Original Article

Computer Assisted Learning for the Mind (CALM): the mental health of medical students and their use of a self-help website

Fiona Moir, Antonio T Fernando III, Shailesh Kumar, Marcus Henning, Simon A Moyes, C Raina Elley

Abstract

Aims The aim of this study was to develop an evidence-based self-help website, Computer Assisted Learning for the Mind (CALM) designed to improve mental health amongst medical students; and to assess the proportion, demographics and mental health of students who chose to use the site.

Methods All 2nd and 3rd year medical students from one New Zealand university were invited to participate. Demographics and mental health scores of those accessing CALM were compared with those not accessing it. Outcome measures included depression (PHQ-9) and anxiety (GADS-7) scores recorded at baseline. Anonymous identifiers were used to track website use.

Results Baseline questionnaires were completed by 279/321 (87%) of eligible students. CALM was accessed by 80/321 (25%) of the students over a 5 week period. Those who accessed CALM and could be linked by unique identifier (n=49) had significantly higher anxiety scores (p=0.01) but not higher depression scores (p=0.067) at baseline, than those who did not access CALM (n=230). Of those students with both PHQ-9 scores and GAD-7 scores ≥10 (at risk of significant depression and anxiety) at baseline, 41% went on to access CALM.

Conclusions The CALM website was used by 25% of medical students, particularly those with poorer anxiety scores. Self-selection to a web-based resource may provide assistance to those most in need, but further research would be needed to assess effectiveness.

High levels of depression and anxiety in tertiary students in New Zealand is an area of concern. Support, resilience, coping strategies and treatment for mental disorders are protective factors for suicide, and resilience can be increased with training. However, there is a paucity of New Zealand research looking at the identification of effective interventions, and the factors enabling their successful implementation in the tertiary student population.

Self-care and help-seeking behaviour of medical students need to be improved because such attributes impact on their credibility with patients, as well as affecting the way that they talk with patients about preventive health. There is growing evidence that the way that doctors care for themselves affects the way they care for their patients.

If medical students develop psychological difficulties, this can have adverse effects on empathy and sometimes lead to attrition from the medical programme. Medical students using stress management programmes experience less depression and anxiety, and have increased empathy and more positive coping skills. However, it is clear that despite the existence of effective interventions, medical students often do not seek professional help, even when they are unwell. Reasons given for this are the lack of time, cost and concerns about confidentiality and stigma: a perception that they will be labelled ‘weak’ or that it may affect their future career plans.

It has been stated that to enhance their students’ psychological health and prevent burnout, medical schools could provide a confidential resource to treat depression, and equip students with self-care strategies and skills. One such strategy may be to provide an evidence-based, anonymous electronic...
service. Web-based resources to improve health have been found to be feasible and effective in a tertiary student population.\textsuperscript{12}

Amongst the general population, there is evidence that internet-based self-help treatments using cognitive behavioural therapy for panic disorder and mild to moderate depression can be effective.\textsuperscript{13} However, adherence to such interventions is low, and there is a need for shorter on-line interventions, or ways of providing brief electronic information to promote resilience as well as help-seeking.\textsuperscript{14} Furthermore, there is limited knowledge about the mental health of those who choose to access computer-assisted care, in comparison with those who do not, as most studies only collect data about user profiles.\textsuperscript{15} Such research is important as it investigates who are most at risk of experiencing psychological issues, and who are accessing available mental health resources.

The aim of this study was to develop an evidence-based on-line mental health intervention, Computer Assisted Learning for the Mind (CALM), and to assess the mental health and use of CALM in a sample of medical students.

**Methods**

The first part of the study involved development of the CALM website. The second part of the study piloted CALM and assessed the mental health and CALM usage across two classes of medical students. Using a prospective cohort design, the uptake of CALM over a 5-week period was measured, and the depression and anxiety scores of medical students who accessed the site were compared with those who did not. Demographic information and mental health scores were collected in-class at baseline.

All 2\textsuperscript{nd} and 3\textsuperscript{rd} year medical students at one New Zealand University were invited to participate in the study midway through the academic year. No students were excluded.

