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An interdisciplinary mental wellbeing intervention for increasing flourishing: two experimental studies

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ABSTRACT

Positive Psychology Interventions (PPIs) have been shown to improve mental health, but little is known about their impact on the quantifiable experience of flourishing. Two experimental studies investigated whether the proportion of participants flourishing, assessed using the Huppert and So conceptual framework, could be increased through a 10-week online interdisciplinary intervention that combined strategies from positive psychology and lifestyle medicine. In Study 1 (n = 421), flourishing was significantly increased ($p < 0.001$) in the intervention but not the control group and was sustained at 12 weeks post-intervention. Study 2 (n = 458) showed that the addition of human support to the online intervention did not further improve its effectiveness at increasing flourishing. These studies demonstrate that online interdisciplinary interventions that incorporate positive psychology and lifestyle medicine strategies can increase human flourishing, irrespective of the addition of human support.

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Flourishing; positive psychology; lifestyle medicine; interdisciplinary; online; multicomponent; randomized controlled trial; mental wellbeing

Background

Over the past two decades, the positive psychology literature has progressed understanding of pathways to higher levels of mental health and functioning, commonly referred to as 'flourishing'. Human flourishing contrasts with the historical 'deficit' focus of psychology, which has long been concerned with stress, depression, and dysfunctional attitudes and behaviors. The associated benefits of flourishing include increased productivity, learning, creativity and longevity (Schotanus-Dijkstra et al., 2017; VanderWeele, 2017). By contrast, the antithesis of flourishing, referred to as 'languishing' (Keyes, 2007), is characterised by low levels of positive emotion and life satisfaction, high levels of distress, increased risk of chronic disease and higher rates of all-cause mortality (Diener & Chan, 2011; Keyes & Simoes, 2012).

Several definitions of 'flourishing' have been presented in the literature but to date theorists have not arrived at a consensus. Seligman (2011) defined flourishing as a multi-dimensional construct that integrates the presence of positive emotions (hedonic wellbeing) with high levels of psychological functioning (eudemonic wellbeing). Diener (2012) argued that flourishing includes important components such as prosperity (Ryff, 1989), social capital (Helliwell et al., 2009), good social relationships that also provide support to others (Brown et al., 2003), and purpose in life (Steger et al., 2008). Huppert and So (2013) defined flourishing as the combination of feeling good and functioning effectively to achieve high levels of mental wellbeing – the experience of life going well.

Despite the lack of consensus about what constitutes flourishing, and how it should be measured, it has been referred to as the 'gold standard of measuring wellbeing' (Seligman, 2011, p. 13). Accordingly, it is gaining attention from governments, policy makers, researchers and the general public as an important construct (Seligman, 2019; Forsman et al., 2015).

Quantifying flourishing

The construct of 'flourishing' is still in its infancy, with no consistent standard to conceptualize and measure the term (Huppert, 2009). While the concept continues to be developed and reimagined (Węziak-białowolska et al., 2018), Hone, Jarden, Schofield et al. (2014) reviewed four frameworks for the measurement of flourishing and applied these on a large sample of ten thousand adults from New Zealand. Significant variation in the prevalence of flourishing was recorded between the frameworks, with the Huppert and So conceptual framework indicating the lowest levels of flourishing among the cohort [Huppert and So (24%), MHC-SF (39%), Flourishing scale (41%) and PERMA model (47%)].

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The mental health continuum short form (MHC-SF)

The MHC-SF, developed by Keyes (2005) is a 14-item self-reported assessment derived by identifying the opposite of each symptom of depression listed in the Diagnostic and Statistical Manual of Mental Disorders (DSM–III–R; American Psychiatric Association, 1987). The assessment contains three items relating to emotional wellbeing, six items relating to psychological wellbeing and five items relating to social wellbeing. A 6-point Likert scale ('never', 'once or twice', 'about one a week', '2–3 times a week', 'almost every day' or 'every day') is used to assess the individual's experience over the past month. Perugini and colleagues (2017) reported a high internal consistency for the MH-SF scale (Cronbach's alpha = 0.89) while Orpana et al. (2017) reported Cronbach's alphas of 0.82 for both emotional and psychological well-being subscales and 0.77 for social wellbeing.

Flourishing scale

The Flourishing scale was developed by Diener et al. (2010), and involves eight items that relate to purpose and meaning, positive relationships, engagement, social contribution, competence, self-respect, optimism and social relationships. Each item utilizes a 7-point Likert scale ('strongly disagree', 'disagree', 'slightly disagree', 'mixed or neither agree or disagree', 'slightly agree', 'agree' and 'strongly agree') that when cumulated provides a score out of 56. The Flourishing scale has a high internal consistency (Cronbach's alpha = 0.89) (Hone, Jarden, Schofield et al., 2014).

PERMA model

Seligman (2011) proposed a flourishing model represented by the acronym PERMA: Positive emotion, Engagement, Relationships, Meaning and Achievement. A 15-item instrument was subsequently developed that included three items for each pillar in the acronym. Each item is based on a 11-point Likert scale (from 0–10, 'never' to 'always; or 0–10, 'not at all' to 'completely'). The PERMA Profiler has demonstrated high internal consistency (Cronbach alpha = 0.93) (Ryan et al., 2019).

Huppert and so conceptual framework

The Huppert and So conceptual framework was deemed by Hone, Jarden, Schofield et al. (2014) to be the most stringent conceptualisation of flourishing, and was found to have the highest internal consistency amongst the four frameworks (Cronbach alpha = 0.83). Therefore, the Huppert and So conceptual framework was utilized in the present study. The definition of flourishing conceptualized by Huppert and So (2013) was developed using internationally agreed criteria derived from the Diagnostic and Statistical Disorders (DSM-IV) of the American Psychiatric Association (1994) and the International Classification of Diseases (ICD-10) of the World Health Organization (1993). As the majority of common mental health disorders belong to two key diagnostic categories – Major Depressive Episode (DSM-IV)/Depressive Episode (ICD-10) and Generalised Anxiety Disorder – these categories were systematically examined and the mirror opposite symptoms associated with these disorders were determined.

