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**A Local Community Course That Raises Mental  
Wellbeing and Pro-Sociality**

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## **Abstract**

Although correlates of mental wellbeing have been extensively studied, relatively little is known about how to effectively raise mental wellbeing in local communities by means of intervention. We conduct a randomised controlled trial of the "Exploring What Matters" course, a scalable social-psychological intervention aimed at raising general adult population mental wellbeing and pro-sociality. The manualised course is run by non-expert volunteers in their local communities and to date has been conducted in more than 26 countries around the world. We find that it has strong, positive causal effects on participants' self-reported subjective wellbeing (life satisfaction increases by about 63% of a standard deviation) and pro-sociality (social trust increases by about 53% of a standard deviation) while reducing measures of mental ill health (PHQ-9 and GAD-7 decrease by about 50% and 42% of a standard deviation, respectively). Impacts seem to be sustained two months post-treatment. We complement self-reported outcomes with biomarkers collected through saliva samples, including cortisol and a range of cytokines involved in inflammatory response. These move consistently into the hypothesised direction but are noisy and do not reach statistical significance at conventional levels.

JEL Codes: C93, I12, I31

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# 1. Introduction

For decades, enormous academic effort has been put into exploring the causes and consequences of wellbeing (Diener et al., 1999; Dolan et al., 2008; De Neve et al., 2012a; Layard et al., 2014). Health (especially mental health), being partnered, and social contacts account for more than three quarters of the explained variance in adult people's life satisfaction (Clark et al., 2018; Frijters et al., 2020). At the same time, there is growing evidence showing that how satisfied people are with their lives is an important predictor of life outcomes, including health and longevity (Danner et al., 2001), income and productivity (De Neve and Oswald, 2012b; Oswald et al., 2015), or pro-sociality (Dunn et al., 2008; Akinin et al., 2013).

However, despite this large and growing evidence base, little is known about how to effectively increase the wellbeing of the general adult population by means of intervention. At the same time, average wellbeing in many developed countries has been stagnant, despite substantial rises in economic living standards (Easterlin et al., 1974, 2010). In the nationally representative UK Household Longitudinal Survey ("Understanding Society"), for example, average life satisfaction, measured on a scale from one to seven whereby higher values denote higher wellbeing, was not significantly higher in 2016 than in 1996 (5.3 vs. 5.2), despite large rises in real incomes.<sup>1</sup> Reported prevalence of depression, anxiety, loneliness, and social exclusion have, if anything, increased in recent years (Banks et al., 2015; Global Burden of Disease Study, 2016).

The interventions that have been tested for raising wellbeing have typically been narrow in focus, looking at specific, often clinical target groups and at-risk populations such as people suffering from depression and anxiety (Taylor et al., 2017) or bodily pain (Hausman et al., 2014).<sup>2</sup> A notable exception is Heintzelman et al. (2019): the authors evaluate the impact of ENHANCE, a 12-week wellbeing course targeted at the general adult population in their local communities which is, when delivered in groups, led by graduate-level trained clinicians. It focuses primarily on positive habits, skills, and attitudes. During this course, a new skill is introduced every week, participants practice that skill, and then write about their experiences.

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<sup>1</sup> Similar numbers can be found in the Household, Income and Labour Dynamics in Australia Survey (life satisfaction, zero-to-ten scale, 2001: 8.0, 2016: 7.9) and German Socio-Economic Panel Study (life satisfaction, zero-to-ten scale, 1984: 7.4, 2016: 7.4).

<sup>2</sup> See Sin and Lyubomirsky (2009) and Bolger et al. (2013) for meta-analyses.

The authors find that it has strong, positive impacts on participants' wellbeing up to six months post-treatment.

We evaluate the impact of the "Exploring What Matters" course – a local community intervention aimed at raising general adult population mental wellbeing and pro-sociality. Besides contents, it differs from existing interventions in at least two critical implementation aspects: first, the manualised course is led by non-expert volunteers rather than trained clinicians, making it more scalable. Second, due to the higher scalability, it is normally delivered face-to-face in the local communities of course leaders and participants.

The "Exploring What Matters" course is run by Action for Happiness, a registered charity in England, which was launched in 2011 and has become a global movement with more than 175,000 members across 180 countries and over one million followers online. The charity aims to help people take action to create more happiness, with a focus on pro-social behaviour to bring happiness to others around them. Its patron is the Dalai Lama, who helped to launch the "Exploring What Matters" course in London in 2015.

We find that the course has strong positive impacts, raising participants' self-reported subjective wellbeing while reducing measures of mental ill health (PHQ-9 for depression and GAD-7 for anxiety). It also shifts participants' attitudes towards more pro-sociality. Impacts are large: the course increases participants' life satisfaction on a zero-to-ten scale by about one point, which is more than being partnered as opposed to being single (+0.6) or being employed as opposed to being unemployed (+0.7) (Clark et al., 2018). Impacts are sustained at a follow-up two months post-treatment. Biomarkers collected through saliva samples, including cortisol and a range of cytokines involved in inflammatory response, move consistently into the hypothesised direction but are noisy and do not reach statistical significance at conventional levels.

The "Exploring What Matters" course brings together participants in face-to-face groups to discuss what matters for a happy, meaningful, and virtuous life. Participants come from across society, spanning a wide range of ages and socio-economic backgrounds. They broadly fall into two main categories: "seeking", i.e. people who are unhappy and looking for answers; and "spreading", i.e. people who care about happiness and want to learn more, or want to share these ideas with others. Participants span a wide range of ages and socio-economic backgrounds.