Outcome measures included PHQ-9 depression scores and GAD-7 anxiety scores. The PHQ-9 has been shown to have a specificity of 88% and a sensitivity of 88% for major depression in comparison to clinical interview, using a cut-off point of ≥10.\textsuperscript{16} This tool has also been shown to be reliable in a tertiary student population, with an internal consistency of 0.85, and a good one month test-retest reliability (r=0.89, p<0.001).\textsuperscript{17}

For the GAD-7, a cut-off point of ≥10 has sensitivity for diagnosing Generalised Anxiety Disorder of 89% and a specificity of 82% compared with diagnostic interview.\textsuperscript{18} The GAD-7 has been shown to have good reliability and criterion-related validity against clinical interview, as well as good agreement between self-report and interviewer administered versions of the scale.\textsuperscript{19}

The intervention was a self-care website (CALM) containing written information and audiofiles to promote good mental health and wellbeing. The content was devised by the authors (FM, AF and SK), and the site was built and run by a team of web developers. Several interventions were chosen to enhance psychological health, based on their research credibility. The authors included a broad range of strategies to maximise user choice, and to create a focus on promoting wellness as well as preventing illness. Accordingly, the website was divided into three sections: ‘managing stress, anxiety and depression’; ‘mental resilience’; and ‘finding meaning in life’.

The first section contained explanations as to why stress, depression and anxiety can occur and some of the common symptoms or experiences. It included audiofiles on techniques for managing stress such as progressive muscle relaxation and self-hypnosis, as well as multiple tracks of mindfulness meditation of varying lengths. A 2011 Cochrane review concluded that the evidence supports that ‘Mindfulness Based Stress Reduction’ improves mental health, and that ‘Mindfulness Based Cognitive Therapy’ prevents relapse of depression.\textsuperscript{20} A 2012 Cochrane review concluded that mindfulness-based therapies were effective in reducing depressive symptoms.\textsuperscript{21} Furthermore, there is evidence demonstrating that mindfulness interventions are effective at improving mental health and wellbeing in tertiary students,\textsuperscript{22} and specifically in a medical student population.\textsuperscript{23}

The second section of the CALM website included information and exercises to aid the development of positive mind-states and attitudes, such as exercises in gratitude and compassion, which have been shown to enhance wellbeing.\textsuperscript{24} A review of ‘Loving Kindness Meditation’ stated that it can cause a decrease in stress and an increase in empathy and other positive emotions, and that it could be a useful adjunct to other psychological therapies.\textsuperscript{25}
The third section of the CALM website focused on the importance of connection to other people, beliefs and values. Having ‘a meaning in life’ and paying attention to one’s non-professional life has been reported to have protective effects against burnout.26 In CALM, this concept was described as having ‘something beyond the daily grind’ that led to the inclusion of a section on finding meaning in life, whether that be religion, a cause or a philosophy.

The format of the CALM site was designed to be as user-friendly as possible, with words being kept to a minimum. Audiofiles could either be listened to directly from the computer, or downloaded onto an I-pod or MP3 player for multiple use. Many of the topic web pages also had links to other relevant evidence-based websites, in line with one of the key principles of youth development: enabling young people to have access to accurate information.27

Demographic information for the whole student group (years 2 and 3) was collected using administrative databases. Demographic and mental health characteristics of participants were assessed in class at the baseline measures meeting, and participating students created an anonymous ‘unique identifier’, a reproducible personal code, on their paper baseline questionnaire. They re-entered this code if they chose to access CALM on-line. These codes were used to track each participant whilst maintaining their anonymity.

Seven weeks after baseline assessment, the CALM website was made available to participants for a 5-week period. During this 5-week trial, CALM could only be accessed by the participants and not by the public. Students were informed about CALM at baseline, and were reminded in a lecture and by one email when the website was launched.

Demographic and mental health characteristics of all study participants are described at baseline and the proportion of those at risk of depression or anxiety calculated. The proportion and characteristics of the medical students who accessed CALM are also described, and are compared with those who did not access CALM. Accuracy of data entry was checked by using double data entry and an electronic comparison of the two datasets. Means and standard deviations were calculated to describe characteristics of the total and sub-samples of participants. Chi-squared and t-tests were used to assess differences between those accessing CALM and others. Only data that were present were included in the analyses, with no imputation.

The CALM study was approved by the University Ethics committee (no. 2008/216 Appendix 1) in 2008.

Results

Table 1 shows the characteristics of the 321 medical students. Of these, 279 (87%) completed PHQ-9 and GAD-7 assessment at baseline with mean scores of 5.14 (SD 4.1) and 3.91 (SD 3.7), respectively. The proportion of students at risk of any degree of depression was 48% (n=133), with 2.5% (n=7) moderately severely depressed (PHQ ≥15), 12% (n=33) moderately depressed (PHQ=10–14), and 33% (n=93) mildly depressed (PHQ=5–9).

