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Resilience in allied health undergraduate education: a scoping review

Elio Arruzza, Minh Chau, and Gisela Van Kessel

Purpose: Students of allied health disciplines deal with daily challenges. Without methods to mitigate stress, a decline in academic and clinical performance may result. This scoping review aims to examine the current evidence for the efficacy of interventions for enhancing resilience for allied health students.

Materials and Methods: Medline, Embase and Cochrane Library were systematically searched for literature published until October 2022. The search included Quantitative studies which employed a pre-post or controlled study design to evaluate an intervention to improve resilience for university students in medical radiation, pharmacy, optometry, physiotherapy and podiatry. Screening and data extraction was conducted independently by two reviewers. Critical appraisal was conducted using Joanna Briggs Institute (JBI) critical appraisal tools. Seven studies were included.

Results: A range of resilience interventions were discovered in terms of the frequency and duration, method of implementation including didactic and online learning. Statistically significant findings were found in most controlled trials and pre-post studies. Interventions to enhance resilience are effective within allied health curriculum.

Conclusions: The evidence that resilience can be significantly influenced by an intervention suggests that stakeholders should spend more time on designing and piloting interventions within their context. Future research should look to assess longer term and clinical related outcomes.

Introduction

University students preparing for allied health roles encounter stresses due to academic pressures such as exams, assignments and interpersonal relationships [1]. Furthermore, students within the health sciences may experience continuous exposure to human suffering during work-integrated learning [2]. Without methods to mitigate stress, a decline in academic and clinical performance may result [3]. Thus, preparing the future healthcare workforce for managing the growing complexity of care is of the upmost importance. Among viable suggestions to address this, interventions to enhance psychological resilience have gained significant popularity.

Resilience is described as the “ability to bounce back, grow stronger from failure, and remain positive in times of adversity” [4]. It is considered a mentality involving skills and attributes that can be developed and is not necessarily just an individual trait [5]. Globally, universities and healthcare organizations consider resilience to be a critical capability of graduates in many allied health professions [6,7]. The significance of resilience has been bolstered by the recent pandemic’s negative effect on the wellbeing student and healthcare professionals [8]. Although the concept of resilience is commonplace within sport and military contexts, it is increasingly being applied in the academic setting to enhance students’ ability to respond to challenging situations.

Research suggests a moderate incidence of depression, anxiety, and especially stress among college students [9]. Health students particularly, experience higher rates of burnout and depression than their peers in other disciplines, despite commencing tertiary education with relatively lower psychological distress [10]. This has been associated with lower test scores and higher dropout rates [10].

Prior to the pandemic, reviews of literature within higher education pointed to a key role resilience plays in supporting students through challenges, to manage their wellbeing and achieve their academic goals [11–13]. Educators continue to seek novel techniques to measure and improve resilience for allied health students. While educational interventions typically share common aims and resources, they differ in terms of their content, delivery and length [14].

This review endeavors to provide a contemporary evidence-based overview of interventions enhancing resilience for allied health students. It is envisioned that a more comprehensive approach will allow universities and healthcare organizations to consider resilience in all their curricula.

IMPLICATIONS FOR REHABILITATION

• Universities and healthcare organizations consider resilience to be a critical capability of graduates in many allied health professions.
• There are positive benefits regarding the perceptions and knowledge of allied health students who participate in resilience training.
• Interventions should be designed to relate closely to an articulated understanding of resilience and utilize measurement tools which possess all forms of validity.

KEYWORDS
Resilience; education; health; pharmacy; physiotherapy

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understanding of the most effective interventions can inform the future design of programs to enhance resilience.

**Methods**

This scoping review followed the methodological framework for scoping reviews described by Arksey and O’Malley [15]. Specifically, this method entailed identifying relevant studies, study selection, charting the data and collating, summarizing, and reporting the results. The independent screening and reviewing of eligible studies, as well as the critical appraisal of studies, followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis extension for Scoping Reviews (PRISMA-ScR) [16].