Huppert and So subsequently developed a 10-item assessment of flourishing determined as meeting the following criteria: 1. A high level of 'positive emotion', as indicated by a score of 8 or above on a scale from 0 ('extremely unhappy') to 10 ('extremely happy'), 2. A high 'positive characteristics' rating, determined by the individual reporting in the highest two rankings on a 4-point Likert scale for four out of five positive characteristics (emotional stability, vitality, optimism, resilience, and self-esteem), and 3. A high 'positive functioning' rating, indicated by the individual reporting in the highest two rankings on a 4-point Likert scale for three out of four items relating to positive functioning (competence, engagement, meaning and positive relationships). Positive rankings in the 'positive emotion' and 'positive characteristics' domains assessed hedonic wellbeing while the 'positive functioning' domain captured expressions of eudemonic wellbeing.

To test their conceptual and operational definition of flourishing, Huppert and So utilized data from the European Social Survey, which included a representative sample of 43,000 individuals aged 15 and older from 23 countries. A wide variation of the prevalence of flourishing was found across European countries from a low of 10% in Slovakia, Russia and Portugal to a high of 41% in Denmark. These results concurred with other studies that have shown Nordic countries consistently rate the highest in happiness and life satisfaction (Biswas-Diener et al., 2010; Böhnke, 2005). Inter-item Spearman correlations were significant ($p < 0.001$) and positively correlated for all items ranging from 0.10 (engagement and emotional stability) to 0.49 (self-esteem and optimism).

To date, the Huppert and So conceptual framework has been applied in two epidemiological studies (Hone et al., 2015; Huppert & So, 2013), however, this conceptual framework has not been used for empirical investigations to measure the effect of interventions on the levels of flourishing amongst a cohort.

Interdisciplinary interventions to increase mental wellbeing

Over the past two decades there has been an increasing interest in a variety of psychological-based strategies for fostering positive psychological states and overall

mental wellbeing. These strategies, commonly referred to as Positive Psychology Interventions (PPIs) include fostering optimism, gratitude, hope, acts of kindness, and positive thinking. Whilst numerous studies have shown PPIs to significantly improve components of mental wellbeing, only three studies have investigated the influence of PPIs on flourishing, and no studies have used the Huppert and So conceptual framework. Firstly, Feicht et al. (2013) conducted a randomized controlled trial (n = 147) and reported significant improvements in flourishing scores using the Flourishing Scale (scored out of a maximum of 56 points) from 43 at baseline to 46 at four-week post-intervention ($p = 0.002$). The intervention involved a seven-week web-based multicomponent PPI applied in an occupational health setting. Secondly, Schotanus-Dijkstra et al. (2017) observed in a randomized controlled study (n = 275) involving a multicomponent PPI a significant increase in the percentage of individuals categorised as flourishing (from 7 to 34%, $p < 0.001$), assessed using the MHC-SF. Most recently, in a RCT involving 654 university students, Bendtsen et al. (2020) observed an 8.5 point increase in the median MHC-SF flourishing score among the intervention group in response to an online multicomponent PPI.

While PPIs are increasingly used and studied, the benefits of positive lifestyle behaviors represent a potential contributor to flourishing. Emerging work by (VanderWeele et al., 2019) has urged the inclusion of physical health into the flourishing construct. Historically, the discipline of 'Lifestyle Medicine' has focused on the prevention, management and reversal of chronic diseases, such as heart disease and diabetes, through the application of positive lifestyle behaviors including physical activity, diet, sleep, smoking cessation and minimizing alcohol consumption (Egger et al., 2011; Morton et al., 2016; Wright et al., 2017). However, there is growing literature demonstrating that the tenants of lifestyle medicine also benefit mental health and wellbeing (Firth et al., 2020; Firth et al., 2019; Jacka et al., 2017; Morton, 2018).

While extensive literature shows the connection between physical activity and physical health, the literature is scant examining the connection between physical activity and mental health and flourishing. In a longitudinal study of US adults (n = 5,789), Leibow et al. (2021) reported a bidirectional association between mental health and physical activity. The authors concluded that physical activity could improve mental health and those who had better mood and psychosocial functioning were more likely to improve their physical activity levels over time.

There is also clear evidence that physical activity is an effective method for preventing mental health disorders. In a prospective study involving Korean adults (n = 107,901), Kim et al. (2019) found that an active lifestyle reduced the incidence of depressive symptoms, regardless of sex, at one year follow up. Further, a meta-analysis of 49 prospective cohort studies (n = 266,939) observed that higher physical activity levels were associated with decreased odds ratios for developing depression, and the protective effect persisted across age, sex and geographical region (Schuch et al., 2018).

In the past decade, the benefits of regular physical activity for improving depression has been a topic of considerable research, culminating in three meta-analyses of randomized controlled trials (Josefsson et al., 2014; Krogh et al., 2011; Kvam et al., 2016). Further, physical activity is well-established as an intervention for depression, with results being comparable to antidepressant medications (Cooney et al., 2013; Kvam et al., 2016).

Similarly, there is limited but a growing body of evidence showing the link between nutrition and mental wellbeing (Akbaraly et al., 2009; McMartin et al., 2013). In a micro-longitudinal study on young adults (n = 403), Conner et al. (2015) observed that in early adulthood fruit and vegetable consumption may be associated with a wide range of well-being states indicative of flourishing. Johnson et al. (2017) implemented a 12-week community-based lifestyle intervention (n = 421) and found physical activity and healthy eating education significantly ($p < 0.001$) improved mental wellbeing at 3-month follow up (observed a 5-point increase in the median). In examining the food diaries of approximately 12,835 Australian adults, Mujcic and Oswald (2016) found that increased fruit and vegetable consumption was predictive of increased happiness, life satisfaction and wellbeing. Notably, consuming eight serves of fruit and vegetables a day was associated with psychological gains equivalent to moving from unemployment to employment. Further, the benefits of healthy eating on happiness preceded improvements in physical health.

There is also growing evidence that improving diet can reduce depressive symptoms (Jacka et al., 2014). In a meta-analysis of 21 studies (n = 117,229), Li et al. (2017) concluded that the Western-style eating patterns, consisting of high intakes of red and/or processed meat, refined grains, sweets and high fat dairy products, are associated with a higher risk of depression. Conversely a healthy diet, consisting of high intakes of vegetables, fruits, wholegrains, soy, fish and low-fat dairy, was found to be associated with a lower risk of depression.

A proliferation of sleep studies have also shown a strong connection between poor sleep hygiene and an increased risk of mental distress, including depression and anxiety (Mason & Harvey, 2014; Neckelmann et al., 2007). In a meta-analysis of 49 randomized controlled trials (n = 5,908), Gee et al. (2019) concluded that non-

pharmacological interventions designed to improve sleep had a positive impact on depressive symptoms.