The course is manualised and scalable: each course is led by two volunteers – screened by Action for Happiness for motivation and skills, and once approved, provided with structured resources – as facilitators on an unpaid basis in their local communities.<sup>3</sup> Recruitment of course leaders follows a carefully documented, standardised process: each candidate completes a Leader Registration process sharing their motivation and skills and is given clear instructions on what is required. Once potential course leaders have a co-leader, venue, and dates in mind, they complete a Course Application process. The team at Action for Happiness reviews this application and, if all criteria are met, arranges a call to discuss next steps.<sup>4</sup> Once a course is fully approved, course leaders receive on-going guidance and support. There is also a post-course follow-up process.<sup>5</sup>

Participants sign up online, and when doing so, are asked to make a donation; donations aim to cover the implementation costs of the course (implementation costs are about £90 per participant, including variable costs for course materials as well as allocated fixed costs). Donations are voluntary and participants can take part without donating. The core function of donations is to make the course financially sustainable, accessible to everyone regardless of their financial situation, and scalable. Besides that, they aim at raising course attendance, by exploiting the notion of sunk costs and loss aversion.<sup>6</sup> The course consists of eight consecutive weekly sessions lasting between two and 2.5 hours each. Each of these sessions builds on a thematic question, for example, what matters in life, how to find meaning at work, or how to build happier communities. Each of these questions, in turn, is rooted in scientific evidence on mental wellbeing and pro-sociality based on an extensive, internal review of the literature on subjective wellbeing, mental health, and pro-sociality, which is summarised in King (2016), as well as insights from evidence on motivation and group learning styles. The course thus

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<sup>3</sup> Although the course is highly manualised, some degree of adaptation is possible. For example, course leaders may choose the most appropriate venue or allow for more group discussion time. However, they are encouraged to stick closely to the course guide.

<sup>4</sup> Course leaders have a similar demographic profile as course participants, with a slightly higher average age. 58% are female. 58% are between 31 and 50 years old, 25% between 18 and 30, and 17% between 51 and 70. They tend to have higher than average levels of life satisfaction and social trust (both about 7.9 on zero-to-ten scales). Some of them have an existing interest in mindfulness or positive psychology (which is not a prerequisite to lead the course), and the majority has some experience of open group discussions, coaching, peer mentoring, or other activities to engage with people in their local communities.

<sup>5</sup> Supplementary Materials II includes a link to the detailed documentation of the recruitment process of course leaders.

<sup>6</sup> Unfortunately, we do not have data on the donation amount per participant, and hence cannot study heterogeneity of course outcomes depending on donation amounts. As we are evaluating the impact of six courses only, we cannot study heterogeneity of course outcomes by volunteer due to lack of power (there are only six volunteers leading these courses).

followed an evidence-based design strategy, with feedback on course contents from relevant subject experts.

Course delivery itself is rooted in psychological self-determination theory (Ryan and Deci, 1985, 2000, 2012), which articulates three fundamental human needs: autonomy, relatedness, and competence. The course builds *(i)* autonomy by helping participants discover for themselves what matters for their lives, using a weekly mindfulness exercise, gratitude exercise, and personal reflection, supported by a weekly "Did You Know?" section that introduces scientific evidence on the week's theme; *(ii)* relatedness by fostering friendship, connection, and social trust, within the gathering of people in their local communities; and *(iii)* competence by helping participants experience for themselves how small behavioural changes to daily routines can make large differences to their and other people's lives, using goal-setting and social commitment tools that help to translate thoughts into action. These elements of self-determination theory are supported by educational components, including videos, self-reflection exercises, and group discussions.<sup>7,8</sup>

There is an established empirical evidence base linking self-determination theory to psychological wellbeing (Ryan and Deci, 2001; Ryan et al., 2008), across life domains and different cultural contexts (Milyavskaya and Koester, 2011; Church et al., 2012), including its constituent elements (Brown et al., 2003; Chirkov et al., 2003; La Guardia et al., 2000). We therefore hypothesise that the "Exploring What Matters" course has positive impacts on the mental wellbeing of course participants, and to the extent that it fosters new connections between strangers and the course content encourages compassionate behaviour and pro-social action-taking, on their pro-sociality.

Courses are advertised both online and offline in local communities, and potential participants have to register online. Online advertising is done via emails to people who have previously registered with Action for Happiness and live nearby and to new people via targeted local Facebook advertising; offline advertising is done via local course leaders using word-of-mouth and, to a lesser extent, location promotion (for example, through notice boards or local press). So far, 431 courses have been completed, with a total of 5,621 participants, yielding an average course size of 15 (13 course participants plus two volunteers leading the course). Most courses have been conducted in the UK (343), with a further 88 courses run in 25 countries. This paper is the first impact evaluation of the "Exploring What Matters" course. It focuses on

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<sup>7</sup> Supplementary Materials II includes a link to the course materials of course participants.

<sup>8</sup> Supplementary Materials II includes a link to the course materials of course leaders.

six of the courses which took place in London between August 2016 and December 2017: two during autumn 2016, two during spring 2017, and two during autumn 2017. Participants were informed about the impact evaluation, both during online registration and on site, and written consent was taken.<sup>9</sup>

## 2. Study Design and Results

Course participants are self-selected. To study the extent to which they differ from the general adult population, we compare our estimation sample, pre-treatment, with a sample from the nationally representative UK Household Longitudinal Survey ("Understanding Society"), restricted to London and to the same age span as our participants. We find that there are little, quantitatively relevant differences in the age distribution between course participants and the general adult population. Participants are, however, significantly more likely to be female in our sample (83% vs. 45%) than in the population. Moreover, they are significantly less likely to be married (20% vs. 53%) and more likely to be in a domestic partnership (25% vs. less than one percent). We argue, however, that this difference is an artefact arising from survey design rather than an actual difference: Understanding Society does not ask about a "domestic" partnership (as our survey does) but about a "civil" partnership. It may well be that individuals who are in a long-term partnership, given no other options than marriage or a civil partnership (which is a legal status), consider themselves *de facto* married.<sup>10</sup> If this was the case, differences in the marital status distribution between course participants and the general adult population would be negligible. When it comes to the income distribution, we find again little, quantitatively relevant differences, except for the highest income category: our sample includes significantly less individuals earning £75,000 or more and is somewhat more skewed towards lower incomes. Finally, although courses include participants with a wide range of different levels of life satisfaction, participants report, on average, a lower level of life satisfaction (by about 47% of a standard deviation), pre-treatment, than the population – presumably one of the reasons why they take the course and are likely to benefit from it.<sup>11</sup>

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<sup>9</sup> This study passed the Internal Review Board of the Research Ethics Division at the London School of Economics (Reference: 00507).