**Search strategy**

A comprehensive systematic search was conducted in databases Medline, Emcare, CINAHL and Cochrane Library for literature published until October 2024. The search terms included the following keywords: [resilience] AND [“higher education” or “tertiary education” or “university” or “college” or “further education” or “undergraduate” or “student”] AND [“allied health” or “health science” or “radiograph” or “physio” or “podiatry” or “occupational therapy” or “physical therapy” or “speech path” or “optometry” or “pharmac” or “speech path” or “speech language” or “medical imag” or “medical rad” or “radiologic technol” or “radiotherapy” or “radiation therapy” or “nuclear medicine”]. The search was limited to English studies and those with human participants. Investigation of the reference lists of previous reviews and of included studies was also undertaken.

**Eligibility criteria**

This review included studies with quantitative experimental designs, including randomized controlled trials, non-randomized controlled trials, and pre-post studies. Cross-sectional studies which simply surveyed resilience without a specific educational intervention preceding it, were excluded. Previous reviews were also not included. This review included interventions designed to improve resilience among students, irrespective of the content, method of delivery or duration. Resilience interventions were considered only if the authors explicitly identified “resilience” as an outcome measure.

Participants included university students within the allied health disciplines. Studies that included primary or secondary school students, or practicing professionals with existing accreditation, were not included. There exists no single definition that outlines the disciplines encompassing “allied health.” We chose to selectively include disciplines which comprise the majority of allied health clinical work and those that constitute the Australian National Registration and Accreditation Scheme [17]. Students from the fields of health science, pharmacy, physiotherapy, podiatry, medical radiation, optometry, speech pathology, and occupational therapy, were eligible for inclusion. Studies that evaluated students in disciplines generally not considered as allied health, such as nursing, dentistry, medicine and its subdisciplines, were excluded.

**Study selection**

Search results were collated, uploaded and de-duplicated with the use of Covidence (Covidence, Melbourne, Australia). Citations were independently assessed for their eligibility by two individuals (EA and MC). Titles and abstracts were then screened, and full texts were then assessed by the reviewers. Where discrepancies arose, discussion between reviewers was undertaken and a third reviewer was consulted if required.

**Data extraction**

Two reviewers (EA and MC) independently extracted data. Extracted information included 1) study characteristics (i.e. year of publication, name of journal, field/discipline, location of study), 2) characteristics relating to the intervention (description of method, sample size), control and outcome measures (i.e. frequency and duration, measurement tools).

**Methodological quality**

Two independent reviewers assessed selected studies for methodological validity prior to inclusion in the review. Each retrieved study was critically appraised, and the methodological quality assessed using Johanna Briggs Institute (JBI) critical appraisal checklists for quasi-experimental studies and randomized controlled trials [18]. The assessment evaluated key areas for pre-post and controlled studies including inclusion criteria, description of study subjects and setting, reliability of measures used and identification of confounding factors.

**Results**

A total of 852 studies were identified via the literature search, entailing 377 studies from Medline, 277 from Emcare, and 198 from the Cochrane Library. After 176 duplicate articles were removed, the titles and abstracts of 507 articles were screened independently by two reviewers (EA and MC). Fifty full texts were then screened for eligibility. Discussion between reviewers resolved disagreements as they arose. After full-text assessment, a further four studies were removed due to a variety of reasons including: ineligible study design (i.e. cross-sectional, review or qualitative) (n = 24), ineligible outcomes (n = 16) and interventions designed for non-allied health students (n = 2). A final seven studies were therefore included in this review. A PRISMA flowchart summarizing this process is presented in Figure 1.

**Tables 1 and 2** summarize the characteristics of all included studies. Publication dates spanned from 2008 until the most recent in 2022. All studies were undertaken within the developed world with representation from the United States of America (n = 4) [19–22], Spain (n = 2) [23,24] and the United Kingdom (n = 1) [25]. Total sample sizes of students ranged from 14 [19,25] to 245 [23]. Two of the studies were randomized controlled trials (RCTs) [20,23], while a pre-post study design without a control group was employed in five studies [19,21,22,24,25].

Physiotherapy students were represented in three studies [19,20,23], pharmacy in two [21,22], and solitary studies in occupational therapy [24] and radiotherapy [25]. No studies from radiography, nuclear medicine, podiatry, optometry, or speech pathology were included. The duration of engagement varied across studies, ranging from single sessions [23], several weeks [20,22,24,25], or the entire duration of a term or semester [19,21].

