Research paper

Sharper minds: Feasibility and effectiveness of a mental health promotion package for university students targeting multiple health and self-care behaviours

Genevieve A. Dingle [a,*], Rong Han [a], Kevin Huang [b], Sakinah S.J. Alhadad [c], Emma Beckman [b], Sarah V. Bentley [a,d], Shannon Edmed [e,f], Sjaan R. Gomersall [g,h], Leanne Hides [a], Nadine Lorimer [a,f], Fiona Maccallum [a], Blake M. McKimmie [a], Norman Ng [b], Kalina Rossa [e,f], Simon S. Smith [e,f], Zoe C. Walter [a], Elyse Williams [a], Olivia R.L. Wright [b], Radhika Tanksale [a]

[a] School of Psychology, The University of Queensland, Brisbane, Australia
[b] School of Human Movement and Nutrition Sciences, The University of Queensland, Brisbane, Australia
[c] School of Education and Professional Studies, Griffith University, Brisbane, Australia
[d] Commonwealth Scientific and Industrial Research Organisation (CSIRO), Brisbane, Australia
[e] Child Health Research Centre, The University of Queensland, Brisbane, Australia
[f] ARC Centre of Excellence for Children and Families over the Life Course, The University of Queensland, Brisbane, Australia
[g] Health and Wellbeing Centre for Research Innovation, School of Human Movement and Nutrition Sciences, The University of Queensland, Brisbane, Australia
[h] School of Health and Rehabilitation Sciences, The University of Queensland, Brisbane, Australia

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ABSTRACT

Objective: This study assessed the feasibility and effectiveness of the Sharper Minds package, a mental health intervention designed for university students, co-developed with student input. The program included a weekly self-monitoring e-tool and/or a short course targeting six self-care areas: physical activity, diet, sleep, music to aid study, mood regulation, and social connection.
Method: A non-randomised controlled trial involved 433 undergraduate students in three conditions: control, one-intervention (either e-tool or course), and two-intervention (both e-tool and course). Data were collected at baseline and after six weeks. Feasibility was measured by reach, retention, and acceptability, while primary outcomes focused on mental health indicators such as depression and anxiety, and secondary outcomes were somatic symptoms, wellbeing and academic motivation.
Results: Results indicated good retention (72 %) and positive feedback on acceptability. Students receiving both interventions (two-intervention condition) showed a 17.6 % reduction in the proportion screening positive for mental health issues, a change not seen in other conditions. A MANCOVA analysis identified a significant interaction between condition and time across combined outcomes (depression, anxiety, somatic symptoms, wellbeing, and motivation), with a small effect size.
Conclusions: This is the first mental health promotion package for Australian university students addressing multiple health and self-care behaviours. Findings indicate students found the package components acceptable and experienced positive effects on mental health.
ANZ Clinical Trial Registration: Retrospectively registered 1/09/2023, https://www.anzctr.org.au/Trial/Registration/TrialReview.aspx?id=386141&isReview=true

University undergraduate students are typically in their young adulthood and navigating multiple life transitions. These may include a change of location and living situation, new educational systems, social networks, and for some, a new climate, culture, and language. As a result, many students experience symptoms of psychological distress such as stress, anxiety, somatic concerns, and depression. For example, a 2016 study of Australian university students reported that 65 % of students experienced high psychological distress (NUS and Headspace,

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unpublished; cited in Orygen, 2017). The prevalence of distress increased with the onset of the COVID-19 pandemic, which brought rapid changes to higher education and left many students isolated and overwhelmed. In Australia, the rates of distress increased in both domestic students (from 66 % to 76 %) and international students (from 46 % to 67 %) during 2020 (Dingle et al., 2024). Similar rates have been reported in university students around the world in the wake of the pandemic (ACHA, 2021; Mao et al., 2024; Schmits et al., 2021). It is also clear that inadequate mental health literacy is a significant barrier to help seeking for many university students (Han et al., 2024). More needs to be done within universities to prevent mental health problems in students (Pérez et al., 2023). This project applied principles of co-design and a multidisciplinary approach to developing and evaluating a prevention package that aims to increase students' awareness and engagement in health and self-care behaviours to support their mental health.

1. Health and self-care behaviours promote mental health

Sleep, exercise and nutrition are often collectively referred to as the three pillars of health and wellbeing (e.g., Wickham et al., 2020). When students engage in healthy eating, increase their physical activity, and eliminate binge drinking, they report improved sleep quality and lower depression, anxiety and stress levels (Di Benedetto et al., 2020). In relation to eating, a review found that eating a Mediterranean diet was related to lower levels of depression among university students (Antonopoulou et al., 2020). A systematic review and meta-analysis of 59 studies revealed that physical activity interventions were related to improvements in stress, depression and anxiety in undergraduate students (Huang et al., 2024a, 2024b). Meanwhile, sleep quality is positively longitudinally related to mood and academic performance (Scott et al., 2021).

In addition to these well-established health behaviours, our package focused on three self-care behaviours of importance to young people's mental health: emotion regulation skills, social connectedness, and music listening. Emotion regulation is an ability to flexibly alter one's emotions in adaptive ways in response to the social context (Campos et al., 2011). Using effective emotion regulation skills – such as attentional redirection, cognitive reappraisal, and acceptance - are key to managing emotions in daily life and are associated with fewer psychological problems and better academic performance among university students (Al-Badareen, 2016; Hasking et al., 2023). Social connectedness has been shown to foster a sense of identification and belonging at university and is particularly important when managing transitional

challenges (Iyer et al., 2009). Further, a sense of positive social connection is associated with improved mental health (Haslam et al., 2022). Finally, music listening can be used to help young people to regulate negative emotions such as anxiety, stress and disappointment, and to support wellbeing (Papinczak et al., 2015; Vidas et al., 2021). Interventions using music listening produce positive effects on emotion regulation and wellbeing in university students (Dingle and Fay, 2017; Vidas et al., 2023) and help maintain positive mood and energy levels while studying (Vidas et al., n.d.). Although most university students know there is a link between engaging in health and self-care behaviours and their mental health, many do not put this knowledge into action (e. g., Whatnall et al., 2020; Zochil and Thorsteinsson, 2018). This suggests a need to provide students with accessible, brief interventions that help them engage with health and self-care behaviours while at university.