<sup>10</sup> Marital status in Understanding Society offers the following options: single, married, civil partner, separated, divorced, or widowed.

<sup>11</sup> See Supplementary Materials Table 1a for this analysis.

To account for self-selection of participants into the course, we exploit that the course is over-subscribed and employ a waitlist randomisation design protocol: after registering for the course online, participants (who report that they are able to attend the course on either one of two sets of pre-specified upcoming dates, two months apart) are randomly allocated to one of the two sets, unaware of how these relate to treatment and control group. Participants in the earlier set of dates are in the treatment group, those in the later set in the waitlisted control group. They are then invited to arrive on the same date to have their baseline data collected. The event starts with a brief introductory session which explains to participants that they are required to fill in surveys and provide saliva samples. This is where participants read the project information sheet and sign written consent forms. After written consent has been obtained, baseline data are collected. After data collection has finished, the brief introductory session is over and participants in the treatment group start their course immediately. Participants in the control group start their course eight weeks later, after the treatment group has finished, and leave the premises. Neither group knows anything about the other group, and the two groups do not meet.<sup>12</sup>

Waitlist randomisation ensures that observable and unobservable characteristics are balanced between treatment and control group. We employ a difference-in-differences design that compares the evolution of course outcomes between groups over time to identify the causal effects of course participation. There were no known confounding events during the study period.

Data are collected at three points in time, all in approximately the same timely spacing: at baseline ( $t=0$ ), right before the course starts; at endline ( $t=1$ ), after it has ended, which is eight weeks after baseline; and at follow-up ( $t=2$ ), eight weeks after endline. At each point in time, data are collected at the same hour of day (circa 6pm in the evening). Our main sample (exploiting data points at baseline and endline) consists of 146 respondents (279 observations), of which 73 are in the treatment (136 observations) and 73 (143 observations) are in the control group. To look at treatment effect persistence, we exploit data points at follow-up in an extended sample. As all respondents have been treated at follow-up, we cannot estimate causal effects, so that results are exploratory.

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<sup>12</sup> See Supplementary Materials Figure 1 for an illustration.



Importantly, baseline and endline data are collected right before the start of the first and the last session, respectively, at the back of the meeting room. Collecting data before the start of the respective session reduces measurement error which may result from participants' euphoria of having started or finished the course being mixed up with actual course outcomes. Note that, during baseline and endline data collection, the atmosphere is deliberately kept neutral, and participants are asked to complete surveys and give biomarker samples before they have a chance to connect with other participants in the main room. This is to reduce measurement error which may result from participants' socialising and exchanging positive expectations about the course. To be consistent, the same protocol regarding neutrality of atmosphere that applies to baseline and endline also applies to follow-up data collection. Attending follow-up data collection has been communicated as mandatory. To avoid creating excitement about attending this additional session, participants do not know what content and format it involves. Finally, note that neither course participants nor volunteers leading the course know whether they are in treatment or control group during baseline data collection. Participants' group allocation is announced only after baseline data collection has finished.

We collect data on two categories of outcomes: self-reported outcomes come from survey data, which include items on subjective wellbeing, mental health, and pro-sociality. Biomarkers come from biomarkers collected through saliva samples, which include cortisol – a steroid hormone responsive to stress – and a range of cytokines – immune proteins involved in inflammatory response. Activation of the inflammatory response system has been shown to be bidirectionally associated with mental ill health and depressive symptoms (Dowlati et al., 2010; Miller and Raison, 2016). Recovery from depression is associated with reductions in levels of cytokines, as has been shown from pharmacological interventions and cognitive behavioural therapy (Dahl et al., 2014; Moreira et al., 2015).<sup>13</sup>

Items on subjective wellbeing cover evaluative (life satisfaction), experiential (happiness and anxiousness), and eudemonic (worthwhileness) dimensions, and have been used by the UK Office for National Statistics to measure national wellbeing since 2011 (Office for National Statistics, 2017). They are measured on eleven-point single-item Likert scales whereby zero denotes the lowest possible level and ten the highest. Items on mental health cover frequently used screening measures to detect depression (the three-point nine-item Patient-Health Questionnaire, PHQ-9) and anxiety (the three-point seven-item Generalised-Anxiety-

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<sup>13</sup> Supplementary Materials III contain the project information sheet, written consent form, and the survey instruments used in the impact evaluation, including baseline, endline, and follow-up survey.

