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Mindfulness

A pilot randomized controlled trial for a videoconference-delivered mindfulness-based group intervention in a nonclinical setting

--Manuscript Draft--

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Abstract:	Technology is increasingly being integrated into the provision of therapy and mental health interventions. While the evidence base for technology-led delivery of mindfulness-based interventions is growing, one approach to understanding the effects of technology-delivered elements includes so-named blended programs that continue to include aspects of traditional face-to-face interaction. This arrangement offers unique practical advantages, and also enables researchers to isolate variables that may be underlying the effects of technology-delivered interventions. The present study reports on a pilot videoconference-delivered mindfulness-based group intervention offered to university students and staff members with wait-list controls. Apart from the first session of the six-week course, the main facilitator guided evening classes remotely via online videoconferencing, with follow-up exercises via email. Participants

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	were taught a variety of mindfulness-based exercises such as meditation, breathing exercises, mindful tasting, as well as the concepts underpinning such practice. Participants completed pre- and post-intervention questionnaires on depression, anxiety, repetitive negative thinking, dysfunctional attitudes, positive and negative affect, self-compassion, compassion for others, and mindfulness. For participants who attended at least five of the six sessions, scores on all outcome measures improved significantly post intervention and remained stable at three-week follow up. The videoconference-delivered mindfulness-based group intervention appears to provide a viable alternative format to standard mindfulness programs where the facilitator and participants need to live in close physical proximity with each other.
Response to Reviewers:	We thank the reviewers for their thoughtful comments and suggestions. We have revised the manuscript accordingly and believe that it has improved substantially as a result. Please see our specific responses below. Reviewer #1: Given the very small numbers and apparent lack of a control group I think this paper would be more appropriate as a feasibility and "effective dosing" study demonstrating that the blended delivery works for participation and that it produced strong effect sizes for participants who engaged with more than 4 sessions Our response: We have modified the title slightly and making it clear there that this is a pilot study. We are also using that term throughout the manuscript, but stating it in the title makes it clearer. I would also recommend a shift in the opening narrative away from a focus on therapy or eTherapy. The population studied here is a non-indicated non-clinical population. Our response: As advised, we have removed detail about eTherapy and now start with material that is much more directly relevant to the present study. Participants - the actual inclusion exclusion criteria is not defined please provide some information on exclusion criteria as you reference several people were excluded because they did no meet criteria (?) Our response: We have added information about the requirement to have no psychological condition requiring ongoing medication, absence of epilepsy or brain injury, and no alcohol of substance abuse. In order to maintain anonymity and protect the participants, we cannot be specific about how many participants did not meet which one of these criteria. Lines 1-4 pg. 7 Some of the information about the room where the in person program took place is extraneous and not relevant I would recommend removing information noted in ( ) it e.g. Mindfulness sessions took place in a (recently refurbished) classroom (within a single-level block of classrooms). (Because sessions were generally conducted between 17:00 to 19:00 hours, no other classes were run in adjacent classrooms, and the campus was generally very quiet at that time. The classrooms were heated and well lit. Prior to conducting the mindfulness sessions, any tables were moved to the side of the room,) and chairs were arranged in a semi-circle, facing the main mindfulness facilitator Our response: As advised, we have removed the detail. Paragraph 1 of results please address the missing data using missing data analysis you used SPSS so you could use the MCAR function Our response: The setting of the online platform for questionnaire administration was set up in such a way that participants were required to complete all questionnaire items. We have added this information to the manscript. As there were no missing data, there was no need to conduct an MCAR to inform data imputation. Overall I would recommend that you simplify the basic structure of the description of the study and eliminate the unrelated descriptive information e.g. programs in spring and winter, space configuration etc. As it is presented it is difficult to understand the

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basic research design.

Our response: As advised, we have removed quite a bit of the detail.

Reviewer #2:

This manuscript presents a study of a group-based mindfulness program, which has been delivered face-to-face in person and via videoconferencing. Pre and post comparisons are made for up to twenty two participants on nine outcome measures pertaining to mental health, wellbeing, compassion, and mindfulness (total plus 5 subscales). The general context of the manuscript is interesting, and an important direction for the field of mindfulness research to investigate - ie. Effects of adapted mindfulness-based approaches. However, there are issues that are not given due consideration in the presentation of this study. Furthermore, I have concerns regarding the design and analysis.

The manuscript is pitched as a pilot study of a 'blended online' mindfulness program, but overall I am left unconvinced this is actually 'blended online' delivery. Using the term blended, and comparison with online delivery, suggests that content is made available to participants to access independently (i.e that the student control some aspect such as time, place or pace of program). However, the 'online' component of this program was a scheduled live video-conference, during which the session otherwise proceded as if face-to-face (e.g. interaction with facilitator). I'm therefore not convinced that this actually helps further our knowledge of online content in mindfulness program delivery - I would expect such an investigation to consider the potential moderation effects of having a 'live' versus 'recorded' facilitator.

Our response: Thank you for this suggestion. We can see now how the term “blended online” is not precise enough and also potentially misleading. We have changed it now to videoconference-delivered mindfulness-based group intervention. We have made the necessary adjustments throughout the manuscript.

Further general comments follow with regards to each section of the manuscript.

Introduction:
The introduction reads as descriptive, and long-winded in places. This should be more concise and focused, and critique of the previous research should be built in to lead towards the current study.

Our response: We have removed the material about eTherapy, which made the introduction long-winded. We have also sharpened our research question and explained the function of this pilot study.

In general, the introduction provides a detailed context of eTherapy (perhaps too extensive) at expense of context with regards to mindfulness-based approaches and study outcomes in particular. The context of mindfulness-based therapies (inc effectiveness) more generally should be provided - including the relevance of online content for these approaches in particular, consider experiential aspects, training and modelling of teacher, inquiry process. In addition, a more thorough literature review is required to consider other relevant studies, for example, Magtibay et al. (2017) report findings from a study of blended mindfulness for stress and burnout in nurses.

Our response: As mentioned in response to the comment above, we have removed the unnecessary and distracting detail about eTherapy. Thank you for the Magtibay et al. (2017) reference – this enabled us to add more material about directly relevant studies. As a result, our introduction now has more depth. We address the additional suggestions (e.g., embodiment of mindfulness practice by the teacher) in the modified Discussion section.

The aims, predictions and hypotheses are not clear in the introduction. The context of the study has not been provided - what is the relevance of the university population? What is the context to the outcomes?

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Our response: In response to the reviewer comments, we have revised the introduction section substantially. We are now presenting a much more focused section that includes more specific statements about the hypotheses and the rationale for the study in this nonclinical university setting.

Methods:
The inclusion criteria for the larger study should be provided, or the reasons why participants did not meet criteria should be provided.

Our response: We have added information about the requirement to have no psychological condition requiring ongoing medication, absence of epilepsy or brain injury, and no alcohol of substance abuse. In order to maintain anonymity and protect the participants, we cannot be specific about how many participants did not meet which one of these criteria.

Was a power calculation conducted?

Our response: In response to the other reviewer comments, we have added more information about the rationale of this pilot study. We did not include a power calculation as the purpose of the pilot study was to test the feasibility of our new approach by providing information about recruitment, adherence, and possible effect sizes. We have added two references to support our approach. The new section at the end of the introduction thus reads: “The primary purpose of this pilot study was to test the feasibility of a videoconference approach to delivering a mindfulness-based group intervention, which included gaining information about recruitment and treatment adherence. Prior power calculation is not necessarily a feature of such pilot work (Arain et al. 2010; Thabane et al. 2010), although the purpose of the study was to explore expected effect sizes for various outcome measures of interest. As this videoconference-based mindfulness program was delivered in a group format, it was hypothesized that effect sizes may be comparable to the moderate effect sizes found for group MBIs in nonclinical settings (Khoury et al. 2015).”