2. A co-designed package informed by social identity and behaviour change theories

The authors are researchers with collective expertise across the six domains of health and self-care behaviours related to young people's mental health: physical activity, diet and nutrition, sleep, music listening for study related emotion regulation, social connection, and mood regulation. We worked with international and domestic student advisors to co-design a self-monitoring e-tool and a set of brief group courses to help students engage in these six behaviours (see descriptions in Table 1). The self-monitoring e-tool asked students to rate how they have been doing in each of the health and self-care behaviours over the past week, using a single item rating with 5 emoji faces from very positive to very negative. This e-tool produced a graph of their progress over time in the six domains. In low intensity interventions, self-monitoring promotes self-awareness and encourages self-control (Proudfoot and Nicholas, 2010). There is evidence that engagement with using e-tools such as mobile phone apps for self-monitoring predicts decreases in depression and anxiety, and increases in mental well-being (Bakker and Rickard, 2018). The co-design process and content of the Sharper Minds package are described in detail in a separate paper (Dingle et al., 2025).

Although the courses were informed by theories relevant to each target behaviour (e.g., emotion theories for the emotion regulation course and nutrition theory for the diet course), the overall Sharper Minds package was informed by two main theories: the social identity approach to health (Jetten et al., 2017) and behaviour change principles summarised in the COM-B model (Michie et al., 2011). The social identity approach states that when individuals receive health messages from others 'like us', their shared ingroup identity becomes salient

Table 1
Summary of sharper minds group short courses.

Domain & short course	Background and evidence base
Study Strategies – Tuned In 4 × 45-min weekly sessions	*Tuned In* (Dingle and Fay, 2017; Vidas et al., 2023) teaches students music listening and other strategies for managing their emotions within the academic environment (e.g., panic, stress) and associated unhelpful behaviours (e.g., rumination, procrastination).
Physical Activity – Fit 4 Study 4 × 45-min weekly sessions; Self-paced online modules between sessions.	*Fit 4 Study* (Huang et al., 2024a, 2024b) teaches students the benefits of physical activity for health, and strategies to set goals and identify barriers to achieving them during study. The course is informed by systematic review evidence that participation in physical activity and decreased sedentary behaviour improve educational outcomes in university students (Babaeer et al., 2020)
Social Connection – Groups 4 Education (G4E) 5 × 45-min weekly sessions	*Groups 4 Education* is adapted from Groups 4 Health (Haslam et al., 2019) and teaches students the knowledge, skills, and confidence to enhance social connectedness to their learning experience. Students learn online social identity mapping (Bentley et al., 2020) and strategies to develop social identifications at university, which helps wellbeing and academic outcomes.
Healthy Eating – Food for the Brain (F4TB) 4 × 45-min weekly sessions	*Food 4 The Brain* teaches students which foods and nutrients help maintain cognitive and general health, and practical skills for meal planning, shopping, cooking, and sharing cultural and social connections with food. F4TB is evidence- informed by barriers to healthy eating in university students (Sogari et al., 2018) and dietary impact on cognitive function.
Mood Regulation – GRUNT 4 × 45-min weekly sessions (online via videoconference)	*GRUNT* is adapted from the evidence-based Grit program (Quinn et al., 2022). It teaches students about the mind-body connection and staying within the present moment by learning grounding techniques to increase self-awareness. Grunt focuses on non-verbal communication (e.g., physical activity, music), making it suitable for young people with poor literacy, or with English as a second language.
Sleep – Better Sleep 4 × 45-min weekly sessions	The *Better Sleep* program is adapted from cognitive behaviour therapy for insomnia (CBTi). CBTi is effective in reducing time taken to fall asleep, increasing time spent asleep and reducing frequency of waking during sleep.

(Turner et al., 1987) and they are more likely to follow the norms and attitudes presented than if the messages are presented by experts or others who they do not identify with. Therefore, the Sharper Minds materials (promotional materials, website, slides, manuals, and videos) featured students of diverse ages, genders and ethnic backgrounds at the university to promote a shared group identity. Further, the courses were facilitated in small groups by postgraduate students, so that student participants could identify with the facilitators and fellow group members. In addition, behaviour change principles summarised in the COM-B model (Michie et al., 2011) informed the interventions. According to the COM-B model, there are three essential conditions for behaviour change to occur: capability, opportunity, and motivation. The Sharper Minds package was made available to students both online and in person at no cost to provide easy *opportunities* for them to access the strategies. The courses focused on simple and proven skills and strategies to build students' *capabilities* in each domain. Finally, the intervention components were designed to meet needs that students stated in co-design sessions and were framed around helping students towards their common motivation to succeed at university.

3. Aims and hypotheses of this study

This study represents the first open trial of the Sharper Minds package at a major metropolitan university, including feasibility and effectiveness aspects. In terms of feasibility, we sought to examine the reach of the package including the diversity of the undergraduate students sampled, students' level of engagement with the components of the package, as well as retention rates, and acceptability feedback. The effectiveness aspect involved a comparison of pre- to post- change in outcome measures in controls (students who completed online surveys at baseline and six weeks later) against change in students who opted to use one of the Sharper Minds interventions (either the weekly self-monitoring e-tool for six or more weeks or one of the group courses aligned with the six domains: one-intervention condition); and students who opted to use the self-monitoring e-tool and completed a course (two-intervention condition). We hypothesised that:

H1. Students in the one-intervention and two-interventions conditions would show improved primary outcomes (% screening positive for mental health symptoms, and reduced depression and anxiety symptom scores) from pre- to post-intervention compared to the students in the control condition.