Disorder Questionnaire, GAD-7). PHQ-9 scores from zero to four imply minimal, from five to nine mild, from ten to fourteen medium, and from fifteen to 27 strong depression symptomatology (Kroenke et al., 2001). GAD-7 scores have a similar interpretation but are cut off at 21 (Spitzer et al., 2006). Respondents in our sample can thus be characterised as, on average, mildly depressed ( $M=6.4$ ,  $SD=4.5$ ) and anxious ( $M=6.1$ ,  $SD=4.6$ ). Distributions are, however, highly skewed: in the case of depression, for example, we find that 24 out of 133 respondents (about 18%) show medium or strong depressive symptomatology. When these are omitted, the remaining respondents would be characterised as only minimally depressed ( $M=4.4$ ,  $SD=2.7$ ), not much different from PHQ-9 scores typically found at the general adult population level, which range from  $M=3.0$ ,  $SD=4.3$  for 30 to 39 year olds to  $M=3.7$ ,  $SD=5.1$  for 50 to 59 year olds in the US, for example (Tomitaka et al., 2018a, 2018b). Items on pro-sociality include the Santa Clara Brief Compassion Scale (Hwang et al., 2008) – a composite score running from 5 to 35 which measures pro-sociality by asking respondents about their readiness to help others – and eleven-point single-item Likert scales on social trust and gratitude. We standardise self-reported outcomes to have mean zero and standard deviation one, using the course-set-specific control group mean and standard deviation, to interpret impacts as percentages of standard deviations.<sup>14</sup>

Biomarkers include, besides cortisol, pro-inflammatory cytokines IL-1 $\beta$  and IL-6, anti-inflammatory cytokine IL-10, interferon IFN- $\gamma$ , and chemokine IL-8. These markers have been shown to be responsive to both short-term and long-term psycho-social interventions (Fancourt et al., 2015; Camerer et al., 2018). Given recent research suggesting the promise of saliva as an alternative to blood analysis in bio-behavioural research (Bosch, 2008; Williamson et al., 2012; Byrne et al., 2013), biomarkers are collected by means of a saliva sample right after the surveys with self-reported outcomes have been completed. We apply passive drool method of sample collection in accordance with recommendations by Nicolson (2008) and Zhou et al. (2010), using low protein-bind collection cryovials. Samples are stored at  $-40^{\circ}\text{C}$  prior to analysis at the Institute for Interdisciplinary Salivary Bioscience Research at the University of California at Irvine, where they are analysed – three times independently – using multiplex immunoassays. Cortisol is measured in  $\mu\text{g/dL}$ , cytokines in  $\text{pg/mL}$ . We take means across the three analyses run for each biomarker, remove outliers, and log-transform the data. We standardise biomarkers to have mean zero and standard deviation one, using again the course-set-specific control group mean and standard deviation, to make them comparable to the self-reported outcomes.

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<sup>14</sup> There were three sets of courses, each including two courses (one treatment and one control group): one in autumn 2016, one in spring 2017, and one in autumn 2017.

Finally, we collect survey data on socio-demographic characteristics of respondents, including age, gender, marital status, education, employment, income, religion, religious practice, preference for meeting new people and making friends, health (including pregnancy), and health-related behaviour (including smoking and medication usage), to control for potential differences between treatment and control group over time. All controls are measured pre-treatment. Table 1b in the Supplementary Materials shows variable definitions and descriptive statistics, Table 1c balancing properties between treatment and control group: there is little evidence for significant mean differences in outcomes and controls between groups prior to course start.

Our empirical model is a difference-in-differences specification in regression form:<sup>15</sup>

$$y_{it} = \beta_0 + \beta_1 \text{Treatment}_i * \text{Post}_t + \beta_2 \text{Treatment}_i + \beta_3 \text{Post}_t + \beta_4' X_{it} + \mu_s + \varepsilon_{it} \quad \text{with } t = \{0, 1\}$$

(1)

where  $y_{it}$  is the outcome of respondent  $i$  at time  $t$ , with  $t=0$  as baseline and  $t=1$  as endline;  $\text{Treatment}_i$  is a dummy equal to one if the respondent belongs to the treatment group, and zero else;  $\text{Post}_t$  is a dummy equal to one at endline, and zero else;  $X_{it}$  is a vector of time-varying observables; and  $\mu_s$  is a course-set-specific fixed effect.<sup>16</sup> Our model is estimated using OLS, with robust standard errors clustered at the respondent level.  $\beta_1$  is the causal effect (average treatment effect on the treated) of course participation. Note that our model cannot exploit data points at follow-up ( $t=2$ ) since there is no credible control group anymore. We conduct an additional stepwise p-value correction to account for multiple hypotheses testing (Romano and Wolf, 2005), and reported significant effects remain significant.

## Impacts on Subjective Wellbeing, Mental Health, and Pro-Sociality

We first look at descriptive evidence. Figure 1 plots the raw means of four of our self-reported outcomes – life satisfaction, mental health (PHQ-9 for depression and GAD-7 for anxiety), and social trust – during the observation period.<sup>17</sup>