Further, in a cross-sectional study of Lithuanian adults (n = 6,497 aged 45–72), Sapranaviciute-Zabazlajeva et al. (2017) found that healthy lifestyle factors such as physical activity and healthy eating increased the probability of higher psychological wellbeing. The authors also concluded that higher psychological wellbeing was positively associated with the consumption of fruit and vegetables and physical activity for both genders. Whilst the literature is sparse with regards to the influence of lifestyle interventions on the construct of flourishing, clearly lifestyle behaviours are linked to components of the flourishing assessment such as positive emotion.

An integrative approach

Positive psychology and lifestyle medicine strategies have demonstrated efficacy in improving metrics of mental wellbeing, however, they are rarely used together. In previous studies we have examined the effectiveness of an online multicomponent intervention that integrated positive psychology and lifestyle medicine strategies on metrics of mental health, including depression and anxiety (Morton et al., 2020; Renfrew et al., 2020). Notably, the change in effect size observed in our studies were relatively larger than those reported in two meta-analyses of PPIs that predominantly used a single-modality approach (Bolier et al., 2013; Sin & Lyubomirsky, 2009; White et al., 2019). This highlights the potential value of multicomponent interventions.

Online interventions

Online interventions are becoming increasingly well used due to their accessibility, scalability and cost-effectiveness. There are conflicting reports regarding the addition of human support (through personalised SMS, videoconferencing, telehealth, etc) on the outcomes of online wellbeing interventions. For example, a systematic review and meta-analysis of online and computer-based stress interventions observed that the effect size of guided studies were almost double that of unsupported studies (Heber et al., 2017). Conversely, a number of studies have found no significant differences between supported and unsupported interventions (Aardoom et al., 2016; Renfrew et al., 2020).

The present studies

Two studies were conducted to test the hypothesis that a 10-week online mental wellbeing intervention, that integrated strategies from positive psychology and lifestyle medicine, could affect the prevalence of flourishing. Study 1 was a randomised controlled trial that included a 12-week follow-up. Study 2 was a three-arm randomised comparative study in which the influence of adding modes of human support to the intervention was examined.

Method

Intervention

The present studies both used an intervention referred to as 'The Live More Project' or 'The Lift Project' (Morton et al., 2017; Renfrew et al., 2020). The intervention is a 10-week program that integrated evidence-based strategies from positive psychology and lifestyle medicine for improving mental wellbeing (see Table 1).

The intervention used an experiential pedagogical framework of Learn, Experience, Think, and Share (LETS), facilitated through an e-learning management system (Morton et al., 2020). In each one-hour weekly session, the participants viewed a themed educational video that presented an evidence-based strategy for promoting mental wellbeing. The aim of the

Table 1. An overview of weekly topics and challenges for the intervention.

Week/Topic	Daily Challenge	Weekly Challenge
1. Speak positively	Offer a genuine compliment.	Memorise an inspirational text or saying.
2. Move dynamically	Spend 30 minutes of moderate exercise or 10,000 steps.	20 minutes of guided resistance exercises.
3. Immerse in an uplifting natural environment	Spend 30 minutes in an uplifting natural environment.	Experience a sunrise.
4. Immerse in a positive social environment	Do something intentional to show you care.	Forgive someone who has hurt you.
5. Look to the positive	Spend 15 minutes to reflect on three things that went well.	Write a letter of gratitude to someone and share it with them.
6. Eat nutritiously	Eat eight serves of plant-based food.	Prepare a high-fibre, plant-based meal with one or more friends.
7. Rest – sleep	Spend eight hours in bed without a device.	Spend an evening by firelight.
8. Rest – from stress	Spend 15 minutes in a quiet place, relaxing and being mindful of surroundings.	Take a day off work and a digital Sabbath (going 'off-line' for 24 hours to recharge).
9. Serving others	Perform a random act of kindness.	Use signature strength to perform an act of service.
10. What does it take to flourish?	Continue challenges found to be helpful.	Continue challenges found to be helpful.

intervention was to promote positive behaviour change through education by encouraging participants to apply what they had learnt through involvement in daily and weekly challenges (see Table 1). A gamification element was added to the intervention through 'challenge points' that the participants were awarded for engaging in the challenges. Points were recorded on an e-learning management system and the participants were ranked on a leaderboard. A maximum of 100 challenge points could be earned each week (i.e. maximum of 1,000 points for the 10-week intervention). Participants were also given the opportunity to interact with each other on a social forum for encouragement and accountability. Participants were able to post photos and comments relating to the challenges and access an e-book to expand their knowledge on the content presented in the videos. An e-workbook was also made available for journaling.

Study 1

Study 1 was an unblinded, randomized controlled trial (RCT) with an intervention and a wait-list control group. All procedures involving human subjects were approved by the Avondale Human Research Ethics Committee [project number 2017:13]. The trial protocol, which was registered at the Australian New Zealand Clinical Trials Registry (ACTRN12619000993190), commenced in September 2017 and concluded in February 2018. The wait-list control group had the opportunity to participate in the intervention free of charge at the completion of the study.

Randomization

The participants were randomized into the intervention or control group by a non-member of the research team using computer random number generation. Participants were then notified of their group allocation and provided online informed consent before screening took place.

Participants

Five hundred and ten individuals from a faith-based organization across Australasia self-selected to participate in the study (see Figure 1). The intervention was advertised as a mental wellbeing program in the faith-based organization's internal communication channels such as bulletins, periodicals and magazines.

As shown in Figure 1, of the 510 individuals who applied to participate in the study, only two did not meet the inclusion criteria which included: 18 years and older; fluent in English; having email and internet access; and were an Australian or New Zealand resident. The subjects agreed to participate in either arm of the study before randomization. A total of 421 individuals then completed the baseline assessment and entered the study (210 intervention, 211 control). A total of 366 (86.9%) participants completed the post-intervention questionnaire (169 intervention, 197 control participants) and 324 (77.0%) completed the 12 weeks post-intervention questionnaire (164 intervention, 160 control).

The baseline characteristics of the groups are shown in Table 2. There was no significant difference between the groups in any of the demographic measures, and both groups were equally distributed for age and gender. Combined, the 421 participants had a mean age of 47.3 ± 14.6 years and were predominantly female (70.8%), of a white/Caucasian background and tertiary educated.