H2. Students in the one-intervention and two-interventions conditions would show improved secondary outcomes (improved wellbeing scores, reduced somatic symptom scores) from pre- to post-intervention, compared to students in the control condition.

H3. Students in the one-intervention and two-intervention conditions would show increased academic motivation compared to the students in the control condition.

4. Method

4.1. Study design

Feasibility was assessed using reach, retention, student satisfaction and acceptability indicators. A non-randomised 3 (conditions) x 2 (time points) mixed design was used to evaluate the effectiveness of Sharper Minds, a package of interventions targeting health and self-care behaviours to support student mental health using a self-monitoring e-tool and six short courses. Recognising the values of autonomy and choice, students were able to opt into up to two interventions of their choice. Thus, randomisation to conditions was not considered appropriate.

4.2. Participants

An a priori power analysis was conducted using the software package G*Power3.1 (Faul et al., 2007) to determine the sample size. This analysis indicated that for 3 conditions and 2 timepoints, to detect a modest effect size of $f = 0.1$, with an alpha level of 0.05 and a power of 0.95, we would need a total of 390 participants.

4.3. Feasibility

Reach – the goal was to reach a representative sample of students from the university, and this was estimated by examining the demographic characteristics of the students who completed the pre-survey compared with published student profile characteristics of the university. Demographic information collected included age, gender, living situation, faculty of enrolment, relationship status, international student status, and citizenship and ethnicity.

Retention – this was measured in terms of the % of participants who completed the pre-survey in each condition, who also completed the post-survey, signalling the completion of their involvement.

Acceptability – this was estimated from participants' feedback to two open text questions in the post- surveys: 'Please give us some feedback on what you liked about the Sharper Minds package' and 'Please let us know about anything you think could be improved about the Sharper Minds package?'

4.4. Effectiveness measures

4.4.1. Primary outcomes
Mental health screening. The PsyCheck mental health screener (Jenner et al., 2013), derived from the WHO Self-Reporting Questionnaire (Harding et al., 1980), is a 20-item measure that is quick to administer and assesses symptoms of depression and anxiety and somatic symptoms such as headaches or upset stomach. The PsyCheck was chosen for the study rather than other commonly used measures of psychological distress (e.g., DASS or K-10) because it includes somatic symptoms. Research indicates that many international students report somatic symptoms rather than emotional or cognitive expressions of depression and anxiety (Chang et al., 2017). Participants responded 1 = *Yes* 0 = *No* to questions asking whether they have experienced each symptom in the last 30 days. Endorsed items are summed to provide a score out of 20. Scores above five indicate a positive screen, indicating a recommendation for further assessment and management of a mental health issue. The internal consistency of the PsyCheck measure in our study was good at pre and post, with Cronbach's $\alpha = 0.86$ at both time points.

Depression was indexed by four items on the PsyCheck: *Do you feel unhappy? Do you find it difficult to enjoy your daily activities? Are you unable to play a useful part in life? Do you feel that you are a worthless person?* These items represent key diagnostic criteria for depression (anhedonia and sad mood) and the highest loading items on the depression factor in a factor analysis.[1] Respondents were asked whether they had experienced each symptom over the past 30 days, scoring 1 = *Yes* or 0 = *No*. Item scores were summed to produce a score in the range of 0 to 4. The depression scale showed adequate reliability in our sample at both time points (Cronbach's $\alpha_{pre} = 0.71$ and $\alpha_{post} = 0.75$ respectively).

Anxiety was indexed by a score computed from the sum of scores on four PsyCheck items[1]: *Are you easily frightened? Do your hands shake? Do you feel nervous? Do you find it difficult to make decisions?* Respondents were asked whether they had experienced each symptom over the past

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[1] Han, R., Walter, Z. C., Maccallum, F., & Dingle, G. A. (2025). Evaluating the Psychometric Properties of the PsyCheck Screening Tool for Mental Health Concerns in University Students. *Manuscript under review.*

30 days, scoring 1 = *Yes* or 0 = *No*. Item scores were summed to produce a score in the range of 0 to 4. The anxiety subscale showed low reliability in our sample at both time points (Cronbach's α_{pre} = 0.55 and α_{post} = 0.64 respectively).

Secondary outcomes.

Somatic distress was indexed by a score computed from the sum of scores on four PsyCheck items[1]: *Do you often have headaches? Is your appetite poor? Is your digestion poor? Do you have uncomfortable feelings in the stomach?* Respondents were asked whether they had experienced each symptom over the past 30 days, scoring 1 = *Yes* or 0 = *No*. Item scores were summed to produce a score in the range of 0 to 4. The somatic subscale showed low reliability in our sample at both pre and post (Cronbach's α_{pre} = 0.61 and α_{post} = 0.66 respectively).

Well-being. The Short Warwick Edinburgh Mental Well-being Scale (SWEMWS, Ng Fat et al., 2017) comprises seven positively worded items such as *I have been feeling useful.* Participants rated the frequency they have had those symptoms over the last two weeks (1 = *None of the time* to 5 = *All of the time*). The scores are summed to give a total score in the range of 7 to 35, with higher scores representing better mental health and wellbeing. Published norms for people aged 16–24 years were a mean of 23.57 and standard deviation of 3.61 (Ng at et al., 20I7). Internal consistency of this measure in our study was good at both time points (Cronbach's α_{pre} = 0.84 and α_{post} = 0.86 respectively).

Academic motivation. A four-item measure was purpose written to assess academic motivation. The items were: *I take my own academic responsibilities very seriously; I believe in my own intellectual capacity; I am an involved and engaged student,* and *I am an independent, motivated, and ambitious learner.* Participants were asked to rate their agreement with each statement on a 5-point Likert-type scale from 1 = *Strongly disagree* to 5 = *Strongly agree.* Items were averaged to produce a score on the measure. The internal consistency of this measure in our study was good at both pre and post (Cronbach's α_{pre} = 0.82 and α_{post} = 0.85, respectively).