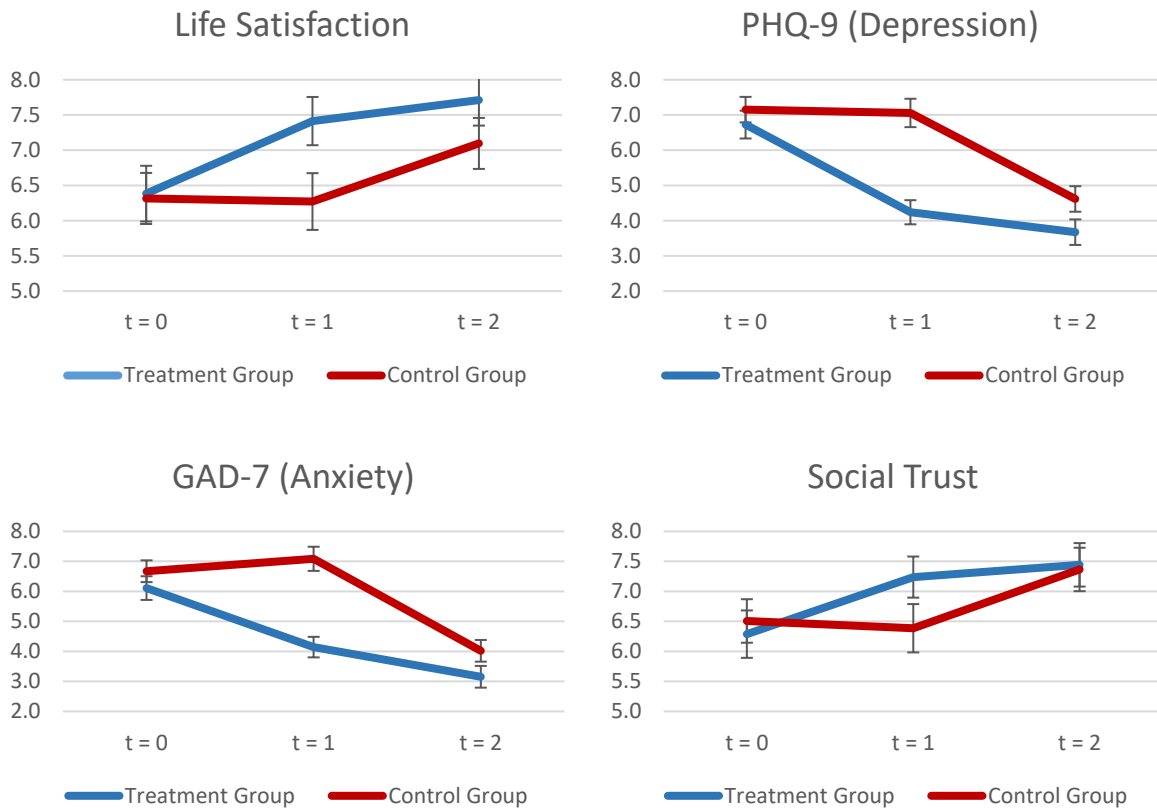
<sup>15</sup> Alternatively, one could regress the post-treatment on the pre-treatment outcome and a treatment dummy, alongside controls (which enforces a balanced panel). Results are qualitatively the same.

<sup>16</sup> Results are almost identical regardless of whether controls are included or not, which reinforces the notion of exogeneity, and that randomisation has been successful.

<sup>17</sup> Figures for other self-reported outcomes show similar developments and are available upon request.

**Figure 1**

*Average Scores of Groups at Different Points in Time*



*Notes:* A waitlist randomisation design is applied: between baseline (t=0) and endline (t=1), the treatment group receives treatment; between endline (t=1) and follow-up (t=2), the control group receives treatment. Hence, at follow-up (t=2), there is no credible control group anymore (the previous control group has been treated). Scores are in natural units. Life satisfaction and social trust are measured on scales from zero to ten, PHQ-9 for depression on a scale from zero to 27, and GAD-7 for anxiety on a scale from zero to 21. N=383 (146 at t=0, 133 at t=1, and 104 at t=2). Confidence intervals are 95%.

*Sources:* Own data collection, own calculations.

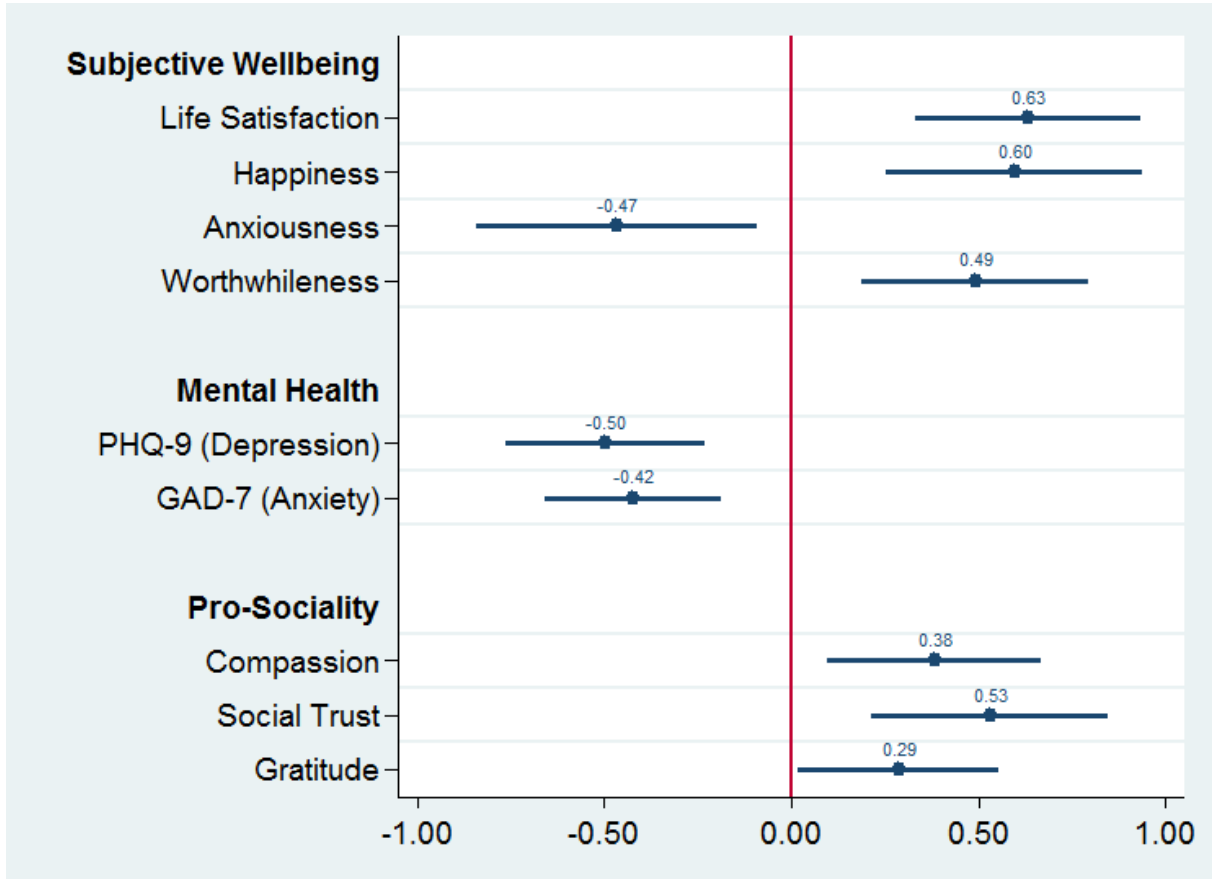
We make three observations: first, between points t=0 (baseline) and t=1 (endline), the course improves the scores of the treatment group, whereas those of the control group remain constant. Second, between points t=1 (endline) and t=2 (follow-up), the course improves the scores of the control group (which is treated during that period) in a similar fashion, whereas those of the treatment group are sustained or even continue to improve.<sup>18</sup>

