Continued)

Authors, year [ref.]	Format	Sessions	Therapeutic component/target	Therapeutic aims	Therapeutic approach and/or techniques
Valle <i>et al.</i> , 2021 [21]	Individual, Online	Behavioral lessons months 1–3: weekly months 4–6: biweekly months 7–12: bimonthly (21 sessions) Adaptive PA goals months 1–12: weekly (48 sessions)	Physical health	Promote PA	Based on SCT, self-regulation framework and BCTs to promote behavioral capability, self-monitoring, self-efficacy, and social support, with an emphasis on self-regulation. FitBit with recommendation to increase their total PA based on individuals' changing PA levels. Feedback based on individual data from FitBit. Text messages: motivational messages, behavioral strategies, prompts to engage in PA, reinforcement or praise, questions about PA. Facebook group for peer support
Valle <i>et al.</i> , 2023 [22]	Individual, Online	Behavioral lessons months 1–3: weekly months 4–6: biweekly months 7–12: bimonthly (21 sessions) Adaptive PA goals months 1–12: weekly (48 sessions)	Physical health	Promote PA	Based on SCT, self-regulation framework and BCTs to promote behavioral capability, self-monitoring, self-efficacy, and social support, with an emphasis on self-regulation. FitBit with recommendation to increase their total PA based on individuals' changing PA levels. Feedback based on individual data from FitBit. Text messages: motivational messages, behavioral strategies, prompts to engage in PA, reinforcement or praise, questions about PA. Facebook group for peer support

ACT, acceptance and commitment therapy; BCT, behavior change technique; FV, fruits and vegetables; GET, goal-focused emotion-regulation therapy; MBCT, motivation and behavior change techniques; MCP, meaning-centered psychotherapy; MIT, motivational interviewing techniques; PA, physical activity; SCT, social cognitive theory; SDT, self-determination theory; YACS, young adult cancer survivors.

with participants [20]. As outlined in Table 2, therapeutic theories such as the social cognitive and the self-determination theories [16,20–22] and behavior change techniques such as motivational and behavioral change techniques and motivational interviewing techniques [20–22] were selected to enhance physical activity (PA) and resilience.

The first program, the IMPACT intervention was developed to increase physical activity among young adult cancer (YAC) survivors [21]. The intervention, described in a published protocol, was evaluated in a two arms RCT with a large sample size. The study, grounded in social cognitive theory, compared the self-help arm, receiving basic digital tools (activity tracker and smart scale) and minimal Facebook interaction, with the IMPACT arm, receiving this plus additional support like active Facebook engagement, weekly lessons, adaptive goals, tailored feedback, and text messages. Impact participants increased self-reported but not accelerometer-measured total PA, like the self-help arm participants. However, they doubled their moderate-to-vigorous PA compared to self-help participants [22].

The second program compared usual care with a self-administered PA program using an actigraph and exercise manual, and an internet-delivered behavioral activation (BA) group program incorporating light PA and cognitive strategies to improve self-efficacy, control, and coping [17,18]. The intervention was assessed in a three-arm pilot RCT in terms of sleep quality [17] and psychological distress [18]. Both arms reduced anxiety, depression, and cortisol while improving self-efficacy, sleep, and social support. Stronger effect sizes were observed for physical activity, moderate-intensity activity, and walking activity (at the 3-month follow-up) in the PA arm compared to the BA group. Additionally, the PA arm exhibited a lower attrition rate than the BA arm. The PA intervention was easier to adhere to than the BA intervention [18].

The third program aimed to assess the additional impact of charitable incentives on the effectiveness of a PA intervention [16]. This pilot RCT compared a PA-alone intervention, which targeted behavioral change determinants such as self-efficacy, outcome expectations, facilitators/barriers, goal setting, and self-monitoring, with the same PA intervention adding a charitable donation component for participants who met their step goals. Findings indicated that charitable incentives enhanced intrinsic motivation, resulting in significant increases in step count and self-determination scores compared to the PA-alone arm.

The fourth program, the ACCESS intervention, based on behavioral change and motivational interviewing techniques, targets autonomous

motivation and perception of autonomy to promote PA through videoconferencing [12]. As detailed in Table 2, the 12-week intervention, ongoing and described in a published protocol, will include six one-on-one videoconference sessions with PA counsellors and target self-determination theory constructs [12].

The fifth program is a telehealth intervention designed to promote behavior change by examining physical activity, fruit and vegetable consumption, and motivational processes among rural-living YACs. Findings of a single-arm trial indicated that the intervention may help promote perceptions of relatedness, competence, and autonomy in relation to PA and fruit and vegetable consumption [20]. As detailed in Table 2, the 12-week intervention, included 12 one-on-one videoconference sessions with a health coach and target self-determination theory constructs [20]. Participants actively shaped the intervention through weekly coaching, questionnaires, and semi-structured interviews, ensuring adaptability for better engagement and effectiveness [20].