Outcomes and measures

As shown in Figure 1, a self-reported wellness questionnaire that included questions about the participants' sociodemographic characteristics (age, gender, ethnicity, marriage status, level of education, and country of birth) and the ten-item Huppert and So conceptual framework was used to measure flourishing (Huppert & So, 2013). As explained in the introduction to this paper, participants were rated as flourishing if they reported 'positive emotion' (one item) and strong endorsements of 'positive characteristics' (four out of five items) and 'positive functioning' (three out of four items). The questionnaire was administered at baseline (Week 1), post-intervention (Week 12) and 12 weeks post-intervention (Week 24). The wait-list control group undertook the same measurements in the same weeks as the intervention group.

Sample size

Published pilot data (Morton et al., 2020) were used for the sample size calculation, based on the following: equal allocation of participants to each group; a 20% increase in the treatment group; a 40% attrition rate, based on reported levels of attrition in other online interventions (Gander et al., 2016); and 80% power and a significance level of 0.05 (95% confidence interval).

Statistical analyses

Data were analyzed using IBM SPSS Statistics (version 25). Descriptive statistics, involving frequencies, means, standard deviations and confidence intervals were used to present the data. An exact McNemar's test was

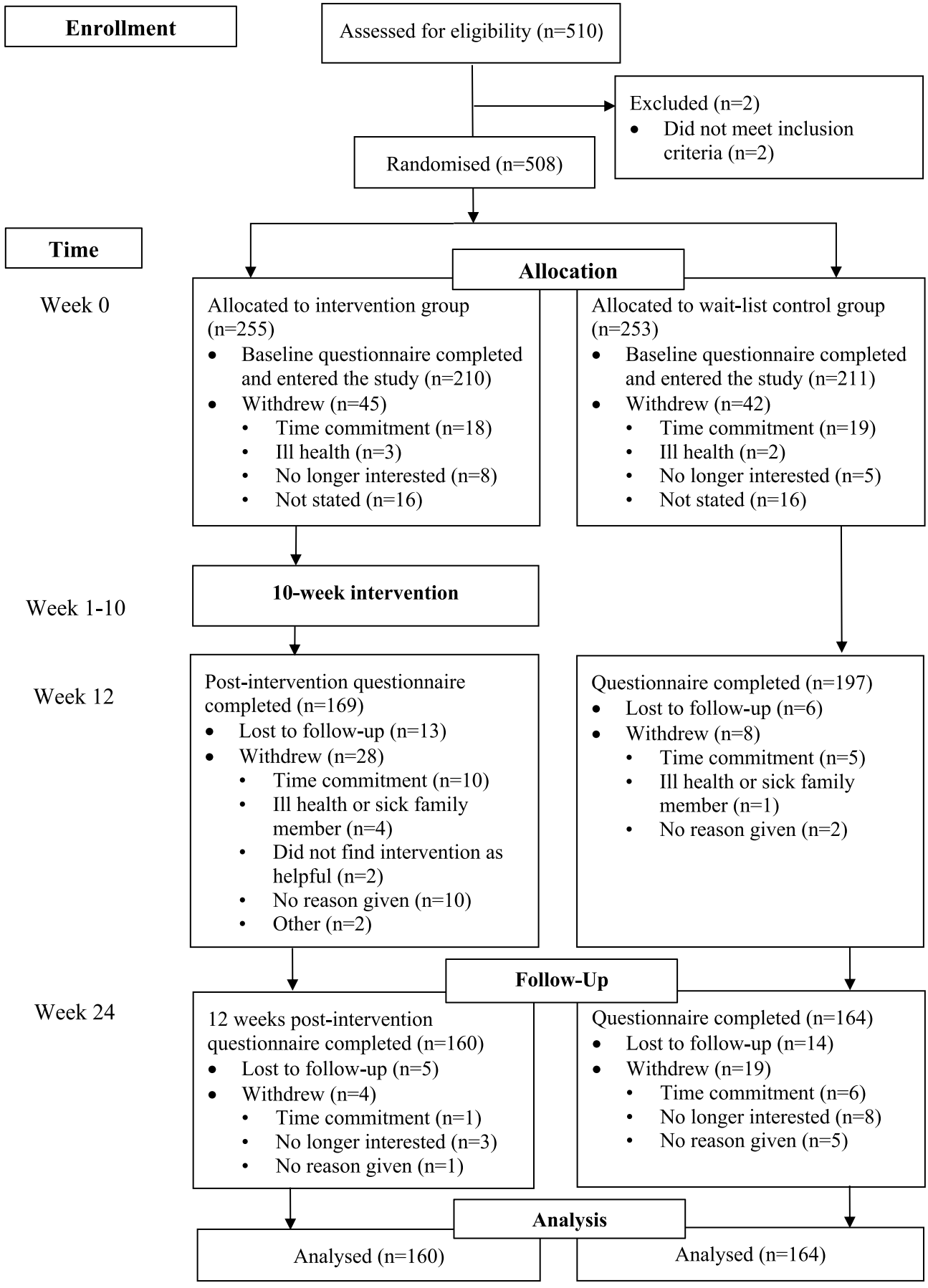


Figure 1. Study 1 CONSORT diagram.

Table 2. Study 1 Participant baseline characteristics.

Baseline characteristics	Intervention (n = 210)	Control (n = 211)
Age, mean (s.d.)	47.9 (15.0)	46.7 (14.4)
Gender, n (%)		
Men	59 (28.1)	64 (30.3)
Women	151 (71.9)	147 (69.7)
Ethnicity, n (%)		
White/Caucasian	177 (84.3)	168 (79.6)
Asian	10 (4.8)	10 (4.7)
Pacific Islander	2 (1.0)	17 (8.1)
Spanish/Hispanic/Latino	2 (1.0)	6 (2.8)
Indigenous	3 (1.4)	0 (0.0)
Black/African American	7 (3.3)	5 (2.4)
Other	9 (4.3)	5 (2.4)
Education status, n (%)		
Primary/Elementary	1 (0.5)	1 (0.5)
Secondary/High School	21 (9.8)	38 (18.0)
Tertiary/University Undergraduate	100 (47.7)	90 (42.7)
Tertiary/University Postgraduate	88 (42.0)	82 (38.9)

performed to analyse the changes in the proportion of participants flourishing from baseline to post-intervention and 12 weeks post-intervention.

Results

As shown in Figure 2, the intervention group observed a 17.2 percentage point increase (30.3 to 47.5%, $p < 0.001$) in those reporting 'flourishing' from baseline to post-intervention, while only a 1.3 percentage point increase (29.8% to 31.1%, $p = 0.360$) was observed in the control group. At 12-weeks post-intervention, the intervention group sustained a significant increase in the prevalence of flourishing from baseline levels (30.3 to 48.8%, $p < 0.001$), while the control group experienced a 1.8 percentage point reduction compared to baseline (29.8 to 28.0%, $p = 0.883$).