The proportion of students at risk of any degree of anxiety was 37% (n=103), with 2% (n=6) moderately severely anxious (GAD-7 ≥15), 7% (n=20) moderately anxious (GAD-7=10), and 28% (n=77) mildly anxious (GAD-7=5–9).

Over the 5 weeks of the website availability, 80/321(25%) students visited CALM at least once. There was no significant difference in the proportion accessing CALM from different ethnic groups (p=0.4).
Table 1. Baseline characteristics of Year 2 and Year 3 medical students

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total class of 2nd and 3rd year medical students (n=321)</th>
<th>Those accessing CALM website (n=80)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female n (%)</td>
<td>167 (52)</td>
<td>38 (47.5)</td>
</tr>
<tr>
<td>Male n(%)</td>
<td>154(48)</td>
<td>42(52.5)</td>
</tr>
<tr>
<td>Age in years, mean (SD)</td>
<td>22.2 (2.9)</td>
<td>21.1 (3.2)</td>
</tr>
<tr>
<td>European n (%)</td>
<td>147 (45.7)</td>
<td>36/147 (24.5)</td>
</tr>
<tr>
<td>Māori n (%)</td>
<td>11 (3.4)</td>
<td>3/11 (27.2)</td>
</tr>
<tr>
<td>Pacific Islander n (%)</td>
<td>27 (8.4)</td>
<td>4/27 (14.8)</td>
</tr>
<tr>
<td>East Asian n (%)</td>
<td>36 (11.2)</td>
<td>12/36 (33.3)</td>
</tr>
<tr>
<td>South Asian/Other Asian n (%)</td>
<td>76 (23.7)</td>
<td>13/76 (17.1)</td>
</tr>
<tr>
<td>Other n (%)</td>
<td>20 (6.2)¶</td>
<td>6/20 (30.0)‡</td>
</tr>
</tbody>
</table>

Note: No significant differences were noted between the distribution of ethnicity in the class and in those that accessed the CALM website (p=0.4). 4 missing values; ‡6 missing values.

Only 49/80 (61%) students used the same unique identifier on the website as they had used at baseline. The mean baseline scores from this group of 49 web-users were compared with the mean baseline scores from the 230 participants who could not be shown to have accessed CALM.

Those who accessed CALM and could be linked by unique identifier to baseline class scores (n=49), had significantly higher anxiety scores (p=0.01) but not higher depression scores (p=0.067) at baseline than those who did not access CALM (or who accessed CALM and could not be linked) (Table 2).

Table 2. Comparison of baseline depression and anxiety scores of those who did and did not access CALM according to linked data

<table>
<thead>
<tr>
<th>Clinical characteristics</th>
<th>Did not access by linked data</th>
<th>Accessed by linked data</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline in-class score (n=230)</td>
<td>Baseline in-class score (n=49)</td>
<td></td>
</tr>
<tr>
<td>PHQ9, mean (SD)</td>
<td>4.93 (4.00)</td>
<td>6.10 (4.26)</td>
<td>0.067</td>
</tr>
<tr>
<td>GAD7, mean (SD)</td>
<td>3.65 (3.59)</td>
<td>5.14 (4.10)</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Out of the participants who entered mental health scores at baseline (n=279), 40 students had a PHQ-9 ≥10 and 26 students had a GAD-7 score of ≥ 10 at baseline. Of the 17 students who had both a baseline PHQ-9 and GAD-7 of ≥ 10, 7 (41%) went on to access CALM (Table 3).

Table 3: Percentage of students with PHQ-9 and GAD-7 scores ≥ 10, who did and did not access CALM according to linked data

<table>
<thead>
<tr>
<th>Proportion of whole class (n=279) with baseline mental health score ≥10</th>
<th>Accessed CALM (according to linked data)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Both PHQ-9 ≥10 and GAD-7 ≥10</td>
<td>17/279 (6%)</td>
</tr>
<tr>
<td>PHQ-9 ≥10 ( but GAD-7 &lt;10)</td>
<td>23/279 (8%)</td>
</tr>
<tr>
<td>GAD-7 ≥10 (but PHQ-9 &lt;10)</td>
<td>9/279 (3%)</td>
</tr>
</tbody>
</table>
Discussion

The CALM study complements previous research demonstrating that electronic interventions can be effective by analysing which groups of people actually use the electronic resource in terms of their demographics and mental health characteristics. In other words it provides some answers to the question, “who chooses to access this resource?” This study has not demonstrated the effectiveness of the website, but it was not designed to do so.