In three of the studies, the concept of resilience was not clearly defined [21–23]. Generally, resilience was conceptualized as an individual’s ability to cope in adversity or adapt to stress [19,20,24,25].
Hilliard extends this to the degree to which an individual can rebound from and react positively to new experiences. Rodriguez-Martinez and colleagues understood resilience to be a personality quality [24], while Mejia-Downs conceptualized it as a “dynamic process” [20].

A range of intervention approaches were implemented. A term-long program entitled “Well-being for Professional Success” was employed by Powell and colleagues, aiming to “build resilience to manage the fluctuations of life” [21]. This featured didactic teaching with the use of guest speakers and mental health experts, followed by small group discussions and team-based assignments.

Mindfulness and meditation were the primary focuses of two studies [22,25]. The decision to pursue these methods was predicated on previous mindfulness intervention literature which has indicated that it has many benefits not only on a personal level

Table 1. Study characteristics of pre-post studies.

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>Year of Study</th>
<th>Journal</th>
<th>Country</th>
<th>Discipline/s</th>
<th>n</th>
<th>Intervention</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Powell et al.</td>
<td>2021</td>
<td>2019</td>
<td>Currents in Pharmacy Teaching and Learning</td>
<td>USA</td>
<td>Pharmacy</td>
<td>42 pre 38 post</td>
<td>Well-being for Professional Success course</td>
<td>1 term × 110m per week</td>
</tr>
<tr>
<td>Rodriguez-Martinez et al.</td>
<td>2021</td>
<td>2016-17</td>
<td>Frontiers in Psychology</td>
<td>ESP</td>
<td>Occupational Therapy</td>
<td>174 pre 156 post</td>
<td>Clinical Practicum</td>
<td>4-6 weeks</td>
</tr>
<tr>
<td>Truhlar et al.</td>
<td>2022</td>
<td>NR</td>
<td>American Journal of Health – Systematic Pharmacy</td>
<td>USA</td>
<td>Pharmacy</td>
<td>60 pre 22 post</td>
<td>Meditation app Ten Percent Happier</td>
<td>4 weeks</td>
</tr>
<tr>
<td>Hilliard et al.</td>
<td>2008</td>
<td>NR</td>
<td>Journal of Allied Health</td>
<td>USA</td>
<td>Physiotherapy</td>
<td>14</td>
<td>Clinical Practicum</td>
<td>40h per week for 23 weeks</td>
</tr>
</tbody>
</table>
Connor-Davidson’s resilience study characteristics of studies that employed a control arm.

Table 2. Study characteristics of studies that employed a control arm.

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>Years of Study</th>
<th>Journal</th>
<th>Country</th>
<th>MRS Field</th>
<th>Intervention</th>
<th>n</th>
<th>Duration</th>
<th>Control</th>
<th>n</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarkson et al.</td>
<td>2018</td>
<td>NR</td>
<td>Radiography</td>
<td>UK</td>
<td>Radiotherapy</td>
<td>Living Mindfully “Mindfulness Based Stress Reduction” (MBSR) program including meditation practices, reading and exercises</td>
<td>8</td>
<td>5 weeks</td>
<td>The control group was taken from year one of the Post Graduate Diploma in Radiotherapy and Oncology in Practice and the intervention group taken from year two of the same programme.</td>
<td>6</td>
<td>NA</td>
</tr>
<tr>
<td>Mayor-Silva et al.</td>
<td>2021</td>
<td>2019</td>
<td>Nurse Education Today</td>
<td>ESP</td>
<td>Physiotherapy</td>
<td>Resilience Gym (RG) intervention</td>
<td>85</td>
<td>1 day</td>
<td>No Intervention</td>
<td>71</td>
<td>NA</td>
</tr>
<tr>
<td>Mejia-Downs</td>
<td>2020</td>
<td>NR</td>
<td>Journal of Physical Therapy Education</td>
<td>USA</td>
<td>Physiotherapy</td>
<td>Stop Running on Empty! curriculum</td>
<td>22</td>
<td>4 weeks</td>
<td>No Intervention</td>
<td>21</td>
<td>NA</td>
</tr>
</tbody>
</table>

USA United States of America, ESP Spain, UK United Kingdom, NR Not Reported.

Table 3. Key findings of included studies.