Presentation of demographic information might be improved by providing percentages where relevant.

Our response: As advised, we have added percentages.

The general design of the study should be made clear prior to reference to 'groups 1 and 2'.

Our response: We have added detail to the Participants section to make it clearer to the reader what the two groups are.

Details missing - psychometric properties of measures. Why are all of these measures included? What were the aims? Hypotheses?

Our response: The “Measures” section mentions that this is part of a larger study that explored the relationship between various self-report measures and measures of brain function and biomarkers. We have added more detail to make this more explicit.

Results:
Statistical analyses are run on overlapping subsamples of the sample - e.g. full sample, those who attended 3-4 sessions, those who attended 5-6 sessions. Better to have applied a cut off, or present descriptively. Unclear how this matches with the aims. Number of statistical analyses is not controlled for in interpretation of findings - no power calculation.

Our response: We believe that the various ways of analysing the data will provide useful information for the reader as it shows how an effect with the entire participants pool will be different if analysed separately by groups that are clustered according to frequency of attendance. Given the pilot nature of this study, such information will we valuable information as it helps gauge the importance of treatment adherence as a potential confounding variables. We are only encouraging comparisons of analyses

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that were conducted for the groups that attended 3-4 sessions with those of the groups that attended 5-6 sessions. That way, there will be no issue with overlapping data. Lastly, we have addressed the issue of potential inflation of type-1 error rate in the Data Analysis section in the following way: “Analyses of this pilot study explored patterns of change such as movement of all measures in expected directions. A nonparametric sign test was conducted to test whether movement in scores was significantly in one direction (Siegel and Castellan 1988). Therefore, if the overall movement of scores in the expected direction was significant according to this sign test, it can be concluded that this change was unlikely due to inflation of Type-1 error rate.”

The discussion focuses heavily on adherence as an issue and fails to provide sufficient interpretation of findings and setting back to previous studies.

Our response: We have added more material into the discussion. This includes more explicit comparisons to previous studies.

The presentation of the manuscript also requires attention. For example. APA guidelines need to be adhered to (citations and references, presentation of numbers, statistics)

Our response: We have carefully read through the journal guidelines one more time before making our revisions. The referencing style of the journal deviates somewhat from APA, and we need to ensure that our referencing style conforms to that of the journal. This includes presentation of “et al.” even at the first time a reference is presented as well as the use of “and” instead of “&” when referring to a study in parentheses. Our presentation of data follows the journal style where an initial “0” is presented when the variable can have values exceeding “1” but without a leading “0” when the values are defined within the range of 0 to 1 (such as for p-values).

Reviewer #3:
This study reports on a very exploratory way a blended online mindfulness program mainly offered to university students, with the main facilitator remotely via online videoconferencing. It is an interesting approach with practical applications, although the design used is very simple. I am in general positive regarding the study, although I think it should be completed with more practical information in order to improve future designs and applications (for instance, by reporting which variables at baseline were/were not related to the number of sessions attended and/or attrition, etc). In other words, I think more information/discussion on how to improve future applications of this kind of programmes should be included/highlighted.

Our response: We have added more material to the discussion that in response this suggestion. This also addresses the recommendations by Reviewer #2.

Other minor issues would be that: a) You states at the final of the introduction that "... This format was expected to result in similarly positive gains in mindfulness, as well as reduction in psychological distress comparable to group MBIs that
teach mindfulness entirely face to face". However, you do not have a specific entirely face-to-face group to compare and test this hypothesis. Please, introduce hypothesis that can be tested considering your design;

Our response: Thank you for noticing this. We have changed the wording to something more precise. We are now explaining the purpose of the pilot more clearly and are presenting the following hypothesis statement: “As this videoconference-based mindfulness program was delivered in a group format, it was hypothesized that effect sizes may be comparable to the moderate effect sizes found for group MBIs in nonclinical settings (Khoury et al. 2015).”

b) Please, include the psychometric characteristics of each questionnaire used and examples of items to be aware of their specific content;

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	Our response: We have added more information about the psychometric characteristics of each questionnaire as well as the wording for selected items as examples. c) Please, introduce percentages in Table 3; Our response: As advised, we have added percentage values to Table 3. d) Please, reorganize table 4 to facilitate understanding (e.g., put the pre-post measures of each group together, and please, include all the parameters and p values for each contrast; Our response: We have revised Table 4 accordingly. e) Please, highlight more the exploratory/pilot nature of the study (e.g., in the tittle, etc). Our response: As advised, we are now also emphasizing this in the title.

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A pilot randomized controlled trial for a videoconference-delivered mindfulness-based group intervention in a nonclinical setting~~Mindfulness group intervention in nonclinical settings: A blended online approach~~

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Running head: ~~Blended online~~Videoconference-delivered mindfulness-based group intervention

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Abstract

Technology is increasingly being integrated into the provision of therapy and mental health interventions. While the evidence base for technology-led delivery of mindfulness-based interventions is growing, one approach to understanding the effects of technology-delivered elements includes so-named blended programs that continue to include aspects of traditional face-to-face interaction. This arrangement offers unique practical advantages, and also enables researchers to isolate variables that may be underlying the effects of technology-delivered interventions. The present study reports on a pilot videoconference-delivered mindfulness-based group intervention offered to university students and staff members with wait-list controls. Apart from the first session of the six-week course, the main facilitator guided evening classes remotely via online videoconferencing, with follow-up exercises via email. Participants were taught a variety of mindfulness-based exercises such as meditation, breathing exercises, mindful tasting, as well as the concepts underpinning such practice. Participants completed pre- and post-intervention questionnaires on depression, anxiety, repetitive negative thinking, dysfunctional attitudes, positive and negative affect, self-compassion, compassion for others, and mindfulness. For participants who attended at least five of the six sessions, scores on all outcome measures improved significantly post intervention and remained stable at three-week follow up. The videoconference-delivered mindfulness-based group intervention appears to provide a viable alternative format to standard mindfulness programs where the facilitator and participants need to live in close physical proximity with each other.~~Technology is increasingly being integrated into the provision of therapy and mental health interventions. While the evidence base for online delivery of mindfulness-based interventions is growing, one approach to understanding the effects of online elements includes so-named blended programs that combine online delivery with traditional face-to-face interaction. This arrangement offers unique practical advantages, and also enables researchers to isolate variables that may be underlying the effects of online interventions. The present study reports on a pilot blended online mindfulness group program offered to university students and staff members with wait-list controls. Apart from the first session of the six-week course, the main facilitator guided evening classes remotely via online videoconferencing, with follow-up exercises via email. Participants were taught a variety of mindfulness-based exercises such as meditation, breathing exercises, mindful tasting, as well as the concepts underpinning such practice. Participants completed pre- and post-intervention questionnaires on depression, anxiety, repetitive negative thinking, dysfunctional attitudes, positive and negative affect, self-compassion, compassion for others, and mindfulness. For participants who attended at least five of the six sessions, scores on all outcome measures improved~~

~~significantly post intervention and remained stable at three-week follow-up. The blended online group program thus appears to provide a viable alternative format to standard mindfulness programs where the facilitator and participants need to live in close physical proximity with each other.~~

Key words: mindfulness-based intervention; group intervention; ~~blended online intervention~~videoconference; pilot study; nonclinical; university;

Authors' Contributions: RS led the funding application for this project. AS, CK, GW, RS, and WW planned and designed the study. The mindfulness intervention was delivered by GR, with assistance of RC, TT, JR, and CK. TT coordinated recruitment and data collection. DA, JR and OM assisted in the coordination of the study. Data were analyzed by OM, TT, CK, and NP. The majority of the write up was completed by CK, with help by OM and NP. All authors contributed to the manuscript and approved the final version.