4.4.2. Procedure

All methods and measures were approved by The University of Queensland human research ethics committee (#2019001150) and registered on the Australian and New Zealand Clinical Trials Registry (ACTRN12623000943640). Rolling recruitment was opened at the beginning of each semester in 2022 and 2023, and students were able to opt in during the first half of each semester (the university year has two semesters, with the first semester typically scheduled from February to June, and second semester typically scheduled from July to November). When students expressed interest on the Sharper Minds website, they were informed about the nature and purpose of the study and given the option to provide electronic written informed consent.

After completing informed consent and indicating which component (s) of the package they wanted to register for, students were given access to the anonymous online pre-survey. The surveys took approximately 15 min to complete. Students enrolled in a first-year course in Psychology could earn partial course credit for research participation. All students could enter a prize draw (drawn each year) for one of ten $30 shopping vouchers, apart from the Better Sleep participants who were offered a $60 voucher in recognition of their additional research requirements such as wearing actigraphy monitors and completing sleep diaries. Courses were all offered online in 2022 due to ongoing COVID-19 social distancing restrictions, but in 2023 after restrictions were relaxed, students were offered a choice or online or face-to-face courses.

The self-monitoring e-tool was a University of Queensland Qualtrics survey which asked respondents to rate how they are going within 6 domains over the past week: study, healthy eating, physical activity, sleep, social connection, and mood. Each screen showed a simple picture of the domain and a single item with 7 emoji faces to use as a rating scale, from very unhappy to very happy. After completing the survey, respondents received immediate personalised feedback in the form of a graph of their ratings across the weeks, and each domain. This allowed

them to visually track their progress across semester in the health and self-care behaviours. Participants who opted to use the weekly self-monitoring e-tool were sent automated weekly email reminders with a link to the e-tool to complete their self-monitoring. Participants who used the e-tool for at least six weeks were allocated to this condition.

The short courses (see descriptions in Table 1) were delivered in small groups by postgraduate student facilitators in four or five sessions, one per week. The authors who developed the courses conducted half-day facilitator training workshops using standardised slide decks, facilitators' manuals, and online resources. Facilitators were postgraduate students from the Schools of Psychology, Nursing, Midwifery, and Social Work, and Human Movement and Nutrition Sciences. These postgraduate students were not paid but their involvement counted towards their supervised practice hours completed as part of their professional training. On occasions when no postgraduate students were available to facilitate, health professionals with relevant experience were paid as casual employees to deliver the courses. The facilitators used standardised manuals and slides to deliver the program and were provided weekly supervision by accredited health professionals during the delivery of the programs, to ensure adherence to consistency of study protocol and to discuss any process issues around student engagement and response to the course content. Students' attendance was monitored weekly. If students could not attend a session, the facilitators offered up to a maximum of two catch-up sessions. Immediately following each course finished, students were asked to complete the post-survey and provide written feedback. All participants (control, one-intervention, and two-interventions) completed the pre and post surveys approximately six weeks apart. Following completion of the post survey, participants were fully debriefed about the study.

Data Checking and Analysis - Analyses for this paper were conducted using SPSS 29.0.0.0 (IBM, 2023). A missing data analysis was undertaken to see if the participants were adequately sampled and whether for each participant over 50 % of the scores were recorded for all variables (Schlomer et al., 2010). There were also no variables with 5 % or more missing values. Little's MCAR test result was insignificant, $\chi 2$ (710, N = 437) = 697.21, p = .627 indicating that the data was randomly missing (Little, 1988). Baseline differences among conditions were assessed using one-way ANOVAs. To evaluate homogeneity of variances, Levene's test was conducted. Where the assumption of homogeneity was not met, and variance was unequal, Welch's ANOVA with subsequent non-parametric post-hoc Games-Howell multiple comparisons testing was conducted.

5. Results

The flow of participants through the study is presented in the CONSORT diagram in Fig. 1. Six hundred and thirty-nine students accessed the Sharper Minds website and 603 registered their interest in one or more components of the package.