<table>
<thead>
<tr>
<th>Study</th>
<th>Tool</th>
<th>Key findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarkson et al.</td>
<td>Connor Davidson Resilience Scale (CDRS)</td>
<td>➢ A steady increase in resilience was seen in the intervention group. The greatest improvement between baseline and 12 months was seen by the intervention group, but this was not statistically significant (p &gt; .05).participants perceived “resilience to manage the fluctuations of life,” increased significantly (p = .04).</td>
</tr>
<tr>
<td>Powell et al.</td>
<td>Likert Scale Survey</td>
<td>➢ There was a significant improvement of global resilience after the clinical practice period, in both women (13.85 points; p &lt; .001) and men (7.72 points; p &lt; .05).</td>
</tr>
<tr>
<td>Rodriguez-Martinez et al.</td>
<td>Connor-Davidson's resilience scale (CD-RISC)</td>
<td>➢ Participants experienced an increase in resilience (p &lt; .0001). There was a significant increase in resilience at week 4 and week 12 compared to baseline.</td>
</tr>
<tr>
<td>Truhlar et al.</td>
<td>Brief Resilience Scale (BRS)</td>
<td>➢ With respect to the PTS (Persistence, Tenacity, and Self-Efficacy) dimension of the CDRS, a higher mean was observed in the CG than in the IGs (p = .08). All other domains were not statistically significant.</td>
</tr>
<tr>
<td>Mayor-Silva et al.</td>
<td>Connor-Davidson Resilience Scale (CDRS)</td>
<td>➢ The participants exhibited statistically significant changes in emotional resilience between pre- and post-inventory scores (p = .02).</td>
</tr>
<tr>
<td>Hilliard et al.</td>
<td>Emotional Resilience - Cross-Cultural Adaptability Inventory (CCAI)</td>
<td>➢ There were significantly greater increases in resilience (p = .03) in the intervention group compared to the control group.</td>
</tr>
<tr>
<td>Mejia-Downs</td>
<td>Connor-Davidson Resilience Scale</td>
<td></td>
</tr>
</tbody>
</table>

but also professionally and can be utilized as a self-care strategy [25]. The former used the Living Mindfully “Mindfulness Based Stress Reduction” program which was inspired by a previous study of patients with chronic psychological issues [26]. Mindfulness was explored via the “Ten Percent Happier” app in Truhlar’s study, which includes meditation courses with videos that highlight the learning component before meditation practice, single meditations, sleep content, short “Teacher Talks,” and mindfulness podcasts.

Shorter-term cognitive behavioral strategies for stress inoculation were implemented in two studies [23]. Mayor Silva implemented “Resilience Gym,” a pedagogical intervention based on several aspects of behavioral therapy including recognition of negative thoughts and emotions, applying “thought stopping,” use of positive emotions to face adversity, pursuing social support, and diaphragmatic breathing [23]. Mejia-Downs initiates a similar curriculum titled “stop running on empty,” which teaches students relaxation techniques and positive reinterpretation [20].

Two studies evaluated clinical placement as the intervention to facilitate resilience improvement. Rodriguez-Martinez chose to evaluate students before and after their first exposure in the occupational therapy workplace, to determine if early work-integrated learning was developing resilience skills for later college and career beyond [24]. Hilliard’s study specifically focused on emotional resilience as a construct important for effective cross-cultural interactions [19]. During this experience, students were expected to incorporate individual and cultural differences into physical therapy practice for effective care under the supervision of a clinical instructor, implementing knowledge learnt in their previous theoretical course.

### Measurement tools

Table 3 highlights the measurement tools and associated findings featured in each study. In all studies, reported outcomes were based on the self-reported perceptions of participants. A variety of scales were used to quantitatively evaluate these perceptions. The Connor Davidson Resilience Scale (CD-RISC) was common in four studies [20,23–25]. Other scales included the Cross-Cultural Adaptability Inventory (CCAI) [19], Brief Resilience Scale (BRS) [22], and a customized Likert-scale survey [21]. The CD-RISC and BRS rate amongst the highest of a number of validated tools to assess resilience [27]. The Cross-Cultural Adaptability Inventory (CCAI) measures adaptability in working with other cultures, a key outcome of diversity education. One subscale of the CCAI assesses emotional resilience, or the ability to adapt to new experiences with a positive and non-judgmental attitude [19].
Methodological quality