Conflict of Interest: GR provides mindfulness-based interventions in educational settings as part of a business. These interventions currently do not follow the blended online approach reported here, but may in the future.

A ~~Mindfulness group intervention in nonclinical settings:~~ pilot randomized controlled trial for ~~A~~a videoconference-delivered mindfulness-based group intervention in a nonclinical setting~~blended online approach~~

Abstract

Technology is increasingly being integrated into the provision of therapy and mental health interventions. While the evidence base for ~~online~~ technology-led delivery of mindfulness-based interventions is growing, one approach to understanding the effects of ~~online~~ technology-delivered elements includes so-named blended programs that ~~combine online delivery with~~continue to include aspects of traditional face-to-face interaction. This arrangement offers unique practical advantages, and also enables researchers to isolate variables that may be underlying the effects of technology-delivered ~~online~~ interventions. The present study reports on a pilot ~~blended online~~videoconference-delivered mindfulness-based group ~~program~~ intervention offered to university students and staff members with wait-list controls. Apart from the first session of the six-week course, the main facilitator guided evening classes remotely via online videoconferencing, with follow-up exercises via email. Participants were taught a variety of mindfulness-based exercises such as meditation, breathing exercises, mindful tasting, as well as the concepts underpinning such practice. Participants completed pre- and post-intervention questionnaires on depression, anxiety, repetitive negative thinking, dysfunctional attitudes, positive and negative affect, self-compassion, compassion for others, and mindfulness. For participants who attended at least five of the six sessions, scores on all outcome measures improved significantly post intervention and remained stable at three-week follow up. The videoconference-delivered mindfulness-based group ~~program~~ intervention appears to provide a viable alternative format to standard mindfulness programs where the facilitator and participants need to live in close physical proximity with each other.

Key words: mindfulness-based intervention; group intervention; videoconference~~blended online intervention~~; pilot study; nonclinical; university;

Introduction

Recent advances in technology have rapidly transformed the way individuals communicate or interact with others, either directly or collectively as a community (Kirk 2013). ~~Communication technology innovations have also influenced the delivery of mental health services. Various names have been given to describe technology-based health applications such as eHealth, web-based therapy, telepsychology, e-interventions, or telehealth (Sucala et al. 2012). eTherapy refers to technology-based therapeutic communications between therapists and clients or the use of technology based tools as an adjunct to routine therapy (Kotsopoulou et al. 2015). eTherapy can also be provided as stand-alone internet-based programs that clients work through guided by pre-defined therapy algorithms rather than being directed by a therapist (Sucala et al. 2012). The requirement for therapist involvement varies in eTherapy approaches, and can be observed along a spectrum ranging from the use of eTherapy tools as a minor adjunct to face-to-face therapy, through to completely stand-alone interventions that require no input from a therapist (Stasiak and Merry 2013).~~

~~Internet videoconferencing and live online chats have become commonly used as an alternative to face-to-face sessions (Simpson 2009), with the advantage that it eliminates or at least reduces the need for physical proximity between client and therapist. Real-time therapy delivered by online psychologists can be beneficial for those who have trouble getting to face-to-face sessions due to travel or financial constraints, disability, or merely because of inconvenience. However, the lack of physical proximity in technology-based communication can produce other challenges. Due to the reduction of non-verbal cues and communications, more time may be needed to build a relationship and to discuss how meaning can be conveyed within the online therapy context (Lee 2010).~~

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~~Although studies investigating the effectiveness of eTherapy are commonly affected by methodological constraints such as high attrition rates or lack of appropriate control groups (van~~

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~~Kessel et al. 2016), the evidence is overall supportive of the utility of such approaches. Cook and Doyle (2002) concluded that meaningful therapeutic relationships between client and therapist can be formed online, and the quality of therapeutic rapport appears to be comparable to that of traditional face-to-face therapy (Simpson 2009). Day and Schneider (2002) reported on a randomized control trial of a five-session CBT intervention with 80 clients identified with mild to moderate psychological issues who were assigned to either a no-treatment control condition, a face-to-face therapy condition, a two-way audio or a two-way video condition. The treatment conditions provided superior improvement compared to the control group with moderate to large effect sizes for two of the outcome measures, but no difference for a third measure inquiring into symptoms. Tuerk et al. (2010) conducted a pilot study investigating the effectiveness of a manualized videoconferencing intervention for war veterans suffering from post-traumatic stress disorder (PTSD). Clients showed strong reductions in symptoms of PTSD and depression, and the authors concluded that videoconferencing can provide a safe and practically viable alternative to standard face-to-face interaction in therapy. The use of videoconferencing is not only restricted to individual therapy but has also been applied to group therapy, although this is less common and associated with unique challenges (Barak and Grohol 2011). Compared to individual eTherapy, online group formats appear to be less effective. When matching for therapeutic approach as well as patients and problems addressed by the therapy, individual approaches revealed average effect sizes above 0.50 (moderate) as opposed to 0.36 for group formats (Barak et al. 2008).~~

Use of communication technology has increasingly been applied to deliver mindfulness interventions or support mindfulness practice. This includes a variety of approaches, ranging from phone-delivered mindfulness training sessions (Salmoirago-Blotcher et al. 2012) and mindfulness-based mobile applications (Plaza et al. 2013; van Emmerick et al. 2017), to mindfulness in self-help interventions delivered through websites (Gu et al. 2017) or mindfulness taught using a combination of a virtual online classroom and website (Aikens et al. 2014).

A recent meta-analysis by Spijkerman et al. (2016) examined the effectiveness of 15 online mindfulness-based interventions (MBIs) to improve mental health. Eight of the fifteen studies delivered a mindfulness-based stress reduction (MBSR; Kabat-Zinn 1990) program, two mindfulness-based cognitive therapy (MBCT; Williams et al. 2007), and five an acceptance and commitment therapy (ACT; Hayes et al. 1999) intervention. Guidance from a therapist was given during the interventions in nine studies, and in five of these participants were given feedback and individual coaching (e.g. positive encouragement, answering questions) through email, telephone or encrypted webpages. In three studies, guidance was given weekly in 1- or 2-hour online classes (group-based), with one also providing supplementary (pre-programmed) individual email coaching. MBIs were predominantly delivered through websites (*n*=14). Further delivery modes included a smartphone application (*n*=1) and also a virtual online classroom (*n*=2). Intervention durations varied from 2 to 12 weeks, and the sessions were usually conducted weekly. Overall, the meta-analysis found small but significant effect sizes for anxiety, depression, stress, well-being, and mindfulness (Spijkerman et al. 2016). Although previous research has demonstrated that online psychological interventions are equivalent to traditional face-to-face interventions in terms of effectiveness (Barak et al. 2008), the effect sizes observed in this meta-analysis were found to be generally lower than those of face-to-face MBIs (Abbott et al. 2014; Cavanagh et al. 2014; Gotink et al. 2015). This may suggest that, as of yet, online MBIs are not as effective as traditional face-to-face interventions. For MBIs in nonclinical populations such as university students, effect sizes for measures of psychological well-being are generally found to be moderate (Khoury et al. 2015).