We now turn to our estimation results. Figure 2 plots the coefficient estimates of our self-reported outcomes.

<sup>18</sup> There are several reasons why the improvement in scores of the control group may not be *exactly* the same as that of the treatment group: first, it may be a random artefact. Second, it may be a seasonal effect: the control group tends to be interviewed, on average, two months later than the treatment group.

**Figure 2**

*Impacts on Self-Reported Outcomes: Subjective Wellbeing, Mental Health, and Pro-Sociality*



*Notes:* Coefficients are standardised, with mean zero and standard deviation one (z-scores), using control group mean and standard deviation. Controls include age, gender, marital status, education, employment, income, religion, religious practice, preference for meeting new people and making friends, health (including pregnancy), health-related behaviour (including smoking and medication usage), and course-set-specific fixed effects. See Supplementary Materials Table 2a for the corresponding regression table. Robust standard errors are clustered at the participant level. N=279 (146 respondents, of which 73 are in treatment and 73 in control). Confidence bands are 95%.

*Sources:* Own data collection, own calculations.

In terms of subjective wellbeing, the course significantly increases life satisfaction by about 63% percent of a standard deviation, happiness by about 60%, and worthwhileness by about 49%; anxiousness, on the contrary, is significantly decreased by about 47%. Effect sizes are large: for life satisfaction, for example, the effect size corresponds to an increase of about one point on a zero-to-ten scale; participants with a mean life satisfaction score of 6.1 pre-treatment see it rise to 7.1 post-treatment. All impacts are significant at the 5% level.

In terms of mental health, the course significantly decreases both PHQ-9 and GAD-7 scores, respectively, by about 50% and 42% of a standard deviation (impacts do not significantly differ from each other). Effect sizes are again large: participants, prior to taking the course, report mean PHQ-9 and GAD-7 scores of about 6.7 and 6.1, respectively, which corresponds to a clinical symptomatology of mild depression and anxiety. The course improves scores to, on average, 4.5 points for the PHQ-9 and 3.9 for the GAD-7, which corresponds to a clinical symptomatology of minimal depression and anxiety – one category lower, and the lowest category for both measures. All impacts are again significant at the 5% level.

Impacts on mental health are strong, although clearly weaker than impacts found in trials based on cognitive behavioural therapy. For example, the IAPT (Improving Access to Psychological Therapies) trial has been found to reduce PHQ-9 and GAD-7 scores, on average, by about eight and seven, respectively, between baseline and follow-up (Clark et al., 2009). The CoBaT (Cognitive Behavioural Therapy as an Adjunct to Pharmacotherapy) trial has been found to reduce PHQ-9 and GAD-7 scores, on average, by about 7.1 and 4.7, respectively (Wiles et al., 2013, 2016). However, these trials are targeted specifically at individuals with depression and anxiety, rather than the general adult population.

In terms of pro-sociality, we find that the course significantly increases both compassion and social trust at the 5% level, respectively, by about 38% and 53% of a standard deviation (about 0.5 and one point). The impact on gratitude, however, is lower and only barely significant; it does not sustain a stepwise p-value correction when accounting for multiple hypotheses testing (Romano and Wolf, 2005).

This gathering of people is an important element of the course. How do course outcomes depend on course participants' preference for meeting new people and making new friends? To study the importance of social context, we run two regressions.<sup>19</sup> First, we re-estimate our baseline specification without controlling for participants' preference for socialising: coefficient estimates are slightly attenuated, suggesting that socialising is an important explanatory variable, yet continue to remain strong. Recall that treatment and control group are balanced in terms of respondents' preference for meeting new people and making friends, pre-treatment. We next split our sample by the mean pre-treatment value, and re-estimate our baseline specification for the split sample: we do not find that impacts are systematically stronger for respondents who have a higher preference for socialising, pre-treatment; rather, it seems that

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<sup>19</sup> We find similar results regardless of whether a stated-preference (i.e. importance for meeting new people and making new friends) or a revealed-preference item (i.e. frequency of meeting in local clubs) is used.

for whom impacts are stronger depends on the specific outcome. Again, it does not seem that participants who have a higher preference for socialising profit more from the course than others.<sup>20</sup>

To explore mechanisms, we collect data on two categories of additional outcomes: information and behaviour. The former includes measures – each using a single-item eleven-point Likert scale – that relate to knowledge of what contributes to one's own and other people's wellbeing. The latter includes measures that relate to behaviour in various life domains, including private, close relationships, and other people; answer possibilities include zero (not at all), one (several days), two (more than half the days), and three (nearly every day).<sup>21</sup> Items on information and behaviour also serve as manipulation checks, as the course explicitly aims at changing both information and behaviour regarding one's own and other people's wellbeing. We therefore hypothesise to find impacts on both.