INTERVENTIONS TARGETING COGNITIVE AND BEHAVIORAL STRATEGIES

Cognitive and behavioral strategies are key resilience promoting factors. Cognitive reappraisal, attention control, and self-efficacy training enhance coping skills, motivation, and strengthen emotion regulation [5^{***}]. Four programs have targeted cognitive and behavioral strategies [11,13–15,17,18]. As outlined in Table 2, programs were based on individual [14,15], dyadic [11], and group interventions [13], in person or online [11,13] in person or at-home [14,15] or only online [17,18]. The numbers of sessions ranged from 4 [11] to 34 [17,18], and session durations ranged from 60 [14,15] to 180 min [17,18]. One study co-design the intervention with participants [13].

As previously discussed, the intervention comparing a PA to a BA program, revealed that the PA program yielded superior outcomes with stronger effects on physical activity levels, better adherence, lower attrition, and comparable mental health benefits to the BA group [17,18].

The second program, the GET intervention, was developed to improve psychological distress symptoms, emotion regulation, and goal-navigation skills [14,15]. The pilot RCTs focused on improving self-regulation skills to better navigate life goals and cancer-related emotions. The study compared the GET intervention arm to a control arm receiving individual supportive listening. The findings suggest that the GET intervention, integrating

techniques from stress and coping theory, emotion regulation theory, and self-determination theory, may mitigate cortisol levels in YACs [14] and, reduce psychological distress and enhance self-regulation skills related to emotions and goal attainment [15].

The third program compared the Peer2Me intervention, described in a published protocol (of a randomized trial using a comprehensive cohort design), to a control arm receiving a one-time, standardized 30-min psycho-oncological consultation. The Peer2Me intervention targeted patients within the last six months of diagnosis, thus during their treatment phase. Peer2Me aims to support acutely ill YACs (mentees) by pairing them with a mentor (YA survivor) to facilitate coping with the disease, increase self-efficacy and reduce psychological distress [11]. The mentoring in this study integrates continuous feedback collection, ensuring adaptability to AYAC needs while maintaining a structured framework.

The fourth program published the development of a behavioral symptom management group intervention for YAC survivors. The two-phase approach involved consulting survivors and healthcare professionals in the design phase to select interventions targets (phase I) and refining the intervention through user testing and providing feedback (phase II) [13]. The prototype intervention incorporated behavioral symptom coping skills and home-based physical activity, alongside strategies from acceptance and commitment therapy, self-compassion techniques, and meaning-centered psychotherapy, aiming to enhance self-efficacy in symptom management. Findings of the first phase confirmed that pain, fatigue, and emotional distress are common and highly correlated concerns among YACs posttreatment. Findings of the second phase found that participants provided positive feedback on this structure, content, and mobile application, leading to refinements for improved relevance and engagement.

INTERVENTIONS TARGETING SOCIAL SUPPORT

Social support is a key factor in resilience and psychological well being as it promotes problem-focused coping, sense of control, self-esteem, and optimism. Interventions aimed at strengthening social skills and support networks have been found to reduce stress-related depression and enhancing resilience [5²²]. Only one study used the social support strategies to enhance resilience [19]. A second study, presented in the previous section, incorporated social support as a technique within the intervention rather than as a primary target component [11].

The Peer Support For You intervention compared an online peer support group to a usual care arm [19]. As indicated in Table 2, the intervention was based on collaborative peer feedback, and acceptance and commitment therapy. The intervention combined online peer support where peers shared experiences they faced during cancer treatment, with offline activities to alleviate psychological distress. The intervention adapted support to the evolving needs of the patients, while ongoing feedback collection ensured flexibility within a structured framework. Findings showed the intervention group efficacy in reducing psychological distress, anxiety, and depressive symptoms, while enhancing perceived peer support and readiness for return to work.

INTERVENTIONS TARGETING EMOTION REGULATION

Emotion regulation skills are key protective factors of long-term resilience [5²²], enabling individuals to modulate stress responses, maintain psychological stability and adapt to adversity. Emotion regulation uses approaches such as mindfulness to strengthen strong regulation promoting rapid stress recovery and delaying gratification [5²²]. No study specifically aimed at improving emotional processes to enhance resilience, but one intervention used cognitive competence to enhance emotion regulation. The GET intervention focused on improving self-regulation in the form of skills to navigate challenged life goals and cancer-related emotions to improve psychological distress symptoms, emotion regulation, and goal-navigation skills [15]. This study highlighted the relevance of using several components in fostering resilience.