While mechanisms underlying the effectiveness of online MBIs are still being proposed and tested (Cavanagh et al. 2017), another avenue of research is through so-named *blended* web-based mindfulness programs. Montero-Marin et al. (2018) combined traditional face-to-face interaction with online-based practice sessions. During an initial four~~4~~-hour face-to-face group session, general practitioners were introduced to the theoretical background of mindfulness, its usefulness for their professional practice, and how to implement this practice into their daily lives. The program was modelled on MBSR, but was designed to be brief and thus did not contain a full-day workshop as is

typical for MBSR. Subsequent to this face-to-face session, participants were provided with four 45-min sessions of online training. These were to be completed within a period of two weeks and presented participants with audio, video, and text material for guided practice and further theoretical description. However, during this online phase, participants received no supervision or feedback from the instructor or any of the researchers. Only 30 of the 290 participants completed two or more of the weekly practices, and, for those participants, significant improvement in positive affect (moderate effect size) and mindfulness (small effect size) was noted. There were no significant effects on secondary outcome measures such as negative affect, resilience, or burnout.

A limitation of the study by Montero-Marin et al. (2018) was the low practice adherence, which may be expected for health professionals such as general practitioners who are frequently reported to have a very high workload (Thompson and Walter 2016). However, the blended approach of combining face-to-face and online delivery of mindfulness intervention has the potential to offer unique advantages and thus warrants further investigation and development. Compared to purely online-based MBIs, blended programs will not pose such a stark contrast to conventional face-to-face delivery facilitating the acceptability of such interventions for participants who may not be particularly comfortable with fully online group programs. Blended programs may thus be perceived as a compromise between the two extremes. For others who are happy with online formats, some may additionally appreciate having met the facilitator in person before continuing with the program online. Additionally, the use of blended programs allows researchers to restrict the number of variables that are manipulated when introducing online elements into delivery of MBIs, which may help isolate variables that are associated with treatment effectiveness.

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A different type of blended approach was taken by Magtibay et al. (2017) – in this case blended learning, where participants were able to choose the format that met their learning styles and goals. Fifty nurses self-selected to participate in an intervention for mindfulness and resilience to address stress and burnout, which had been identified as common issues in this target population. Depending on personal preference, participants could choose between various options for learning the

content: online-based formats, independent reading, facilitation, or a combination of those. There was no requirement to complete the exercises within a specified time period, although participants were encouraged to complete the online-based portion within eight weeks. At Weeks 8 and 12, sessions were conducted face to face, and by telephone during Weeks 16 and 20. During some of these weeks and at follow up, participants also completed a number of questionnaires to assess stress, burnout, happiness, and mindfulness. While attendance as these follow-up sessions was poor (20, 15, 2, and 1 in Weeks 8, 12, 16, and 20, respectively), completion rates for the survey were substantially higher (50, 45, 40, and 33 for baseline, Weeks 8, 12, and 24, respectively). Each outcome measure changed at each assessment point in the expected direction. Although effect sizes were not presented, these can be calculated (comparing baseline with Week 24) from the data provided: small effect size for resilience (Cohen's *d*=0.43); medium effect sizes for happiness (*d*=0.61), client-related burnout (*d*=0.68), and perceived stress (*d*=0.74); and large effect sizes for mindfulness (*d*=0.80), generalized anxiety disorder (*d*=0.87), work-related burnout (*d*=0.88) and personal burnout (*d*=0.89).

The present article reports on a pilot study of a videoconference-delivered mindfulness-based group intervention – thus a blend between a traditional group format and a technology-delivered program~~blended online group MBI~~. This program was delivered in a university setting as it likely ensures higher treatment adherence than in the previous study of ~~a~~ blended ~~MBI~~ approaches (Magtibay et al. 2017; Montero-Marin et al 2018). Additionally, university environments are known to be demanding and stressful where maintaining well-being and a healthy lifestyle can be challenging for both staff and students, making this a population that could benefit particularly well from MBIs (Henning et al. 2018). U~~u~~nlike the study by Montero-Marin et al. (2018), the mindfulness program delivered in the present study retained the group format of standard MBIs such as MBSR and MBCT. The ~~blended~~ program reported here thus provides an approach to investigating the effects of specific aspects of ~~online~~ technology-facilitated content delivery as opposed to offering an experience that differs from standard MBI on a number of dimensions. In our case, the ~~online~~ technology-facilitated element was limited to the facilitator who delivered the group MBI remotely from the second session

onward. The study participants thus met the facilitator in person during the first session, which allowed them to build initial rapport.

The primary purpose of this pilot study was to test the feasibility of a videoconference approach to delivering a mindfulness-based group intervention, which included gaining information about recruitment and treatment adherence. Prior power calculation is not necessarily a feature of such pilot work (Arain et al. 2010; Thabane et al. 2010), although the purpose of the study was to explore expected effect sizes for various outcome measures of interest. As this videoconference-based mindfulness program was delivered in a group format, it was hypothesized that effect sizes may be comparable to the moderate effect sizes found for group MBIs in nonclinical settings (Khoury et al. 2015)~~This format was expected to result in similarly positive gains in mindfulness, as well as reduction in psychological distress comparable to group MBIs that teach mindfulness entirely face to face~~. It was thus hypothesized that the participants will exhibit post-intervention increases in outcome measures related to psychological well-being, such depression, anxiety, dysfunctional attitudes, or positive and negative affect.

Method

This study was part of a larger trial that investigated the effects of mindfulness on brain function and biomarkers. Some baseline data relating to biomarkers have already been published elsewhere (Authors XXXX).

Participants

Participants were individuals either studying or working at XXXX University. The study was advertised to students and staff through posters, emails delivered through various university communications stakeholders, Facebook pages specifically set up for the study, and presentations to students at the beginning of their classes. A total of 204 individuals expressed their interest in

participating in the research, of which three did not meet the inclusion criteria for the larger study on brain function and mindfulness (absence of psychological condition requiring ongoing medication, absence of epilepsy or brain injury, and no alcohol of substance abuse). The remaining 201 interested individuals were randomly allocated to either Group 1 or Group 2 (waitlist control group with delayed start) and then contacted via email and/or telephone to confirm their participation. Of those, 42 initially confirmed their participation in the study, but a further ten were not able to continue. The number of participants attending at least one session was 15 for Group 1 and 17 for Group 2.

Of these 32 participants, 24 were undergraduate students, 6 were enrolled in post-graduate studies, and 2 were staff. Eleven identified as male (34%) and 21 as female (66%). The mean age was 30.06 years, with a standard deviation of 10.94 and a range of 18 to 58 years. The ethnic makeup was diverse, including New Zealand European (*n*=14; 44%), Asian (*n*=6; 19%), Indian (*n*=3; 9%), ~~Asian (*n*=6),~~ Māori (*n*=1; 3%), Pacific Islander (*n*=1; 3%), others or not specified (*n*=7; 22%). There were no notable differences in terms of demographic profile across Groups 1 (immediate start) and 2 (wait list control and delayed start).

Setting

Mindfulness sessions took place in a quiet ~~recently refurbished~~ classroom ~~within a single-level block of classrooms. Because sessions were generally conducted~~ between 17:00 to 19:00 hours. ~~, no other classes were run in adjacent classrooms, and the campus was generally very quiet at that time. The classrooms were heated and well lit. Prior to conducting the mindfulness sessions, any tables were moved to the side of the room, and chairs were arranged in a semi-circle, facing the main mindfulness facilitator.~~ At all times, a clinical psychologist was present who also participated in the exercises but who identified herself as staff who was able to help if any of the students were to experience any psychological distress. Typically, one additional researcher was also present who helped set up the room and tidied up afterwards and also made sure that the videoconferencing technology was working.