Discussion

Study 1 revealed two key findings. First, to the authors knowledge, this is the first RCT to show that an online interdisciplinary intervention, integrating strategies from both positive psychology and lifestyle medicine, can improve the prevalence of flourishing. Second, the outcomes of the intervention were sustained at 12 weeks post-intervention. Given the scalability of online interventions such as the one used in the present study, these findings are important as even modest improvements in wellbeing may confer large benefits in the prevention of mental illness at a population-level (Huppert, 2009; Schotanus-Dijkstra et al., 2016).

Study 2

The study was a multi-arm, unblinded randomized comparative design in which participants were allocated to three groups, differing in the mode of human support offered in addition to the standard online intervention. All procedures involving human subjects were approved by the Avondale Human Research Ethics Committee [project number 2018:09]. The trial, which was registered at the Australian New Zealand Clinical Trials Registry (ACTRN12619001009101), was conducted from July to December 2018.

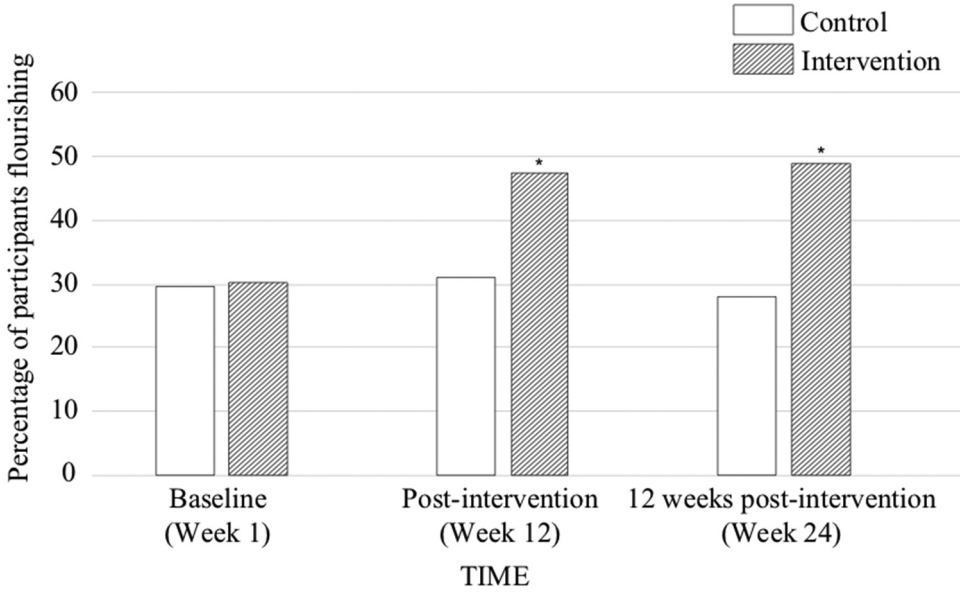


Figure 2. Changes in the percentage of participants utilizing the Huppert and So conceptual framework.
* denotes significant change from baseline ($p<0.001$).

Randomization

Utilising the same procedure as Study 1, the participants were randomized into one of the three groups:

- Group 1: Standard – fully automated emails only (S).
- Group 2: Standard plus personalised SMS support (S+ pSMS).
- Group 3: Standard plus videoconferencing support (S+ VCS).

Participants

As shown in Figure 3, 605 individuals self-selected to participate and met the inclusion criteria: 18 years and over, mobile phone with SMS capability, email and internet access, fluent in English, and were an Australian or New Zealand resident. The participants were then randomized into three groups: S (n = 202), S+ pSMS (n = 202) and S+ VCS (n = 201). A total of 458 completed the baseline questionnaire and entered the study (S = 157, S+ pSMS = 163, S+ VCS = 138). At 12 weeks, 320 (69.9%) participants completed the post-intervention questionnaire (S = 103, S+ pSMS = 114, S + VCS = 103). Advertising was conducted from July to September 2018 for this mental wellbeing program using internal communication channels, online marketing, social media and email strategies.

The baseline characteristics of the group are shown in Table 3. the 458 participants had a mean age of 47.3 ± 14.6 years and were predominantly female (77.1%), of a white/Caucasian background and tertiary educated.

Sample size, outcome measures and statistical analyses

The same assumptions for sample size calculation were based on the same assumptions as used in Study 1 and the same outcome measures were captured.

Results

As shown in Figure 4, all modes of human support groups observed a significant ($p < 0.001$) within-group improvement in those reporting 'flourishing' from baseline to post-intervention (percentage point increase of: S = 15.5, S+ pSMS = 20.2, S+ VCS = 22.3, and Combined = 19.4). A one-way analysis of variance (ANOVA) indicated no significant ($p = 0.651$) between-group differences. The attendance of the video conference support sessions (VCSSs) in the S+ VCs group was 2.8 out of 10 and 35.9% did not attend any session.

Discussion

Building on the findings of Study 1, this randomized comparative design investigated the efficacy of the intervention using three modes of human support. Significant improvements in the proportion of participants flourishing was observed in all groups, and the results were comparable to those observed in Study 1. Interestingly, Study 2 found that the mode of human support had no effect, however, attendance of the video support sessions was very low, and hence this group was operationally similar to the standard online delivery group (S).

Participant characteristics and change in flourishing status

The data from Studies 1 and 2 were combined to examine whether characteristics of the participants related to change in flourishing status from baseline to post-intervention. Presented in Table 4 are the age, gender, ethnicity and education profiles of those who were: flourishing at baseline but not at post-intervention (Regressed); not flourishing at either baseline nor post-intervention (Not Flourishing – No Change); not flourishing at baseline but were at post-intervention (Improved Flourishing); flourishing at both baseline and post-intervention (Flourishing – No Change). ANOVA indicated that there was a small but significant age difference between the groups ($F = 6.203$, $df = 3$, $p < 0.001$) with the post hoc analysis indicating that those who improved their flourishing status trended towards being younger than those who regressed ($p = 0.052$). Over four times more males improved their flourishing status as compared to those who regressed, which compared favourably to less than 3 times for the females ($\chi^2 = 14.854$, $df = 3$, $p = 0.002$). Ethnicity had no effect on change in flourishing status ($\chi^2 = 17.782$, $df = 18$ $p = 0.470$), however, a shift towards flourishing was more evident among those with lower education levels ($\chi^2 = 21.612$, $df = 9$, $p = 0.010$).