When it comes to information, we indeed find that participants report to feel more knowledgeable of what contributes to a happy and meaningful life, know more what matters to them personally, and feel more able to do things to improve their own, and to a somewhat lesser extent, the wellbeing of other people. In terms of behaviour, the course increases the frequency in which participants practice mindfulness or meditation, treat themselves in a kind way, connect with other people, and do something kind or helpful for others. Effect sizes range between 50% and 80% of a standard deviation – comparable to our main outcomes. Smaller impacts can be detected for other behaviour, such as making time for something personally important, learning or trying out something new, and trying to increase happiness at work and in the community.<sup>22</sup>

Do some participants benefit more from the course than others? To shed light on this question, we conduct a heterogeneity analysis, running separate regressions for participants in different terciles of the respective self-reported outcome distribution, pre-treatment: the first tercile corresponds to individuals with the lowest, the third tercile to individuals with the highest score in the respective outcome.<sup>23</sup> Figure 2 in the Supplementary Materials shows our findings: only in case of PHQ-9 scores do differences between terciles turn out to be significant. Impacts on participants in the first tercile of PHQ-9 scores (who are more depressed) are almost seven times larger than for those in the bottom tercile (who are less); the difference is significant at

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<sup>20</sup> Results are available upon request.

<sup>21</sup> Data on these additional outcomes have been collected starting from endline of course one.

<sup>22</sup> See Supplementary Materials Tables 3a and 3b for these findings.

<sup>23</sup> The choice of terciles is motivated by sample size.

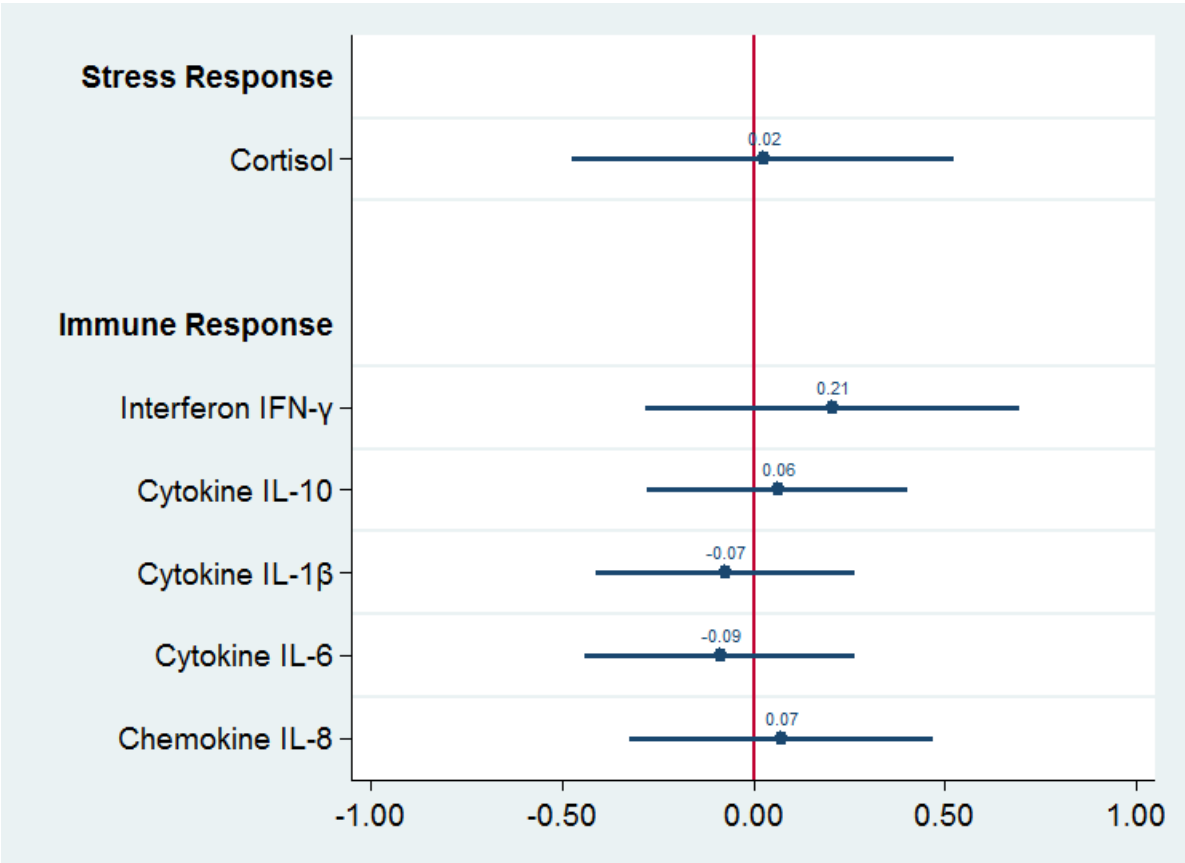
the 5% level. The course seems to show stronger impacts on participants who are initially in more mental distress, and presumably, have more to gain from it.

### Impacts on Cortisol and Cytokines

We next look at biomarkers – cortisol as a stress response hormone and a range of cytokines as immune response proteins associated with mental ill health and depressive symptoms – and re-run our baseline specification with biomarkers instead of self-reported outcomes. Figure 3 shows coefficient estimates.

Figure 3

Impacts on Biomarkers: Cortisol and Cytokines



Notes: Coefficients are standardised, with mean zero and standard deviation one (z-scores), using control group mean and standard deviation. Controls include age, gender, marital status, education, employment, income, religion, religious practice, preference for meeting new people and making friends, health (including pregnancy), health-related behaviour (including smoking and medication usage), and course-set-specific fixed effects. See Supplementary Materials Table 2b for the corresponding regression table. Robust standard errors are clustered at the participant level. N=279 (146 respondents, of which 73 are in treatment and 73 in control). Confidence bands are 95%. Sources: Own data collection, own calculations.