A desktop computer was at the front of the class, adjacent to a projector screen, which showed the main mindfulness facilitator who joined remotely from Session 2. A unit containing a speaker and microphone was situated next to the desktop computer. ~~The facilitator was clearly audible by the participants, and any questions or comments from the participants were audible by the facilitator as long as speech was directed towards the microphone and was not too soft (i.e., similar to the volume in a regular conversation).~~

Two cameras, one mounted to the back wall of the classroom and one in the corner, allowed the facilitator joining via videoconferencing to view the participants. The pictures from both cameras could be viewed either simultaneously or one at a time. ~~Additionally, it was possible to rotate the camera around by 90 degrees and zoom in or out.~~

The software used for the videoconference was provided by the commercially available service from GoToMeeting™ (GTM). GTM allows real-time audiovisual interaction between several parties. In this study, the main facilitator who was located in a different city (from Session 2) sent an email invitation to join a GTM meeting. The same software has been used previously in a study of videoconferencing intervention for individuals with traumatic brain injury (Tsaousides et al. 2014).

Procedure

The mindfulness sessions were conducted weekly for 90 to 110 minutes~~ on a weekday evening in late winter to early spring~~. Session 1 was delivered in person by the main facilitator. The purpose of this was to ensure that the participants and main facilitator were able to build good rapport. The first session consisted of an introductory ice-breaker exercise on well-being, discussion of the purpose of this course, and a 10-minute guided meditation exercise. A detailed outline of the program content session by session is presented in Table 1. This program was adapted from an educational

mindfulness program called *Pause, Breathe, Smile* (Devcich et al. 2017). For the purposes of the present study, the child-centered focus of the original program was modified to an adult-centered delivery style. The facilitator had his own personal long-term practice of mindfulness for more than 20 years and was the developer of the *Pause, Breathe, Smile* program.

<PLEASE INSERT TABLE 1 ABOUT HERE>

From Session 2, the facilitator guided the sessions via videoconferencing using GTM. The second session comprised of a 10 to 15-minute breathing meditation exercise, a physical movement exercise similar to Taijiquan, and a slideshow presentation on mindfulness and the brain. The session concluded with a brief guided meditation exercise and a mindful tasting exercise. Session 3 also included the physical exercise as well as guided breathing meditation. A slideshow presentation was given by the main facilitator on types of awareness, negative bias, and advantages of walking meditation. Session 4 included physical breathing exercises, breathing meditation, and a 45-minute talk on the foundations of mindfulness and emotion. The session similarly concluded with a meditation exercise, which focused on observing sound, body, and emotions. Session 5 contained the physical movement exercise, concentration meditation, and a talk on accepting and regulating emotion. Session 6 involved physical movement and a breathing exercise, meditation practice, as well as a discussion on the four foundations of mindfulness and its purpose. The facilitator also discussed loving kindness meditation, and explained it as involving repeating mantras to mentally send warmth, goodwill, and kindness to others.

At various stages during the face-to-face session and the sessions delivered via videoconferencing, the facilitator encouraged interaction with and among the participants. This could be in the form of a discussion but also as brief feedback. For example, immediately after the guided meditation session in Session 3, participants were asked to describe with one word how they felt. All sessions concluded with questions and answers.

Group 1 started the six-week mindfulness program three weeks prior to Group 2. As there was a three-week overlap period, the groups met on different days of the week. The sessions in Group 2 followed the same outline. However, the program occasionally had some minor variations, in response to questions by participants such as requests to elaborate on certain material or exercises. Due to logistical reasons, the mindful tasting exercise was conducted for Group 2 during Session 3 and not Session 2. Any other differences in session content were minimal. Apart from technical problems occurring in one of the sessions, which delayed the start by 15 minutes, there were no noteworthy issues with the equipment. Ethical approval was obtained from the authors' institutional ethics committee, and written informed consent was given by all participants.

Participants were encouraged to practice for at least 15 minutes per day. Exercises to be practiced were either those covered in class or those shown by following a link to audio or video files sent to the participants after each session. A day before the start of the next session, participants were sent a reminder email as well as a link to an online questionnaire inquiring about their home practice during that week. This included questions about frequency of practice during the week and average length of practice.

For both groups, baseline measures were taken during the week immediately prior to commencement of the mindfulness program. As Group 2 started the mindfulness program three weeks after Group 1, there was an opportunity to collect baseline measures twice, which served as a means to control for history effects as well as learning effects from repeated assessment. For both groups, a post-intervention measure was obtained during the first week following the final session of the mindfulness program. As Group 1 finished their program three weeks prior to Group 2, a second post-intervention measure could be obtained for Group 1, which served as a three-week follow-up measure. The timeline is illustrated in Table 2. Out of 15 participants in Group 1 who completed at least one mindfulness sessions, 13 completed the questionnaires. Twelve participants in Group 1 completed the first post-intervention measure, of which eight participants had completed at least five

of the total of six sessions. For Group 2, the number of participants who completed at least five sessions was also eight.

<PLEASE INSERT TABLE 2 ABOUT HERE>

Measures

As part of the larger study investigating the relationship between self-report measures of mindfulness, depressive symptoms, anxiety, compassion, and self-compassion with ~~-~~brain function~~,~~ and biomarkers, participants made appointments with one of the researchers to complete a variety of tests. This was scheduled according to the availability of the participants as it included several other behavioral and physiological assessments. The following psychometric instruments were completed online using the software Qualtrics. Respondents were required to answer all items in each questionnaire.

Depression. Participants completed the Beck Depression Inventory II (BDI; Beck et al. 1961, 1996). This questionnaire has 21 items where each item presents four statements from which the respondent needs to select one. The four statements are scored 0, 1, 2, or 3, and a higher score reflects a greater degree of depression. For example, one item lists the word “Sadness” followed by the options “I do not feel sad”, “I feel sad much of the time”, “I am sad all of the time”, and “I am so sad or unhappy that I can’t stand it”. The BDI-II has been used with samples including university students (de Sá Junior et al. 2018), and there is also good psychometric evidence for the use of a single general score (de Sá Junior et al. 2018; Siegert et al. 2009), which was used in the present study ~~Item scores are summed to yield an overall score~~.

Anxiety. The Beck Anxiety Inventory (BAI; Beck et al. 1988) ~~contains~~ presented 21 items that describe symptoms of anxiety (e.g., "Numbness or tingling"). Respondents rate each item ~~scored~~ on a four-point Likert scale (ranging from "Not at all" to "Severely (I could barely stand it)", which are added to a summary score, where higher scores represent higher levels of anxiety. The BAI has been used with variety of populations including university students, with good psychometric properties including Cronbach's alpha above .90 (Julian 2011).

Dysfunctional attitudes. Dysfunctional attitudes linked to vulnerability to depression were measured using one of the short forms of the Dysfunctional Attitudes Scale (DAS-SF_1; Beevers et al. 2007). The nine items of this scale (e.g., "If I don't set the highest standard for myself, I am likely to end up a second-rate person.") were presented using a four-point Likert scale (ranging from "Totally agree" to "Totally disagree"), which were summed together to yield a summary score where a higher score indicates a lower level of dysfunctional attitudes. The scale was originally developed using university student samples and shows good psychometric properties including Cronbach's alpha above .80 (Beevers et al. 2007).

Repetitive negative thinking. The Perseverative Thinking Questionnaire (PTQ; Ehring et al. 2011) presents 15 items (e.g., "The same thoughts keep going through my mind again and again.") on a five-point Likert scale ranging from "never" to "almost always". Items are summed together to a total score, where a higher score indicates a higher level of repetitive negative thinking. The scale was originally developed and validated with samples that included university students, with good psychometric properties such as Cronbach's alpha above .90 (Ehring et al. 2011).

Positive and Negative affect. The 20-item Positive and Negative Affect Schedule (PANAS; Watson et al. 1988) lists 20 adjectives (e.g., "Interested", "Distressed", "Excited", and "Upset") and asks the participant to indicate on a five-point Likert scale (ranging from "Very slightly or not at all" to "Extremely") the extent to which each adjective indicates how much they currently feel this way. The scores of ten items are summed to generate a total score of positive affect (PA), and the

remaining ten indicate level of negative affect (NA). The original development and validation work of the scale included samples of university students, which demonstration good psychometric properties such as Cronbach's alpha above .80 (Watson et al. 1988).