5.1. Feasibility

Reach: A total of 603 students (94 %) completed the pre-survey, including 156 international students (M_{age} = 22.00; SD_{age} = 15.60) and 446 domestic students (M_{age} = 20.30; SD_{age} = 5.05). In terms of the reach of the package, there was a higher uptake from female participants (77.4 %) compared with other genders; domestic students (74.1 %) compared with international students (25.9 %, which was a lower proportion than the 38 % enrolled at the University). That said, students from a large range of ethnic backgrounds were reached: 54.6 % identified their ethnicity as other than white Australian. Only 0.5 % of participants identified as Aboriginal or Torres Strait Islander, which is lower than expected, given that 3.2 % of the Australian population are Aboriginal or Torres Strait Islander (ABS, 2022). Uptake was higher from students enrolled in the Health and Behavioural Sciences Faculty (38.8 %) compared to others like Engineering, Architecture and
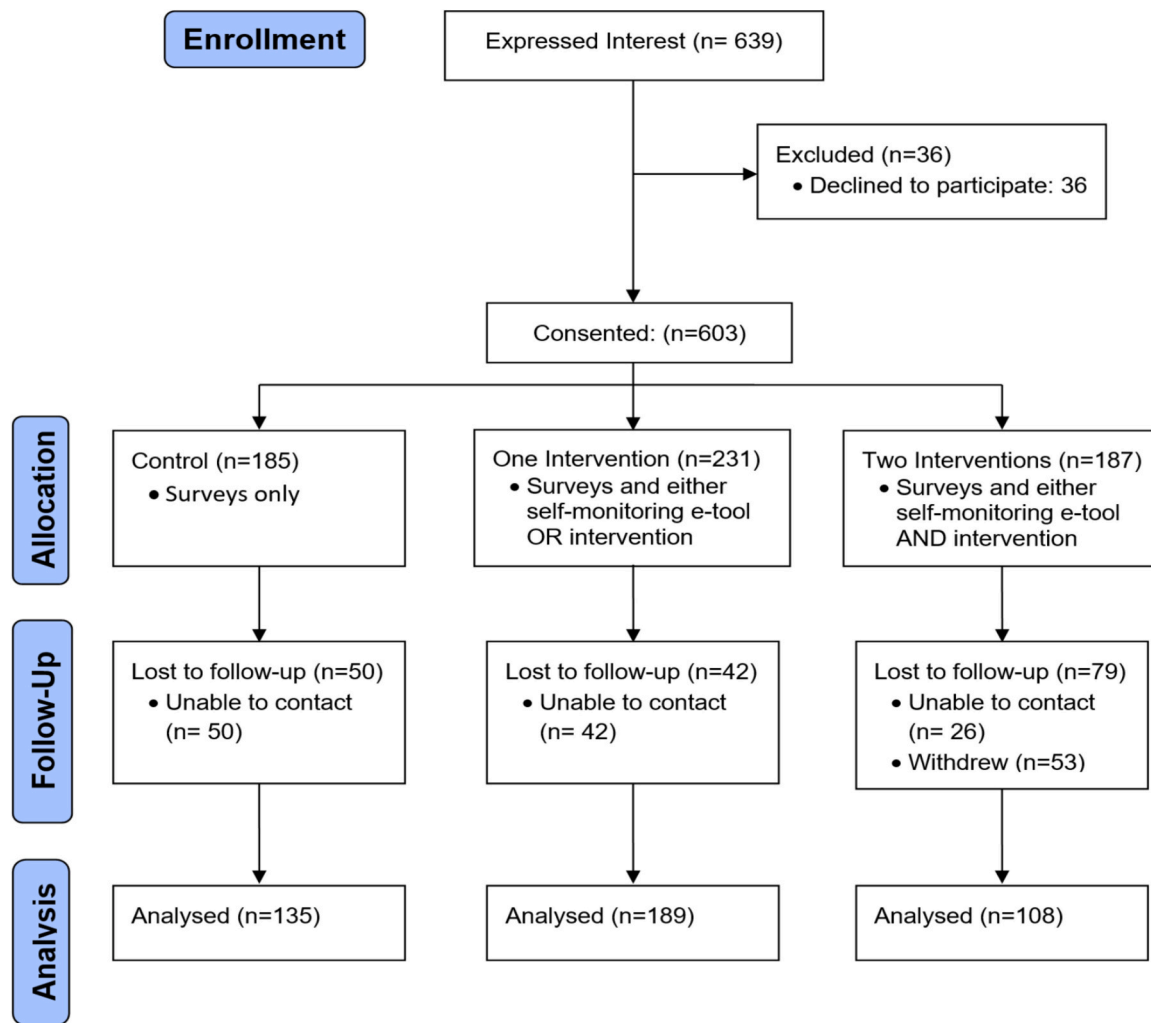
Fig. 1. Consort diagram showing the flow of participants.

Information Technology (2.7 %) and Medicine (12.3 %).

Retention and Acceptability: In a, 72 % of the participants who completed the pre-survey also completed the post-survey. Retention rates differed by condition, with 73 % of controls, 82 % of one-intervention and 58 % of two-intervention participants completing the study. Participant written responses to the two feedback questions (see selected examples in Table 3) indicated that students found all aspects of the Sharper Minds package to be helpful and acceptable. Participating in a group, sharing and discussing ideas with peers, information, and topics relevant to the University students, as well as interactive sessions, were welcomed by the students. The weekly self-monitoring e-tool was considered a valuable check-in resource for increasing self-awareness and monitoring how they were tracking weekly in each of the domains. Common feedback by students in 2022 was a preference for face-to-face groups. Participating in larger groups, follow-up sessions to support ongoing connections with peers, and providing post-workshop online modules were some other suggestions.

5.2. Baseline comparisons between the three conditions

At baseline, there were no significant differences between the three conditions on demographic variables, except for age (see descriptives in Table 2). To further investigate this, Welch's ANOVA, $F(2, 430) = 5.55$, $p = .004$ was conducted. Games-Howell post hoc tests suggested a significant difference between control and one-intervention (*Meandiff* $= -1.307$, 95 % CI $[-2.33, -0.29]$, $p = .008$) and between control and

two-interventions conditions (*Meandiff* $= -1.996$, 95 % CI $[-3.56, -0.43]$, $p = .009$). However, there was no significant difference between one-intervention and two-interventions conditions (*Meandiff* $= -0.689$, 95%CI $[-2.37, 0.99]$, $p = .596$). Of the measured variables, there were no significant differences between the three conditions at baseline (see Table 4), except on Academic Motivation, $F(2, 429) = 4.00$, $p = .019$. Participants in the one-intervention condition ($M = 16.65$, $SD = 2.75$) had higher academic motivation scores than those in the control condition ($M = 15.90$, $SD = 2.71$), $p = .015$, and those in the two-intervention condition ($M = 15.90$, $SD = 2.71$), $p = .024$. We decided not to enter this variable into main analyses as a covariate as it was not considered to be directly related to the mental health variables.

5.3. Effectiveness analyses

% Screening positive for mental health problems: the proportion of students in each condition screening positive for mental health problems (i.e., % of students in each condition with PsyCheck scores over five) in the two-interventions condition reduced from 64.8 % to 47.2 % which corresponds to a 17.6 % decrease, whereas in the one-intervention condition it reduced from 62.8 % to 60.1 %, and in the control condition it reduced from 58.5 % to 57.8 % (both negligible). Thus, hypothesis 1 was supported.