Tables 4 and 5 summarize the methodological quality of included studies. Across the three RCTs, assessors were blinded in two [20,23]. Expectedly, participant blinding did not occur considering the nature of the educational intervention. A common drawback across the controlled studies was that the control group potentially experienced a different treatment than the intervention group; control groups often were not tested simultaneously with the intervention group but rather featured more experienced students who undertook the intervention later [20,25]. This was conducted to ensure educational equity for all students. Two of the pre-post studies employed multiple timepoints postintervention [22,25]. A loss in participants was prevalent in most studies, and when this occurred, reasons for loss to follow up and analyses of its impact, was not reported [19,21,22]. Baseline characteristics such as age and gender were reported in all studies, and were statistically tested for similarity in all but one [25]. No studies were excluded based on methodological quality.

Randomized and non-randomized controlled trials

Three studies evaluated resilience by comparing it to a control group which did not receive the intervention [20,23,25]. In two of the studies, participants were randomized into each group [20,23]. These two studies showed significantly greater increases in resilience in the intervention group compared to the control [20,23]. In the study by Clarkson and colleagues, the largest improvement between pre- and post-test at 12 months was experienced by those engaging in resilience training, but this improvement was not deemed statistically significant [25]. In Mayor-Silva’s study, both the online and face-to-face intervention were demonstrated statistically significant over the control group, and each resilience intervention was as effective as the other [23].

Table 4. Critical appraisal of included experimental studies.

<table>
<thead>
<tr>
<th>Is it clear in the study what is the “cause” and what is the “effect” (i.e. there is no confusion about which variable comes first)?</th>
<th>Powell et al.</th>
<th>Rodriguez-Martinez et al.</th>
<th>Truhlar et al.</th>
<th>Hilliard et al.</th>
<th>Clarkson et al.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Were the participants included in any comparisons similar?</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Was there a control group?</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Were there multiple measurements of the outcome both pre and post the intervention/exposure?</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Were the outcomes of participants included in any comparisons measured in the same way?</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Were outcomes measured in a reliable way?</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Was appropriate statistical analysis used?</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

Y = Yes, N = No, U = Unclear.

Table 5. Critical appraisal of included RCTs.

<table>
<thead>
<tr>
<th>Was true randomization used for the assignment of participants to treatment groups?</th>
<th>Mayor-Silva et al.</th>
<th>Mejia-Downs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Was allocation to treatment groups concealed?</td>
<td>U</td>
<td>Y</td>
</tr>
<tr>
<td>Were treatment groups similar at the baseline?</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Were participants blind to treatment assignment?</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Were those delivering treatment blind to treatment assignment?</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Were treatment groups treated identically other than the intervention of interest?</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Were participants analyzed in the groups to which they were randomized?</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Were outcomes measured in the same way for treatment groups?</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Were outcomes measured in a reliable way?</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Was appropriate statistical analysis used?</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

Y = Yes, N = No, U = Unclear.

Pre-post studies

Four studies measured the resilience levels of students before and after an intervention to enhance it [19,21,22,24]. In three studies, resilience scores were significantly greater post-intervention. In the study by reference [21], two of three resilience-related metrics demonstrated significantly positive results.

Discussion

This review analyzed the effectiveness of educational interventions in enhancing resilience for university students within a range of allied health disciplines including radiotherapy, pharmacy, physiotherapy and occupational therapy. Resilience training has seen an uptake in university education in recent times, which has spurred research into its value, and how best to implement it [28]. To the best of our knowledge, this is the first review specifically examining the interventions for allied health students. The analysis of effectiveness was based on quantitative data from pre-post, non-randomized and randomized controlled trials. All pre-post studies and three of four controlled trials reported statistically significant findings supporting the use of resilience education. A further controlled trial reported enhancement in resilience, though this was not deemed statistically significant. These findings suggest that interventions may be of considerable value to allied health curriculum.