Self-compassion. The 12-item short form of the self-compassion scale (Raes et al. 2011) was used to measure self-compassion. Unlike the full-length self-compassion scale (Neff 2003), which contains six sub-scales, the short form produces a single score of self-compassion. The short form presents two items from each of the six sub-scales using a five-point Likert format ("Almost never" to "Almost always"). An example item is "When I fail at something important to me, I become consumed by feelings of inadequacy" (*over-identification* sub-scale). Items from the sub-scales *isolation*, *over-identification*, and *self-judgment* are reverse coded before adding all items together to a single score, where a higher score represents a higher level of self-compassion. The 12-item short form has been validated in samples with university students, with Cronbach's alpha exceeding .80 (Raes et al. 2011).

Compassion. The compassion scale (Pommier 2010~~1~~) contains 24 items (e.g., "XXX") presented in a five-point Likert scale format ("Almost never" to "Almost always"). Items are grouped into six sub-scales of four items each. An example item is "When people cry in front of me, I often don't feel anything at all" (*disengagement* sub-scale). After reverse coding items from three of these sub-scales (*disengagement, indifference,* and *separation*), a total score can be calculated by summing all items so that a higher score represents a higher level of compassion. The original validation work of the scale included university student samples, with Cronbach's alpha for the total score reported as exceeding .80 (Pommier 2010).

Mindfulness. The 39-item Five Facet Mindfulness Questionnaire (FFMQ; Baer et al. 2006) assesses aspects of mindfulness grouped into one of five sub-scales: *Act* (e.g., "I am easily distracted"), *Describe* (e.g., "I am good at describing the words to describe my feelings"), *Nonjudge* (e.g., "I criticize myself for having irrational or inappropriate emotions"), *Nonreact* (e.g., "I perceive

my feelings and emotions without having to react to them"), and *Observe* (e.g., "When I am walking, I deliberately notice the sensations of my body moving"). Questions are scored on a five-point Likert scale ranging from "Never or very rarely" to "Very often or always true". After recoding negatively worded items, higher scores indicate a higher level of mindfulness. Data were converted from ordinal- to interval-level scores for each sub-scale according to the algorithms recommended by Medvedev et al. (2017). These conversion algorithms were based on validation work that included university student samples. Reliability of this scale was measured using person separation index (PSI), which is interpreted in a similar way to Cronbach's alpha (Tennant and Conaghan 2007). Reliability was acceptable, with PSI values of the five sub-scales ranging from .76 to .89.

Data analysis

Analyses were conducted using the software SPSS v25. Given the small sample size, nonparametric tests were conducted, namely paired-samples Wilcoxon rank-sum test for within-group comparisons (such as pre- versus post-intervention scores) and independent-samples Kruskall-Wallis test for between group comparisons such as when comparing baseline scores of Groups 1 and 2. Analyses of this pilot study explored patterns of change such as movement of all measures in expected directions. A nonparametric sign test was conducted to test whether movement in scores was significantly in one direction (Siegel and Castellan 1988). Therefore, if the overall movement of scores in the expected direction was significant according to this sign test, it can be concluded that this change was unlikely due to inflation of Type-1 error rate.

Results

The baseline scores of Groups 1 and 2 were comparable for all measures. Even though there were 15 participants in Group 1 who took part in at least one of the mindfulness sessions, only 13 of

those completed the Pre1 questionnaires immediately prior to the intervention (Table 2). In contrast, all participants in Group 2 completed the Pre1 questionnaires. Comparing the Pre1 scores across groups, the only significant differences were for NA (Group 1 mean=25.00, SD=8.24, Group 2 mean=19.31, SD=7.89, H=4.37, $p<.05$) and the *Nonjudge* sub-scale of the FFMQ (Group 1 mean=23.21, SD=5.83, Group 2 mean=26.80, SD=3.75, $H=7.69$, $p<.01$). When comparing the Pre0 scores of Group 2 with the Pre1 scores of Group 1 (both of which were collected during the same week), only the scores for *Nonjudge* were significantly different ($H=4.42$, $p<.05$). At Pre0, the mean *Nonjudge* score for Group 2 was 25.02 (SD=2.58). The comparisons of Pre0 scores with Pre1 scores indicated that the baseline scores for Group 2 remained stable. The only significant difference between these two time points was noted for BDI ($z=-2.67$, $p<.01$), which increased from 7.19 (SD=6.18) to 10.12 (SD=7.32).

Table 3 shows attendance at each mindfulness session of Groups 1 and 2. Attendance dropped steadily throughout the six-week course. The lowest number of participants was in Sessions 4 and 5, but attendance increased again for the final session. Four of the initial 32 participants attended only one ($n=1$) or two sessions ($n=3$) and were not available for post-intervention assessment. Of the remaining 28 participants, six participants each attended three and four sessions, while eight participants each attended either five or six sessions. Of the 12 participants who came to either three or four sessions, seven provided Pre1 and Post1 data, and for the 16 participants who attended either five or six sessions, Pre1 and Post1 data were available for 15 participants.

<PLEASE INSERT TABLE 3 ABOUT HERE>

The pre- and post-intervention results for all measures are shown in Table 4. Results are presented separately for the entire sample of 22 participants for whom pre- and post-interventions scores were available ($n=22$), those participants who only attended three or four of the six sessions ($n=7$), and those who attended either five or six sessions ($n=15$). However, the pre-post comparisons did not reach statistical significance for those who only attended three out of four sessions. While the effect

sizes were clearly smaller for this sub-group, the lack of statistical significance is very likely also due to the small sample size.

<PLEASE INSERT TABLE 4 ABOUT HERE>

For the participants who completed five or six sessions, scores changed significantly for all scales except for positive affect (PA), compassion for others (CS), FFMQ Describe, and FFMQ Observe. All significant changes were in the expected directions, with negative change for depression (BDI), anxiety (BAI), repetitive negative thinking (PTQ), negative affect (NA) and positive change for self-compassion (SCS), total mindfulness score (FFMQ total), acting with awareness (FFMQ Act), nonjudging (FFMQ Nonjudge), and nonreactivity (FFMQ Nonreact). Also note that the DAS scores increased significantly, and here a higher score indicates lower levels of dysfunctional attitudes. Effect sizes for these changes ranged from small (Cohen's $d \geq 0.20$) for BAI, DAS, PTQ, and FFMQ Nonreact, medium (Cohen's $d \geq 0.50$) for NA and FFMQ Nonjudge, to large (Cohen's $d \geq 0.80$) for BDI, SCS, and FFMQ total. Not considering the FFMQ total scores as they are not independent of the sub-scale scores, all of the nine significant changes in outcomes measures were in expected directions (BDI, BAI, DAS, PTQ, NA, SCS, FFMQ Act, FFMQ Nonjudge, and FFMQ Nonreact). According to a sign test, a movement of nine out of nine scores in one direction is statistically significant (two-tailed, $p<.02$).

The second post-intervention data collection (Post2) for Group 1 allows an assessment of post-intervention follow-up. Comparing the Post1 scores with Post2 scores of the participants who completed at least five mindfulness sessions ($n=7$; $n=6$ for DAS), only two significant differences were noted: The decrease in the PTQ mean from Post1 (M=30.29, SD=7.74) to Post2 (M=26.71, SD=10.14) was significant ($z=-2.00$, $p<.05$) as well as the increase in FFMQ Nonreact ($z=-2.00$, $p<.05$) from 16.43 (SD=2.87) to 17.88 (SD=2.95).