A repeated measures MANCOVA was conducted, with 2 times (pre, post), 3 conditions (control, one-intervention, two-interventions), five dependent variables (depression, anxiety, somatic, wellbeing, academic

Table 2
Descriptive characteristics of the full sample, and in the three conditions.

	Total Sample (N = 433, %)	Control (N = 135, %)	One-Intervention (N = 189, %)	Two-Interventions (N = 109, %)
Age (Mean, SD)	20.52, 4.88	19.44, 2.87	20.75, 4.87	21.44, 6.41
Gender				
Female	340 (78.5)	97 (71.9)	157 (83.1)	86 (78.9)
Male	83 (19.2)	34 (25.2)	29 (15.3)	20 (18.3)
Non-binary	9 (2.1)	4 (3)	3 (1.6)	2 (1.8)
Prefer not to say	1 (0.2)	–	–	1 (0.9)
Living Situation				
Living with family	207 (47.9)	74 (54.8)	80 (42.3)	53 (49.1)
Living alone	26 (6)	14 (10.4)	5 (2.6)	7 (6.5)
Share-house	69 (16)	18 (13.3)	35 (18.5)	16 (14.8)
Residential College	59 (13.7)	15 (11.1)	33 (17.5)	11 (10.2)
Student accommodation. (studio)	27 (6.3)	6 (4.4)	14 (7.4)	7 (6.5)
Student accommodation. (shared)	44 (10.2)	8 (5.9)	22 (11.6)	14 (13)
Missing	1 (0.2)			1 (0.9)
Faculty of Enrolment				
Health & Behavioural Sciences	152 (48.3)	49 (49)	68 (47.2)	35 (49.3)
Humanities & Social Sciences	55 (17.5)	17 (17)	28 (19.4)	10 (14.1)
Business, Economics and Law	19 (6)	9 (9)	8 (5.6)	2 (2.8)
Medicine	20 (6.3)	7 (7)	10 (6.9)	3 (4.2)
Engineering, Architecture, IT	5 (1.6)	3 (3)	1 (0.7)	1 (1.4)
Science	44 (14)	12 (12)	19 (13.2)	13 (18.3)
Other Institute	20 (6.3)	3 (3)	10 (6.9)	7 (9.9)
Missing data	118 (27.3)	35 (25.9)	45 (23.8)	38 (34.9)
Relationship Status				
Single	292 (67.4)	93 (68.9)	123 (65.1)	76 (69.7)
In relationship (not living together)	102 (23.6)	35 (25.9)	47 (24.9)	20 (18.3)
Living together	29 (6.7)	6 (4.4)	14 (7.4)	9 (8.3)
Married	6 (1.4)	–	3 (1.6)	3 (2.8)
Divorced	3 (0.7)	1 (0.7)	1 (0.5)	1 (0.9)
Other	1 (0.2)	–	1 (0.5)	–
Enrolment Status				
Domestic	315 (72.7)	107 (79.3)	131 (69.3)	77 (70.6)
International	118 (27.3)	28 (20.7)	58 (30.7)	32 (29.4)
Racial or Ethnic Group				
Aboriginal/Torres Strait Islander	2 (0.5)	1 (0.7)	1 (0.5)	–
White Australian	190 (44.1)	57 (42.2)	87 (46.3)	46 (42.6)
North East Asian	48 (11.1)	10 (7.4)	24 (12.8)	14 (13)
South East Asian	92 (21.3)	32 (23.7)	38 (20.2)	22 (20.4)
South Central Asian	23 (5.3)	8 (5.9)	9 (4.8)	6 (5.6)
North Africa and the Middle East	8 (1.9)	1 (0.7)	3 (1.6)	4 (3.7)
West European	16 (3.7)	9 (6.7)	5 (2.7)	2 (1.9)
East European	5 (1.2)	1 (0.7)	–	4 (3.7)
Multiple Ethnicities	22 (5.1)	8 (5.9)	11 (5.9)	3 (2.8)
Other	25 (5.8)	8 (5.9)	10 (5.3)	7 (6.5)
Missing	2 (0.5)	–	1 (0.5)	1 (0.9)

motivation) and age as a covariate. This revealed a significant time x condition effect: Wilks λ = 0.949, $F (10, 834) = 2.21$, $p = .016$, partial n^2 = 0.026. Bonferroni post-hoc tests indicated that academic motivation was the only dependent variable that significantly varied between conditions. The mean scores (Table 4) indicate that academic motivation declined over time in the control condition but increased over time in the one-intervention and two-intervention conditions. The time main effect was not significant: Wilks λ = 0.994, $F (5, 417) = 0.526$, $p = .756$; nor was the time x covariate (age) effect: Wilks λ = 0.998, $F (5,417) = 0.192$, $n = 0.965$. However, there was a main effect of condition: Wilks λ = 0.953, $F (10, 834) = 2.047$, $p = .026$, partial $n^2 = 0.024$, modified by the significant interaction described above. Thus, the hypotheses were supported, with small effect sizes.

6. Discussion

This was the first open trial to test the feasibility and effectiveness of a package targeting multiple health and self-care behaviours for mental health promotion in Australian undergraduate university students. Feasibility results indicated that the package reached a representative sample of students, although more could be done to engage Aboriginal and Torres Strait Islander students, and students enrolled in programs in the faculties of Engineering, Architecture and Information Technology,

and the faculty of Medicine. Once students enrolled in the Sharper Minds package, retention through to post-survey was good, with >70 % completing the components they signed up for. This compares favourably with retention rates reported in other university mental health programs (e.g., 36.3 % in the Uni Virtual Clinic intervention reported in Farrer et al., 2019). Feedback from participants indicated that students found the optional components of the package to be acceptable, helpful, interesting and relatable. Suggestions for improvement tended to focus on requests for learning and memory aids such as session overviews and summaries and providing a space for reflections at the end of each session or a video recording of the session to review afterwards.