There was significant variation in the duration and frequency of interventions, ranging from single sessions to semester-long dedicated courses which taught broader curriculum relating to student wellbeing. Positive findings were discovered irrespective of timing characteristics. In a 2018 review focused on fostering resilience for nursing professionals, training was more likely to have a sustained impact where interventions were more frequent, and longer in duration [29]. Pertaining to the studies featured in
our review, it is likely that researchers adopted shorter study durations to prioritize its methodological benefits over longer term counterparts. For example, and as highlighted by Mayor-Silva's study, single short sessions permit researchers to isolate variables, as students will naturally participate in other activities that may obscure the true effectiveness of the resilience intervention. Furthermore, concerns about workload and long-term assessment can affect the overall perceptions held by students and lead to participant withdrawal. Although short-term studies exhibit limited data on long-term benefits, positive findings in these studies provide reassurance for educators who are looking to trial resilience education. However, based on the findings of previous reviews of practicing health professionals [29], positive findings from Hilliard’s longitudinal study [19], and calls for further longitudinal studies within the literature [20,22,25], longer-term interventions should be prioritized over shorter ones. After all, resilience is a “process that can be developed, takes time to generate results and requires a particular training frequency” [30].

This review supports e-learning as a viable alternative to conventional didactic methods. E-learning may provide greater access to learning to students, and be of great value given the recent necessity to adapt learning in pandemic-affected settings. Digital interventions permit for participation in sessions in the student’s own time, and often do not require scheduling of instructors [22]. It is encouraging to observe that resilience may be developed during work-integrated learning. Clinical practice serves as an adversity by which resilience stems; sources of stress include the fear of unfamiliar situations arising, mistakes made with patients or in the handling of technical equipment, striving for learning opportunities and discovering the social rules in clinical settings [21]. It cannot be assumed, however, that a sufficient degree of resilience is attained naturally through exposure to daily clinical practice; purposeful and specific interventions to improve resilience whilst on clinical practice, such as case-studies, communication skill checks and objective structured clinical exams, should supplement clinical practice to bolster resilience [19]. These methods can prompt discussion about resilient behaviours, allowing students to responses to recognize and exercise coping strategies, emotional competence and reframing skills.

The use of groupwork may have also contributed to the success of resilience programs. Groupwork created strong bonds between peers and their faculty in the study by Powell [21]. In the field of medicine, literature [31] explains the need to incorporate resilience into curriculum, with the aim of assisting students to confront the difficult interactions present within the multidisciplinary team [31]. For this reason, groupwork in the resilience context may simultaneously fulfill the requirement for students to engage in interprofessional education prior to graduation. This review is naturally limited by the methodological shortcomings of included studies. Most of the studies supplied low participant numbers which minimizes statistical power. Convenience sampling was prevalent, and this may have prejudiced more highly motivated students to contribute to the data. Furthermore, studies experienced significant attrition resulting in uneven groups. This review did not distinguish between health professionals, and it is an argument that findings cannot be transferrable from one allied health discipline to the other. Moreover, the low sample size and heterogeneity in methods, scales and interventions precluded a meta-analysis. Future research should employ valid and reliable measures of resilience which go beyond self-reported and subjective assessments. Comparing multiple forms of resilience training will be beneficial in determining whether novel pedagogies rival established methods.

Conclusion
Resilience is a growing area of research and curriculum for allied health students. This systematic review has shown positive benefits with regards to the perceptions and knowledge of allied health students who participate in resilience training. These findings contribute to the accumulation of evidence that resilience training is a positive educational intervention. The evidence that resilience can be significantly influenced by an intervention suggests that practitioner should spend more time on designing and piloting interventions in their context. The interventions should be designed to relate closely to an articulated understanding of resilience. The pilots should use a resilience scale that has all forms of validity (i.e. construct, content, face and criterion). A range of interventions and recommendations are described in this review. Rigorous RCTs with larger sample sizes, sufficient follow-up and an emphasis on determining the ideal education modes, frequencies and durations, are needed to better inform educational practice.

Ethics approval
Ethical approval was not required due to the secondary nature of this article.

Consent
Informed consent was not required due to the nature of the project.

Authors contribution
All authors (EA, MC and GVK) made substantial contributions to the conception and design of the work and the acquisition, analysis, and interpretation of data. All authors drafted the work and revised it critically for important intellectual content. All authors approved the version to be published and agree to be accountable for all aspects of the work.

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