Data on home practice was relatively incomplete as the overall response rate to questions about home practice was 58%. However, of those 15 participants who completed at least five sessions, 14 participants provided data for at least four of the five times they were asked. For those 14 participants, the average frequency of practice and average length of practice was calculated for the six-day period since the last mindfulness session. Excluding one outlier who indicated practicing 50.00 min per day, the median frequency was 2.50 and median length of daily practice time was 14.00 min (range 5.00 to 18.80 min). Average frequency of practice was not correlated (Spearman's rho) with change scores of any of the outcome measures. For length of practice per day, the significant correlations were found for only two of the outcomes measures, and in both cases in unexpected directions: Pre1-to-Post1 change scores of the FFMQ Describe were negatively correlated (rho=-.58, $p<.05$) with practice length, and also for FFMQ Nonreact (rho=-.59, $p<.05$). However, given the small sample size and limited range of variability in scores, these results need to be interpreted with caution.

Discussion

The present study reported on a pilot ~~blended online~~videoconference-delivered ~~program to deliver a~~ group MBI in a nonclinical setting. For participants who attended at least five of the six sessions of the mindfulness program, significant reductions of depression, anxiety, repetitive negative thinking, negative affect and dysfunctional attitudes and significant increases of self-compassion, total mindfulness, acting with awareness, nonjudging, and nonreactivity were evident. The changes were particularly large for depression, self-compassion, and overall mindfulness, as indicated by effects sizes above 0.80. Overall, this ~~blended~~ approach of delivering a mindfulness intervention program was effective and brought about positive change in participants that is ~~comparable~~ higher than ~~with the~~those reported ~~effects of other~~in online-based MBIs (Spijkerman et al. 2016) and more comparable to those found in face-to-face group MBIs in nonclinical settings (Khoury et al. 2015). The limited

evidence from the follow-up data indicated that the effects remained for at least three weeks after the intervention.

The similarity of the results of the present study with those of traditional face-to-face group MBIs rather than online formats might be related to the fact that the facilitator in our study was present during the first session, which allowed participants to build rapport. When introducing himself to the group, the facilitator provided background about his own personal mindfulness practice, thus potentially establishing himself as a role model for course participants. The importance of so-called embodiment of mindfulness practice by the teacher has increasingly been recognized in the literature as an important variable that could affect the effectiveness of an MBI (Broderick et al. 2018). Future studies might deliberately arrange different conditions that enhance or diminish such embodiment as perceived by the participants.

~~However~~In the present study, no changes were found for positive affect, FFMQ Observe, and FFMQ Describe. The lack of an effect of the present intervention on the Observe sub-scale of the FFMQ may not be entirely surprising given the fact that it has frequently been reported to present with unexpected relationships with variables of psychological well-being (Rudkin et al. 2018). Similarly, the FFMQ Describe sub-scale has been found to yield occasional contradictory associations (Fernandez et al. 2010) and has also been described as theoretically problematic (Christopher et al. 2014; Feng et al. 2017). The lack of an effect on compassion for others may be a reflection of the focus of the present program more on personal observations and self-compassion, although some loving kindness practice had been incorporated. While the link between mindfulness and compassion has been argued conceptually (Krägeloh 2016), empirical evidence suggests that a fair amount of explicit practice focusing on compassion for others is required to develop this characteristic (Brito-Pons et al. 2018).

Out of the initial 32 participants, only 23 remained during the final session of the six-week program, and only 15 participants attended at least five sessions. This attrition rate is not dissimilar to

those found in eTherapy. Richards and Richardson (2012) published a meta-analysis of 40 studies on computer-based psychological interventions. The dropout rate for unsupported treatments was almost 75%, compared to 38% for those with administrative support, and 28% for those with therapist support. Even values for conventional face-to-face psychological therapy range from 30 to 60% (Richards and Richardson 2012). Forbes et al. (2017) provided a detailed analysis of adherence rates for an online-based MBI for university students. After the first meditation exercise, 16.5% of participants dropped out, followed by a steady decline to around 50% after the 10th daily meditation. Other reports of attrition rates include ranges from 8% to more than 50% for MBIs delivered via technology with no facilitator involvement (Fish et al. 2016).

Poor adherence will likely decrease the effectiveness of the intervention, which may be particularly the case in mindfulness training, as regular practice is considered essential in acquiring mindfulness skills (Lacaille et al. 2017; Spijkerman et al. 2016). Because the studies in the meta-analysis by Spijkerman et al. (2016) used diverse definitions of adherence and often lacked clarification of how adherence was measured, the authors did not rule out that non-optimal adherence rates may have prevented the full potential of online MBIs. This poses the question of how adherence can be enhanced in online MBIs. Prior research has suggested that providing support has a positive influence on adherence and also enhances the effectiveness of online interventions (Andersson and Cuijpers 2009). On the other hand, there may be aspects of the delivery format that cannot be easily addressed in program designs as participants may have particular preference due to a variety of reasons. As reported by Lauricella (2014), for example, about half of the university students in their sample preferred a face-to-face mindfulness exercise, while a quarter preferred digital practice. As individuals gain more familiarity with online formats, their preference may either shift more in favor of these approaches, or individuals may self-select for these types of individuals with more realistic expectations. Increasing adherence is an important goal as it is often individuals with higher baseline levels of depressive rumination that tend to drop out of MBIs (Banerjee et al. 2017), and these individuals are particularly in need of this intervention.

The results of the present pilot study provide useful information about the extent of recruitment activities that might be required for a future full trial. In response to the first wave of advertisement for this pilot study, 201 individuals registered interest in the program. Of those, 42 confirmed their continued willingness to participate when contacted by the researchers with more details, and 32 individuals formally took part by attending the first session. This result can be seen as an indication of the extent of recruitment required to meet target sample sizes. It is therefore not a conservative estimate to expect only 15% of those expressing initial willingness to participate in a MBI of that type to convert into an actual participant. Future studies may explore in more detail the barriers for participating as well as the characteristics of individuals who tend to express initial willingness to participate in contrast to those that eventually do participate.

Limitations

The participants were required to complete a number of questionnaires, which may have contributed to response fatigue. To limit this response burden, no measure of therapeutic alliance was included in the present study. However, for online interventions, issues of trust and alliance are likely to be equally important as for more traditional face-to-face formats, and more data on the challenges to building therapeutic alliance in online contexts will be necessary to understand the mechanism for treatment effectiveness and potential reason for non-adherence. Such research could explore the unique context of online environments for miscommunication and develop new strategies to address and avoid misunderstandings (Lee 2010). Even though the present study was not conducted in a therapeutic setting the relationship between the course participants and the facilitator may still have been an important factor in the participants' motivations to attend sessions and conduct home practice.

The effect sizes reported here need to be interpreted in comparison with related programs that may be affected by the same kinds of self-selection biases that could have applied here. Reasons for practicing mindfulness can be very varied (Pepping et al. 2016), and it appears that intention to

practice is related to the perceived benefits of meditation, rather than perceived severity of stress-related problems (Rizer et al. 2016). Due to the low response rate and limited range of variability in scores, frequency and length of home practice could not be used in the present study as a co-variate. Additionally, the empirical evidence for the benefits of home practice is mixed (Lloyd et al. 2017; Ribeiro et al. 2017), and it other ways of assessing practice, such as quality, may be necessary.