The first hypothesis was that students in the one-intervention and two-interventions conditions would show significantly improved primary outcomes (% screening positive on the PsyCheck, Depression and Anxiety symptom scores) from pre- to post-intervention, compared to the students in the control condition. This hypothesis was supported in relation to the proportion of students in each condition with a positive screen for mental health problems. Students who opted to use the weekly monitoring e-tool and completed a short course reported a substantial reduction in psychological distress over time, which was not reported by students in the other conditions. This suggests that both the aware-raising self-monitoring and skills training in the short course were required to produce a meaningful effect. The reduction of 17.6 % of

Table 3

Selected Participant Feedback on the Acceptability of the Sharper Minds Package from the Post-survey.

Positive feedback
"The program was very interactive and informative about specific issues and tendencies that people from our background (age and university students) might experience in our daily lives. I enjoyed the breakout room sessions where I could share and listen to my peer's thoughts and experiences about the music they liked to listen to in different contexts. The facilitators did a great job of providing detailed explanations about the impact of music on our wellbeing." (Participant from Tuned In, F, 19 years)
"Interesting to see how certain aspects of my life fluctuate over time, makes me more conscious of my mood, study habits etc." (Participant from Progress weekly self-monitoring, F, 18 years)
"Provides a platform to allow students to open up and listen to they having the same concerns as I." (Participant from Groups 4 Education, F, 18 years)
"I really enjoyed focusing on topics that were relevant to being a University student with all of the examples guided by things I could relate to. This allowed me to think more about my own experiences and what I can do." (Participant from GRUNT, F, 18 years)
"Provided recipes that were tailored to the session participants - a wide range of food education was provided (quick tips, meal specific, financial tips etc)." (Participant from Food for the Brain, F, 18 years)
"I enjoyed the Better Sleep short course. It made me aware of my current sleep patterns and while I knew quite a bit, knowing some strategies and discussing with other people has helped me apply some strategies to help my sleep." (Participant from Better Sleep, M, 18 years)
"The informational stuff and the group sessions. It got me to consider my relationship with exercise and it did get me to start exercising a little bit more (about an hour a week of walking). It's not perfect but it is an improvement from where I was." (Participant from Fit 4 Study, F, 21 years)

Suggestions for improvement
"Maybe a slightly bigger group would've induced more input and perhaps a bit more utilisation of the handbook" (Participant from Tuned In, M, 19 years)
"I think because the whole course consists of several components (e.g. filling in a sleep diary, the sleep actigraph, going to sessions, doing the progress e-tool), having an overview document on what we are supposed to do every week of the study would be very helpful to ensure that we finish everything that we are required to do." (Participant from Better Sleep, F, 26 years)
"Provide notes section at the end of each survey, if we wanted to write anything extra down to ourselves" (Participant using weekly self-monitoring, M, 18 years)
"[Make] Recordings of sessions available afterwards so I could reflect on what I learnt" (Participant in Food for the Brain, F, 18 years)
"Maybe there could be more online video courses to learn better, because our modules are basically in text format" (Participant in Groups 4 Education, F, 23 years)

Note. Participants were asked the following questions: 1) 'Please give us some feedback on what you liked about the Sharper Minds package' and 2) 'Please let us know about anything you think could be improved about the Sharper Minds package?'

Table 4

Descriptive statistics for primary and secondary outcomes by condition and time.

	Control (N = 135)		One-Intervention (N = 187)		Two-Intervention (N = 107)	
	Time 1 Mean (SD)	Time 2 Mean (SD)	Time 1 Mean (SD)	Time 2 Mean (SD)	Time 1 Mean (SD)	Time 2 Mean (SD)
Primary Outcomes						
PsyCheck Total (range: 0–20)	7.66 (5.37)	7.73 (5.67)	7.50 (4.57)	7.23 (5.05)	7.40 (4.83)	6.05 (4.43)
Depression (range: 0–4)	1.09 (1.31)	1.15 (1.33)	1.07 (1.25)	1.05 (1.34)	1.16 (1.34)	0.89 (1.22)
Anxiety (range: 0–4)	1.93 (1.35)	1.77 (1.43)	1.79 (1.19)	1.56 (1.29)	1.62 (1.18)	1.44 (1.21)
Secondary Outcomes						
Somatic (range: 0–4)	1.40 (1.35)	1.46 (1.41)	1.38 (1.25)	1.36 (1.31)	1.43 (1.25)	1.13 (1.19)
Wellbeing (range: 7–35)	23.27 (5.06)	23.19 (5.02)	23.40 (4.05)	23.92 (4.03)	23.64 (4.45)	24.35 (4.28)
Academic Motivation (range: 4–20)	15.90 (2.70)	15.39 (2.83)	16.65 (2.75)	16.67 (2.45)	15.90 (2.71)	16.41 (2.54)

students screening positive for mental health problems from pre to post in the two-intervention condition is a very promising finding, given the potential negative impact of mental health problems on academic engagement and outcomes in this population (Orygen, 2017; Pérez et al., 2023).

The finding from the repeated measures MANCOVA (combining data for depression, anxiety, somatic symptoms, wellbeing and academic motivation) further supported hypotheses two and three, finding an overall significant interaction between condition and time that favoured the students who engaged with the Sharper Minds interventions over their peers in the control condition. Descriptive values on the outcome variables shown in Table 4 indicated there was an average of one depression symptom for participants in each condition at both pre and post. This suggests a floor effect with little room for improvement over time (perhaps not surprising in this non-clinical sample). For anxiety, there was an average of one-and-a-half to two symptoms at baseline, and improvements were seen over time in all conditions, so this effect cannot easily be attributed to the intervention package. Despite this, the reduction in anxiety across semester is a positive finding, given that academic assessments typically produce an increase in anxiety later in the semester (when the post-surveys were collected). Furthermore, previous research at the same university reported that, unlike other mental health indicators that improved following the lifting of pandemic

restrictions in 2021 and 2022, anxiety continued to worsen among first year students in that period (Dingle et al., 2024).