Analysis of the data from Study 1 indicated that change in flourishing status from baseline to 12 weeks post-intervention was not related to age ($F = 0.200$, $df = 3$, $p = 0.896$), gender ($\chi^2 = 1.813$, $df = 3$, $p = 0.612$), ethnicity ($\chi^2 = 19.671$, $df = 18$, $p = 0.352$) or education level ($\chi^2 = 7.793$, $df = 9$, $p = 0.555$).

General discussion

The two studies described support the hypothesis that a 10-week online interdisciplinary mental wellbeing intervention, that combined strategies from positive

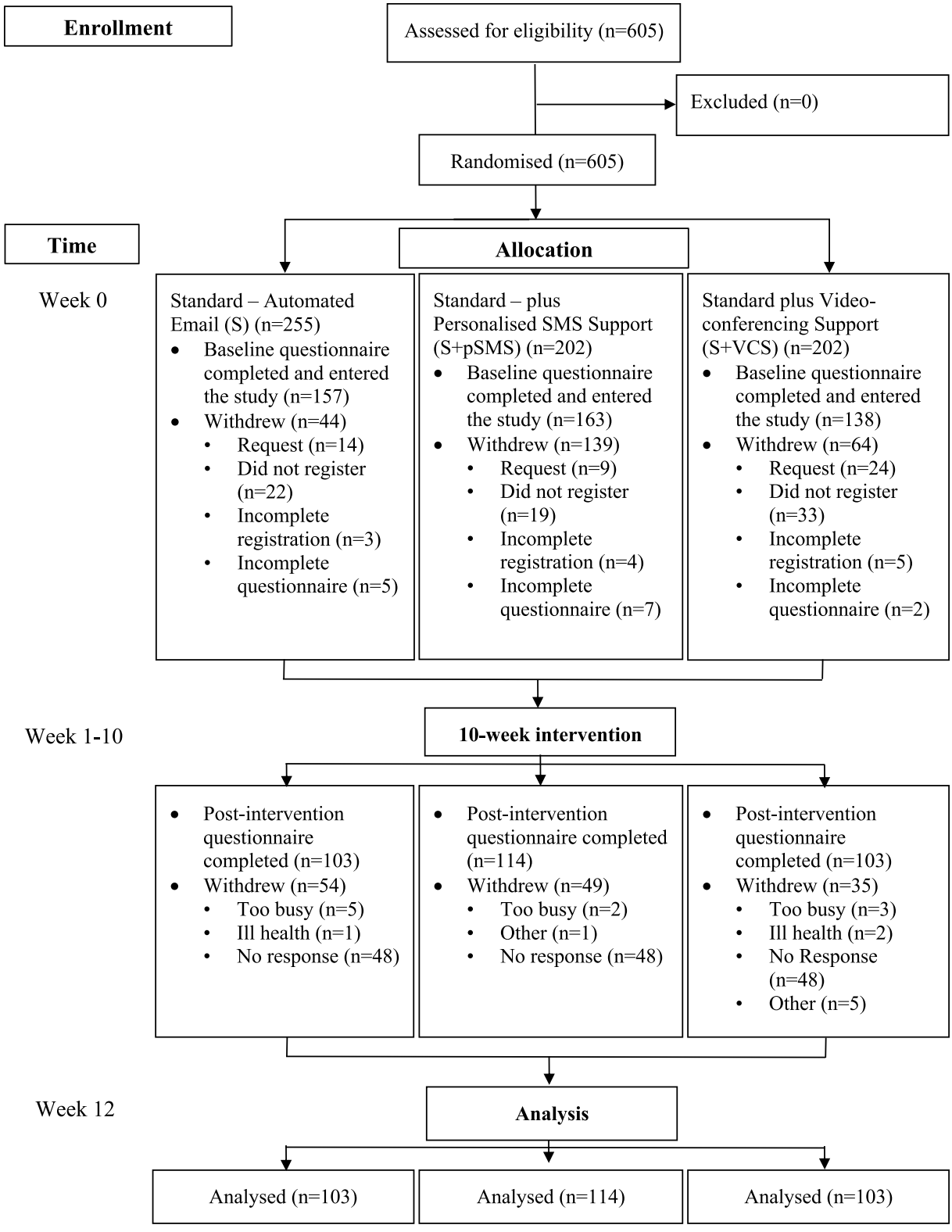


Figure 3. Study 2 CONSORT diagram.

psychology and lifestyle medicine, can increase human flourishing, as quantified by the Huppert and So conceptualization. These findings are notable as the promotion of flourishing can significantly reduce the prevalence of mental disorders (Grant et al., 2013), as well as provide a buffer against mental illness. Interestingly, despite the female bias in the participation of the intervention, which is typically found in PPIs

Table 3. Study 2 participant baseline characteristics.

Baseline characteristics	Group 1 S	Group 2 S+ pSMS	Group 3 S+ VCS	Combined
Age, mean (s.d.)	45.6 (13.9)	46.5 (13.4)	44.3 (13.9)	45.5 (13.7)
Gender, n (%)				
Men	33 (21.0)	37 (22.7)	31 (22.5)	101 (22.1)
Women	124 (79.0)	126 (77.3)	106 (76.8)	356 (77.1)
Other	0	0	0	1 (0.2)
Ethnicity, n (%)				
White/Caucasian	124 (79.0)	118 (72.4)	110 (79.7)	352 (76.9)
Asian	5 (3.2)	11 (6.7)	2 (1.4)	18 (3.9)
Pacific Islander	12 (7.6)	16 (9.8)	7 (5.1)	35 (7.6)
Spanish/Hispanic/Latino	5 (3.2)	3 (1.8)	4 (2.9)	12 (2.6)
Indigenous	0	0	1 (0.7)	1 (0.2)
Black/African American	4 (2.5)	3 (1.8)	3 (2.2)	10 (2.2)
Other	7 (4.5)	12 (7.5)	11 (8.0)	30 (6.6)
Education status, n (%)				
Primary/Elementary	0	2 (1.2)	0	2 (0.4)
Secondary/High School	36 (22.9)	39 (23.9)	24 (17.4)	99 (21.6)
Tertiary/University Undergraduate	74 (47.2)	65 (39.9)	75 (54.3)	214 (46.7)
Tertiary/University Postgraduate	47 (29.9)	57 (35)	39 (28.3)	143 (31.3)

(Gander et al., 2016), there was a trend for males to perform better than females with regards to improving and maintaining their flourishing status. Further investigation is warranted to understand the gender influence on mental wellbeing interventions.