While the results highlight that the pilot ~~blended online~~videoconference-delivered mindfulness group program was ~~successful~~ effective in increasing mindfulness and producing significant positive changes on several relevant outcome measures, it is unclear how long-lasting these effects are likely to have been. Due to limited resources and the requirement to fit in with the schedule of concurrent studies on mindfulness and brain function (Authors XXXX), it was only possible to include one follow-up data collection point. This follow-up was conducted for only one of the groups and was conducted relatively soon, namely three weeks after the first post-intervention data collection. Effects from online therapy approaches may certainly decrease over time (Richard and Richardson 2012), and booster sessions may be beneficial. However, the present study highlighted that a ~~blended online~~videoconference-delivered group format may provide a viable alternative if the main facilitator is located too far away to enable face-to-face contact. Certainly, the program still required the presence of locally based researchers to organize sessions, set up the equipment, and to be available to solve technical issues. It was not the intention to simulate a fully automated online intervention but only to explore to what extent the intervention may still work if the main facilitator is joining in part via videoconferencing. The results also indicate that having guest lecturers join via videoconferencing may not necessarily result in loss of effectiveness of MBIs. The online group format may also be useful for training purposes where the main facilitator and/or mentor may be located in another city or even country.

Compliance with Ethical Standards

All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional ethics committee of Auckland University of Technology, New Zealand, and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

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Table 1 Outline of the blended group mindfulness program.

Session 1 (face to face)	"Already here, always now" Introductory ice-breaker exercise on wellbeing Facilitator introduced himself and spoke about his personal mindfulness practice Guided meditation focusing on breathing
Session 2	"Shifting the auto-pilot" Guided breathing meditation Mindful tasting Mindfulness and neuroscience Physical exercises with focus on breathing Guided breathing meditation
Session 3	"Alright right now" Physical exercises with focus on breathing Mindfulness meditation Guided breathing exercise Body scan Powerpoint presentation and discussion: negativity bias, types of awareness, narratives when learning to meditate, walking meditation Loving kindness meditation Discussion
Session 4	"Making space" Concentration meditation focusing on breathing Powerpoint presentation and discussion: four foundations of mindfulness, urge surfing, transience of emotions, throwing out your anchor Physical exercises with focus on breathing Guided meditation with instructions to observe sounds, body, and emotions Questions and answers
Session 5	"Awareness, pure and simple" Concentration meditation focusing on breathing Powerpoint presentation and discussion: mindfulness and dealing with emotions Physical exercises with focus on breathing Concentration meditation focusing on breathing Questions and answers
Session 6	"Heart in mind" Physical exercises with focus on breathing Concentration meditation Powerpoint presentation and discussion: more on four foundations of mindfulness, mindfulness of mind objects, loving kindness meditation Questions and answers Feedback and discussion

Table 2 Overview of experimental timeline and measurement points. *Pre1* refers to the baseline measure taken immediately prior to the interventions in Groups 1 and 2, while *Pre0* refers to the first of the two baseline measures taken for Group 2. *Post1* is the first post-intervention measure immediately after the intervention for Groups 1 and 2, and *Post2* refers to the follow-up measure for Group 1.

Week	Group 1	Group 2
1	Pre1 baseline measure (*n*=13)	Pre0 baseline measure (*n*=17)
2	1st week of mindfulness program	
3	2nd week of mindfulness program	
4	3rd week of mindfulness program	Pre1 baseline measure (*n*=16)
5	4th week of mindfulness program	1st week of mindfulness program
6	5th week of mindfulness program	2nd week of mindfulness program
7	6th week of mindfulness program	3rd week of mindfulness program
8	Post1 post-intervention measure (*n*=8)	4th week of mindfulness program
9		5th week of mindfulness program
10		6th week of mindfulness program
11	Post2 post-intervention measure (*n*=7)*	Post1 post-intervention measure (*n*=8)

*At Post2 for Group 1, only six participants completed the DAS.

Table 3 Course attendance by session (*n* and %), shown separately for Groups 1 and 2.

	Session 1	Session 2	Session 3	Session 4	Session 5	Session 6
Group 1 (*n*=15)	15 (100%)	14 (93%)	12 (80%)	6 (40%)	7 (47%)	10 (67%)
Group 2 (*n*=17)	15 (88%)	15 (88%)	12 (71%)	9 (53%)	9 (53%)	13 (76%)

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Table 4 Means (M) and standard deviations (SD) for each of the outcomes measures, presented separately for the full sample of participants with Pre1 and Post1 scores (*n*=22), those who only attended three or four sessions of the mindfulness program (*n*=7) and those who attended five or six sessions (*n*=15). Cohen's *d* effect sizes refer to Pre1-to-Post1 comparisons.

Outcome Measure	Pre1 all (*n*=22)	Post1 all (*n*=22)		Pre1 for 3 or 4 sess. (*n*=7)	Post1 for 3 or 4 sess. (*n*=7)		Pre1 for 5 or 6 sess. (*n*=15)	Post1 for 5 or 6 sess. (*n*=15)	
	M (SD)	M (SD)	*d*	M (SD)	M (SD)	*d*	M (SD)	M (SD)	*d*
BDI	11.64 (9.46)	6.00 (4.93)	-0.75**	7.14 (4.88)	4.71 (4.96)	-0.49	13.73 (10.46)	6.60 (4.97)	-0.87**
BAI	8.59 (6.77)	7.55 (7.01)	-0.15	5.57 (2.99)	7.71 (9.29)	0.31	10.00 (7.63)	7.47 (6.06)	-0.37*
DAS	24.32 (5.12)	26.00 (3.92)	0.37*	25.00 (2.77)	26.00 (2.83)	0.36	24.00 (5.98)	26.00 (4.47)	0.38*
PTQ	31.77 (14.40)	26.41 (8.20)	-0.46*	28.86 (15.36)	23.86 (5.58)	-0.43	33.13 (14.27)	27.60 (9.09)	-0.46*
PA	33.59 (8.80)	33.45 (8.77)	-0.02	37.43 (7.28)	33.14 (8.36)	-0.55	31.80 (9.09)	33.60 (9.23)	0.20
NA	22.86 (8.43)	18.64 (5.64)	-0.59*	21.14 (6.31)	19.00 (6.30)	-0.34	23.67 (9.34)	18.47 (5.53)	-0.68*
SCS	31.18 (9.45)	37.41 (7.70)	0.72**	34.71 (7.46)	37.57 (4.83)	0.46	29.53 (10.04)	37.33 (8.88)	0.82**
CS	94.82 (11.24)	95.95 (14.20)	0.09	87.71 (13.05)	82.57 (12.25)	-0.41	98.13 (8.91)	102.20 (10.34)	0.42
FFMQ total	112.78 (7.80)	116.71 (5.75)	0.57**	113.55 (7.74)	113.47 (2.64)	-0.01	112.43 (8.07)	118.22 (6.25)	0.80**
FFMQ Act	24.58 (3.23)	26.15 (3.06)	0.50	25.04 (1.95)	24.85 (3.21)	-0.07	24.36 (3.73)	26.75 (2.91)	0.71**
FFMQ Describe	21.14 (5.23)	22.08 (3.36)	0.21	22.71 (3.03)	22.38 (2.80)	-0.11	20.41 (5.95)	21.95 (3.67)	0.31
FFMQ Nonjudge	25.12 (5.27)	27.56 (5.30)	0.46*	25.28 (7.22)	25.78 (2.89)	0.09	25.05 (4.39)	28.39 (6.02)	0.63*
FFMQ Nonreact	16.60 (3.29)	17.27 (2.47)	0.23	17.90 (3.16)	17.51 (2.23)	-0.14	15.99 (3.27)	17.16 (2.64)	0.39*
FFMQ Observe	24.64 (2.90)	25.34 (2.84)	0.24	23.20 (3.17)	23.04 (3.30)	-0.05	25.31 (2.60)	26.41 (1.87)	0.49

*p<.05, **p<.01