The CALM study showed that one quarter of year 2 and 3 medical students chose to access a self-care mental health website over a five week period. The site was accessed by those students with significantly higher anxiety scores but not higher depression scores, in comparison to those who did not access the website. The reasons for this are not clear, but one possible explanation is that the loss of interest and energy associated with depression may result in less motivation to experiment with a new website than for those with anxiety. Alternatively, it could be that depressed students were in fact more likely to access the website, but that the study was not powered enough to show this as being statistically significant.

The rates of moderate or moderately severe depression and anxiety in the medical students participating in the CALM study were shown to be 14.5% and 9% respectively, using the cut-off score of ≥10. These results are similar to another New Zealand study that found a prevalence of 16.9% for depression and 13.7% for anxiety in medical students. However, the cut-off for anxiety in this previous study was a GAD-7 score of ≥8, which could be one reason for the higher anxiety rate in comparison to the CALM study.

The CALM study finding that the percentage of students with risk of any degree of depression was 48% is also similar to a large multicentre US study which stated that 49% of medical students had depressive symptoms. In the CALM study 2.5% of students had a score of ≥15. Although this is a small percentage, it is important, as one US study showed that 28.5% of tertiary students with a PHQ-9 score of ≥15 also identified themselves as having suicidal ideation.

The average PHQ-9 score for the class in the CALM study was not very high at 5.14, but there was quite wide variation (sd. 4.06), indicating that there were reasonable numbers of students with symptoms of depression present in the class.

There was a high participation rate with 87% of the medical students in the two classes completing the baseline questionnaires in class, which supports the internal and external validity of findings. However, there were some limitations. The data were collected by self-report questionnaires, and although the measures used were well-validated, it does introduce a subjective element to the responses or potential response bias. A gap of 7 weeks between the date of the baseline assessments and the CALM launch occurred because of delay in website development. The students only had a 5 week interval in which to visit the site, which could have affected the number of visitors. However, the fact that CALM was not immediately available after being told about it in class but was available some time later may have been a more realistic assessment of the proportion likely to use such a site (25%) in an every-day setting.

Although the use of unique identifiers did provide an anonymous method of linking in-class students to those who accessed CALM, it was a study limitation, as 31 identifiers entered on the website could not be linked to those used at baseline. It is possible that those 31 students were not in class on the days of the baseline questionnaire, or that individual students used one or more unique identifiers, possibly due to concerns about being identified. The study design allowed for this, as the authors did not want to withhold a therapeutic intervention from students concerned about privacy. This may affect the generalizability of the findings but reflects the reality of conducting studies of a sensitive
topic in a vulnerable population. The low level of linkage may have also limited the sample size and the ability to draw conclusions about differences between those who accessed CALM and those who did not.

Even so, the CALM study demonstrates that electronic interventions can be accepted and used by medical students. Other online mental health resources have been developed for tertiary students such as Ulifeline\textsuperscript{32} in the USA. However, a point of difference with the CALM website was the experiential nature of much of the content, as the audiofiles enabled students to practice techniques.

The results from the CALM study also contribute to the existing literature by demonstrating that students with higher anxiety scores are more likely to access a self-care website than students with lower scores, as well as adding to the New Zealand data about the prevalence of depression and anxiety in medical students. This research has important implications for medical schools and beyond, as it suggests that medical students in need may use a confidential web-based resource designed to improve mental health. The use of audiofiles to provide experiential training in stress-management and positive thinking provides an affordable and anonymous way of targeting this high risk group to enhance self-care and enable early intervention. The health of our future doctors is important given the effect on practitioner quality of life, patient safety and the challenge of retention.\textsuperscript{33,34}

The modules and information on the CALM website could also be of benefit to other student groups and patient populations. Therefore, after the conclusion of the study, minor structural changes were undertaken, and the CALM website was made available to the public (www.calm.auckland.ac.nz), later being linked to the New Zealand National Depression Initiative\textsuperscript{35} and many Universities internationally.

**Competing interests:** Nil.

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**References**