Scores on somatic distress symptoms increased over time in the controls but decreased over time in the intervention conditions, consistent with hypothesis 2. This is an important finding given that somatic symptoms such as stomach-ache, headache and fatigue in adolescence predict mental ill health and decreased productivity in adulthood (e.g. Bohman et al., 2018). The mean values on the short Warwick Edinburgh Mental Wellbeing scale were around the same as published norms for people aged 16–24 years (Ng Fat et al., 2017), suggesting that there was little room for improvement on wellbeing in our study. Finally, the third hypothesis was that participants in the one-intervention and two-interventions conditions would show increased academic motivation compared to the students in the control condition. This was supported, as students who engaged with one or two-interventions increased in academic motivation across the semester while students in the control condition decreased in academic motivation over time. This finding is important, as academic motivation is likely to be related to students' academic outcomes (e.g. Lavrijsen et al., 2022).

Taken together, these are promising findings, given that previous universal mental health prevention programs have yielded disappointing results, at least in secondary school contexts (e.g., Kuyken

et al., 2022; Mackenzie and Williams, 2018; Teesson et al., 2024). These programs have typically involved single interventions (such as mindfulness or cognitive behavioural therapy) delivered in classroom groups where the participants have limited autonomy over the content of the interventions. Research shows that people who have choice over their mental health intervention report better outcomes and are more satisfied compared with people with no choice (Cook et al., 2019). Further, large scale studies show that a variety of health and self-care behaviours such as physical activity, healthy diet, sleep and social connection are mediators of mental health (e.g., Tian et al., 2024) thus supporting multi component behaviour change program approaches.

6.1. Limitations and future directions

It is worth noting some limitations with the current study. The study adopted a non-randomised controlled design (level 3 in the evidence hierarchy according to the National Health and Medical Research Council, 2009) rather than a randomised controlled design (level 2 in the evidence hierarchy) which means that it was more vulnerable to selection bias being a threat to internal validity of the study findings. The opt-in allocation to condition meant that there were unequal numbers in the three conditions and baseline differences between conditions on age and academic motivation (although there was no substantive change in results when age was entered as a covariate, so the influence of this difference was not a threat to the findings). Some measures were purpose-written for the study because no validated measures of our variables of interest were available. The anxiety and somatic subscales showed low internal consistency reliabilities (Cronbach's alphas <0.70) so the results on these variables should be interpreted with caution. However, it is common to see lower Cronbach's alpha values for scales with few items on them (Taber, 2018). Effect sizes were small, and the results need to be replicated with other demographic samples, and possibly in different universities and contexts.

Nevertheless, the study provides preliminary evidence that students found the options acceptable and effective. Although psychological distress and other issues like loneliness have been widely reported in the wake of the COVID-19 pandemic (Dingle et al., 2022, 2024), not all these students need or want to attend individual counselling or psychological treatment. It is also clear that mental health literacy is a significant barrier to help seeking for many students (Han et al., 2024) and the feedback from students in this study indicates that they liked receiving the Sharper Minds short courses from postgraduate students.

A future direction for exploration is *how* the Sharper Minds package components may have produced these effects – that is, the theoretical mechanisms. While the overall Sharper Minds package was informed by behaviour change theory (Michie et al., 2011) and the social identity approach, in which we aimed to evoke a shared 'student' identity in participants, through images and videos of students in the resources and the use of student facilitators for the courses (Tajfel and Turner, 1979; Turner et al., 1987), each component was informed by theories relevant to that health or self-care domain. For example, the Fit 4 Study course was informed by behaviour change theories of physical activity (Huang et al., 2024a, 2024b) while the Tuned In course was informed by music and emotion theories (Dingle and Fay, 2017). An analysis of changes in the knowledge and use of these various health and self-care behaviours as mechanisms of change in explaining the mental health and wellbeing outcomes is a topic for future research. An additional area for future research is a comparative trial. The findings of this feasibility and effectiveness trial have given us an initial proof of concept that can inform the next stage of the research, involving a comparative trial of Sharper Minds against other mental health interventions to identify their relative strengths and limitations.

7. Conclusion

This co-designed multi-component package was feasible and effective in promoting mental health across most outcome measures, with small effect sizes. The combination of a weekly self-monitoring tool to monitor self-care and health behaviours and completion of a short course focusing on one behaviour was most effective. The package is ready for wider implementation.

CRediT authorship contribution statement

Genevieve A. Dingle: Writing – original draft, Supervision, Methodology, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Rong Han:** Writing – review & editing, Project administration, Formal analysis, Data curation. **Kevin Huang:** Writing – review & editing, Project administration, Formal analysis, Data curation. **Sakinah S.J. Alhadad:** Writing – review & editing, Methodology, Conceptualization. **Emma Beckman:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Sarah V. Bentley:** Writing – review & editing, Methodology, Conceptualization. **Shannon Edmed:** Writing – review & editing, Project administration, Data curation. **Sjaan R. Gomersall:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Leanne Hides:** Writing – review & editing, Methodology, Conceptualization. **Nadine Lorimer:** Writing – review & editing, Project administration, Data curation. **Fiona Maccallum:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Blake M. McKimmie:** Writing – review & editing, Project administration, Funding acquisition, Conceptualization. **Norman Ng:** Writing – review & editing, Supervision, Methodology. **Kalina Rossa:** Writing – review & editing, Project administration, Methodology, Conceptualization. **Simon S. Smith:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Zoe C. Walter:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Elyse Williams:** Writing – review & editing, Project administration, Methodology, Data curation. **Olivia R.L. Wright:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Radhika Tanksale:** Writing – review & editing, Supervision, Project administration, Data curation.

Declaration of competing interest

The authors report there are no competing interests to declare.

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Data availability

Data used in this study are available upon reasonable request from the corresponding author.

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