INTERVENTIONS TARGETING NEUROBIOLOGY

Neurobiology supports resilience through promoting neuroplasticity, immunoregulation, gut microbiome composition, and the integrity of both the gut barrier and the blood-brain barrier, including the functions of the hippocampus, prefrontal cortex and reward system [23]. No study explicitly targeted neurobiological processes to enhance AYACs resilience. However, findings of studies reviewed here confirm that interventions focusing on physical activity or cognition and behavior can modulate neurobiological processes [14,18]. The GET intervention, demonstrated that enhancing self-regulation may mitigate cancer-related pro-inflammatory and stress-related processes in YAC survivors [14]. Similarly, findings from another pilot RCT, which

compared a PA program, a BA program, to a usual care arm, found that participants in both interventions exhibited significantly lower salivary cortisol levels [18].

DISCUSSION

This scoping review aimed to synthesize recent interventions aiming to promote resilience in AYAs with cancer. Twelve studies were identified including RCTs, study protocols, pilot RCTs, and a single-arm feasibility study. The interventions revealed a focus on physical health and cognitive and behavioral strategies, while notably neglecting social, neurobiological and emotion regulation resilience-promoting factors. Small-sample qualitative methods have been used to assess feasibility and acceptability, demonstrating varying levels of participant involvement and intervention adaptability.

Our review highlights the importance of integrating physical activity and lifestyle modifications into resilience programs, to enhance psychological and physiological functioning [12,17,18,20]. The emphasis on cognitive-behavioral techniques highlighted the effectiveness of stress management techniques, cognitive restructuring, and self-efficacy enhancement in fostering adaptive responses to cancer-related adversity [14,15]. This review confirms the interdependence of the different resilience promoting factors and their complementarity. It also highlights the relevance of digital health interventions to increase accessibility, especially for AYACs facing logistical or financial barriers [13,17, 18].

Despite strong evidence supporting on the role of social support, emotion regulation and neurobiological in resilience, few interventions targeted these protective factors. A critical consideration for future interventions is the optimal timing of

resilience-building programs. Evidence supports early implementation, particularly at diagnosis and during initial treatment as AYACs face higher mental health disorders in the first six months [24]. Repeated exposure to uncontrollable stressors during early treatment can lead to learned helplessness, dysregulation of emotional, behavioral, autonomic nervous system, and hypothalamic-pituitary-adrenal (HPA) axis responses [5²²]. Early interventions maximize stress resilience by leveraging neuroplasticity windows. They may foster adaptive coping, reduce stress and improve social functioning, potentially mitigating cancer-related cognitive impairments (CRCI) and enhancing long-term psychological well being. Notably, only one study proposed an intervention at the beginning of their oncological journey [11], underscoring a critical research opportunity.

Additionally, this review underscores the importance of co-constructing interventions with AYACs through participatory research approaches ensuring their relevance, acceptability, and engagement [13,20]. Future research should use user-centered methodologies and iterative feedback to accommodate AYACs' commitments. To foster sustained engagement, interventions must be both time-efficient and flexible, aligning with AYACs' lifestyles while enhancing their effectiveness and sustainability.

CONCLUSION

This scoping review highlights recent psychological interventions to enhance resilience in AYACs, emphasizing gaps in social, emotional and neurobiological dimensions. It leads to some suggestions for developing psychological interventions (Table 3). Future research should focus on developing multidimensional and tailored interventions that address the specific needs of AYACs from the

Table 3. Suggestions for developing psychological interventions for in adolescents and young adults with cancer (AYACs)

Accessibility
The acceptability of interventions is a crucial factor in their effectiveness, particularly among AYACs, who often juggle multiple commitments such as education, work, and treatment.
To foster sustained engagement and long-term impact, futures interventions must be time-efficient and flexible to their lifestyles. Online and self-administered interventions represents a promising approach.
Optimal timing
Early resilience-focused interventions can improve adaptive coping strategies, minimize distress, and improve social functioning, potentially mitigating cancer-related cognitive impairments (CRCI) and fostering long-term psychological well being into survivorship.
Co-construction
Co-constructing interventions with AYACs through participatory research approaches is crucial to ensuring relevance, acceptability, and engagement. Future research should prioritize user-centered methodologies and iterative feedback processes to develop interventions that align with the unique needs and preferences of AYACs, ultimately enhancing their effectiveness and sustainability.

start of treatments. By ensuring comprehensive and accessible psychological interventions throughout the cancer journey, we can improve mental health and quality of life for this vulnerable population.

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Conflicts of interest

There are no conflicts of interest.

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