To date, only three studies have investigated the effect of a RCT on flourishing, and in each case the interventions only employed psychological strategies, as compared to an interdisciplinary approach, and they did not use the Huppert and So conceptual framework for assessing flourishing (Bendtsen et al., 2020; Feicht et al., 2013; Schotanus-Dijkstra et al., 2017). Prior to the present studies, the Huppert and So conceptual framework was only applied from an epidemiological perspective (Hone, Jarden, Schofield et al., 2014; Huppert & So, 2013). Hence, the approach adopted in the present studies, using the Huppert and So flourishing construct as a measure of the effectiveness of an intervention, is novel.

While the positive outcomes observed in these studies are encouraging, further work needs to be done to

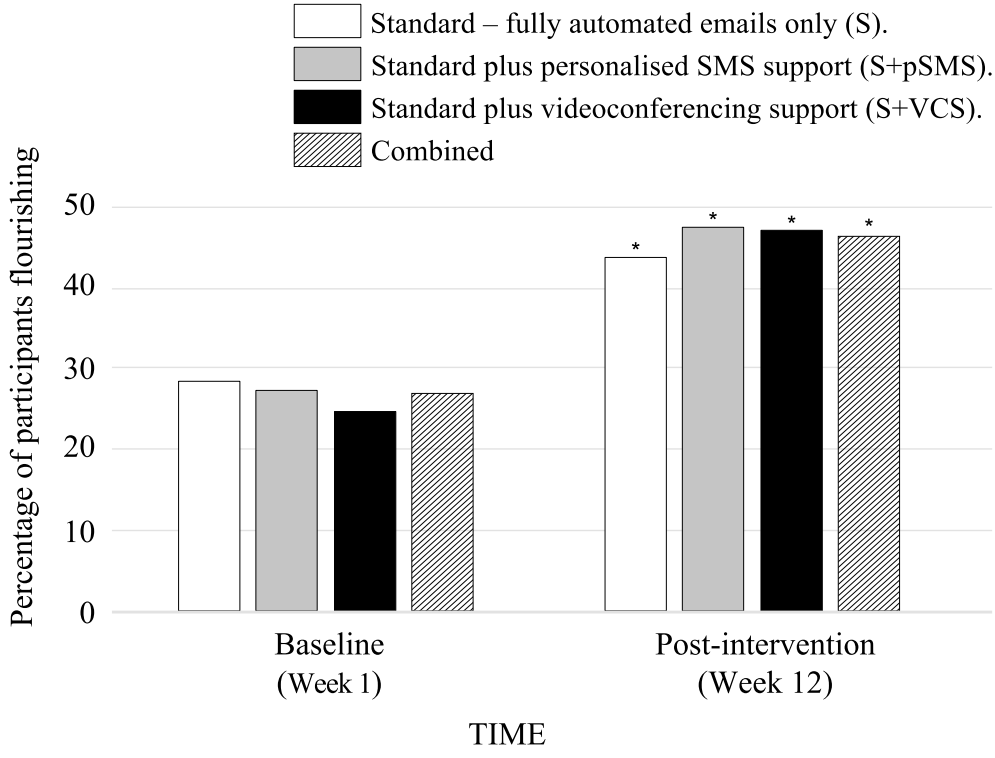


Figure 4. Changes in the percentage of participants utilizing the huppert and so conceptual framework.

Table 4. Participant characteristics and the change in flourishing status.

Baseline characteristics	Regressed	Not Flourishing – No Change	Improved Flourishing	Flourishing – No Change
Age, mean (s.d.)	51.3 (13.1)	44.8 (13.5)	46.7 (14.2)	51.4 (14.9)
Gender, n (%)				
Men (n = 110)	8 (7.3)	36 (22.7)	34 (30.9)	32 (29.1)
Women (n = 380)	38 (10.0)	182 (47.9)	103 (27.1)	57(15.0)
Ethnicity, n (%)				
White/Caucasian	36 (8.9)	180 (44.6)	112 (27.7)	76 (18.8)
Asian	5 (22.7)	7 (31.8)	8 (36.4)	2 (9.1)
Pacific Islander	2 (12.5)	7 (43.8)	4 (25.0)	3 (18.8)
Spanish/Hispanic/Latino	1 (12.5)	5 (62.5)	1 (12.5)	1 (12.5)
Indigenous	1 (33.3)	2 (66.7)	0	0
Black/African American	1 (9.1)	7 (63.6)	2 (19.2)	1 (9.1)
Other	0	10 (38.5)	10 (38.5)	6 (23.1)
Education status, n (%)				
Primary/Elementary	0	0	0	2 (100.0)
Secondary/High School	3(4.0)	36 (48.0)	24 (32.0)	12 (16.0)
Tertiary/University Undergraduate	24 (10.1)	112 (47.1)	70 (29.4)	32 (13.4)
Tertiary/University Postgraduate	19 (10.9)	70 (40.0)	43(24.6)	43 (24.6)

investigate the generalizability of the findings beyond the cohorts used, which consisted of mostly females from a faith-based organization. It is notable that the prevalence of flourishing observed at baseline in Study 1 (29.8% control, 30.3% intervention) and Study 2 (S = 28.3%, S+ pSMS = 27.3%, S+ VCS = 24.3%, and Combined = 26.6%) were comparable to previous findings on a broader New Zealand population (24%) that also used the Huppert and So conceptual framework (Hone, Jarden, Schofield et al., 2014), suggesting that the cohorts were somewhat representative of the broader population in terms of the proportion of those flourishing. However, the low attrition rates observed in the studies indicates a high level of motivation, which might be related to unique characteristics of the cohorts and that the participants were self-selected. Certainly, further investigations involving different demographics and people groups are needed.

A unique aspect of the present studies was the interdisciplinary nature of the intervention employed, which integrated strategies from both positive psychology and lifestyle medicine. As discussed previously, there have been three PPIs using a multicomponent approach to increase flourishing (Bendtsen et al., 2020; Feicht et al., 2013; Schotanus-Dijkstra et al., 2017). However, none have incorporated lifestyle medicine practices such as nutrition, physical activity, sleep and exposure to natural environments that were incorporated in the present studies. In his seminal paper, Walsh (2011) identified eight lifestyle-based contributors to mental health and wellbeing: exercise; nutrition and diet; nature; relationships; recreation and enjoyable activities; relaxation and stress management; religious and spiritual involvement, and contribution and service. To optimise the effectiveness of mental wellbeing interventions it is prudent that an interdisciplinary approach, incorporating several or all of these contributors, be considered and adopted. To date, most wellbeing interventions operate from a lifestyle medicine or psychological framework. However, there is a need for a more collaborative approach as greater benefits may be realized.

In a recent article, VanderWeele et al. (2020) surmised the recommendations of an interdisciplinary workshop on the measurements of wellbeing and identified that existing flourishing scales tended to include only psychological factors. Indeed, this is the case in the scales utilised and appraised by Hone, Jarden, Schofield et al. (2014). The authors asserted that there is no model that fits all scenarios, and hence the measurement of flourishing will depend on the purpose and context of the wellbeing measurement. Further, the inclusion of lifestyle factors and markers of physical health should be considered in flourishing scales moving forward.

Interest in online mental health and wellbeing interventions has increased over the past decade due to technological advances (Deady et al., 2017) and they may present a scalable, low-cost solution to alleviating the growing mental health burden. While online interventions have many benefits and can overcome barriers of face-to-face interventions, such as anonymity and lack of motivation to attend a venue (Richards et al., 2015), it is important to consider design aspects when developing these interventions to optimise engagement and outcomes. The intervention used in the present studies adopted elements that have been shown to increase online engagement such as gamification (leaderboards, badges and points) (Looyestyn et al., 2017) and access to an e-learning management system (including lessons, videos, and an e-workbook), and these may have contributed to the impressive outcomes observed in the present studies. Certainly, further research is required to better inform the design of online interdisciplinary mental

wellbeing interventions to optimise engagement. Counterintuitively, Study 2 found that the provision of videoconferencing might not be well received by many individuals participating in an online intervention. Further elucidating the factors that may or may not contribute to participants' engagement in an online mental wellbeing intervention, and the associated effectiveness of the intervention, is important moving forward.

Strengths

The present studies make a number of contributions to the literature on flourishing. To our knowledge, they are the first to demonstrate that an online multicomponent intervention that integrates strategies from the fields of positive psychology and lifestyle medicine can significantly increase the number of participants flourishing within an experimental cohort, using the most stringent criteria for flourishing (Hone, Jarden, Schofield et al., 2014). Hence, online mental wellbeing interventions might provide a viable strategy for reducing the prevalence of mental illnesses. Secondly, both studies used a high-powered design and involved a larger sample size than most of the previous interventions focused on flourishing (Feicht et al., 2013; Schotanus-Dijkstra et al., 2017), as well as those reviewed in a recent meta-analyses of PPIs (White et al., 2019). Thirdly, the broad distribution in the participants' age, ranging from 18 to 88 years old, across a geographically diverse area can be considered a strength of the study. Finally, the study had a relatively low attrition rate (Study 1 = 20.4% at 12-weeks post-intervention, Study 2 = 30.1% at post-intervention) compared to 45% typically observed in PPI's (Gander et al., 2016), which may be attributed to the pedagogical framework used in the intervention and the engaging interactive components included.

Limitations

There are a number of limitations to the study that mostly relate to the generalizability of the findings. Firstly, the participants were self-selected and hence may have had greater motivation and higher readiness for change than the general population. Secondly, unique characteristics of the study cohorts (i.e. female biased and faith-based) may diminish the transferability of the outcomes to different populations. Finally, the intervention targeted a subclinical population and therefore does not inform the effectiveness of the intervention on a clinical cohort. However, the results of the present studies broadly align with the findings of Schotanus-Dijkstra et al. (2017) who did target a clinical population, but this is an important area for future research.

Practical implications and future research

The results from the present studies have important implications for the literature on flourishing as well as mental health practice as they contribute to the limited knowledge of how to increase flourishing within the general population. Additionally, Study 1 was the first RCT to combine evidence-based positive psychology and lifestyle medicine strategies in an interdisciplinary design to improve flourishing scores. The present studies suggest that online interventions may be a viable low-cost and scalable option for mental health promotion.

Future research is needed in four key areas. Firstly, further investigation is needed to determine the effectiveness of online multicomponent interventions incorporating strategies from positive psychology and lifestyle medicine, such as that used in this study, on clinical populations. Secondly, additional research is warranted to understand the gender responsiveness to mental wellbeing interventions. Thirdly, the influence of various factors such as human support and gamification on the up-take and responsiveness to online mental wellbeing interventions warrants further exploration, as well as the relative impact these have on the outcomes of the intervention. Lastly, healthy lifestyle behaviours are not commonly emphasised in the promotion of mental wellbeing, however, future studies could investigate the contribution that changes in physical health, mediated through lifestyle behavioural change, makes to the measurement of flourishing.

Conclusion

The two studies reported in this article demonstrate that online interdisciplinary mental wellbeing interventions that combine strategies from positive psychology and lifestyle medicine, can increase flourishing. The findings of these studies are relevant to governments, policy makers, researchers, and clinicians as it suggests that an interdisciplinary online multicomponent approach using gamification, e-learning management system and social forum can significantly improve flourishing and potentially provide a low-cost scalable solution at a population-level.

Abbreviations

ANOVA: Analysis of Variance
DSM-IV: Diagnostic and Statistical Disorders
ICD-10: International Classification of Diseases
MHC-SF: Mental Health Continuum Short Form
PPI: Positive Psychology Intervention
RCT: Randomized Controlled Trial

S: Standard group
S+VCS: Standard plus videoconferencing support
S+pSMS: Standard plus personalised short message service group
LETS: Learn, Experience, Think and Share

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Author's contribution

GP, DM, & JM designed the study. GP & DM developed the intervention. GP drafted the manuscript and coordinated the trial. GP & MR collected the data. GP analyzed the data. DM & JM provided supervision in the coordination of the trial and analyzing the data. DM & JM were major contributors in providing supervision in writing the manuscript. DM, JM, JH, MR provided critical revision of the article. All authors read and approved the final manuscript.

Consent for publication

Not applicable.

Disclosure statement

The authors declare that they have no competing interests to declare. GP is Executive Director of ELIA Wellness that promotes a version of the intervention used in this study through the faith-based organisation's network and community.

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Data availability

The datasets used and analysed during the current study are available from the corresponding author upon reasonable request.

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