We do not find that the course has significant impacts on these biomarkers at conventional levels. With the exception of cortisol, however, for which we find near zero impacts, we find that cytokines consistently move into the hypothesised direction: pro-inflammatory cytokines IL-1 $\beta$  and IL-6, which correlate positively with mental ill health and depressive symptoms, are decreased, whereas anti-inflammatory cytokine IL-10, interferon IFN- $\gamma$ , and chemokine IL-8 (which correlate negatively) are increased in the treatment group compared to the control group, after course completion. Compared to the data on self-reported outcomes, the data on biomarkers are noisier and impacts on biomarkers are smaller in size.

As with our self-reported outcomes, we run separate regressions for participants in different terciles of the respective biomarker distribution, pre-treatment. Figure 3 in the Supplementary Materials plots coefficient estimates: we find, again, little systematic evidence that the course has significant impacts on biomarkers at conventional levels, except IL-6 in the first tercile, which moves into the hypothesised direction and turns significant at the 10% level (p-value of 0.07). However, due to the large number of hypotheses tested and the noisiness of the biomarker data, we discard this finding.

### **Evidence for Sustained Impacts**

Do impacts last? Figure 1 provides evidence for sustained impacts on self-reported outcomes. It is difficult, however, to answer this question formally: at follow-up (t=2), the *ex-ante* control group has itself been treated. Nevertheless, we can exploratorily look into the reliability of the longer-term impacts shown in Figure 1, using the example of life satisfaction.

First, note that the difference in mean life satisfaction between treatment and control group at follow-up (t=2) is insignificant, as we expect, given that the *ex-ante* control group receives the same treatment as the treatment group. In fact, the improvement in mean life satisfaction of the treatment group is about 16%, that of the *ex-ante* control group about 13% – almost identical. If anything, treatment intensity is weaker for the latter. If treatment intensity is weaker, possibly due to confounders, it is likely that any such confounders pose a similar "drag" on the treatment group. We would then expect mean life satisfaction of the treatment group to decrease between endline (t=1) and follow-up (t=2). This is not the case, pointing towards sustained impacts. Finally, note that there is little evidence for time trends: Table 4 in the Supplementary Materials shows mean differences in outcomes and controls for the control group between baseline (t=0) and endline (t=1), which is when the treatment group is treated:

most of these mean differences are insignificant.<sup>24</sup> This suggests that it is unlikely that time trends are present and drive longer-term impacts.<sup>25</sup>

An issue that may arise when looking at longer-term, or even short-term, impacts is attrition: to the extent that out-of-sample selection is not random and correlated with outcomes (for example, unhappy people may be more likely to drop out of the panel), or differs by group, it would bias our identified effects. We look at this issue by regressing the number of periods (participants can remain up to two periods in the impact evaluation programme) on each outcome alongside course-set-specific fixed effects, using robust standard errors clustered at the individual level. We find little evidence that outcomes are significant predictors of the number of periods participants remain in the programme, neither on average nor by group.<sup>26</sup> We take this as evidence that out-of-sample selection is rather random, and thus unlikely to bias our identified short-term or longer-term effects. Finally, note that only about 9% of participants drop out between baseline (t=0) and endline (t=1), and a slightly larger proportion (22%) between endline (t=1) and follow-up (t=2). Likewise, compliance in terms of course attendance is high: on average, participants attend seven out of eight sessions of the course.

### **Replication Using Online Surveys**

Since its launch in 2015, 431 courses have been completed worldwide, totalling 5,621 participants. Right from the beginning, the charity running the courses – Action for Happiness – has been collecting data on course outcomes at the participant level. Participants are sent a link to the baseline survey after registering online for the course; completing the online survey is mandatory for course participation. After the course has finished, they are again sent a link to the endline survey; completing it is incentivised by a voucher for a free, one-year subscription to a mindfulness app.

In particular, by means of online surveys, data on course participants' life satisfaction, mental wellbeing, compassion, and social trust have been collected. While life satisfaction, compassion, and social trust are measured the same way as before, mental wellbeing is

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<sup>24</sup> A notable exception are two biomarkers: cytokine IL-1 $\beta$  and chemokine IL-8 significantly increase in the control group between baseline and endline. However, for a hypothetical wellbeing change, these biomarkers should change in the opposite (rather than the same) direction. We take this as further evidence that our biomarker data are noisy.

<sup>25</sup> Recall that, for our short-term impacts, the presence of time trends poses no threat to identifying causal effects of course participation on course outcomes, since we have a valid control group which is measured at the same points in time as the treatment group.

<sup>26</sup> Results are available upon request.

measured using the Short Warwick-Edinburgh Mental Well-being Scale, which asks respondents to report on the frequency of several experiences related to their mental wellbeing during the past two weeks (Tennant et al., 2007; Stewart-Brown et al., 2009). The item is bound between seven and 35, whereby higher scores indicate higher mental wellbeing.

Of course, a simple before-after comparison of these measures does not give us a causal effect of course participation on course outcomes. However, we can still use these online surveys, which are high-powered and widely spread across geographical regions and over time, to check the external validity of our main findings, which are based on six courses that took place in London between autumn 2016 and autumn 2017. Figure 4 shows the results of a simple before-after comparison of course outcomes collected via online surveys, restricted to those respondents for whom we have both baseline and endline data, amounting to about 5,600 observations (about 2,300 before and 2,300 after) for comparison.

Similar to our main findings, the simple before-after comparison of course outcomes shows that the course has strong positive impacts on life satisfaction, mental wellbeing, compassion, and social trust. Impacts are, however, larger those in our main findings: for life satisfaction, for example, we find a mean difference of about 1.4 points on a zero-to-ten scale (pre-mean of 6.1, post-mean of 7.5).

Larger impacts could be driven by three factors: first, our simple-before comparison of course outcomes cannot take into account general trends in wellbeing over time, and online surveys have been conducted over a long period (years 2015 to 2019). Second, they could, in part, be driven by attrition in online surveys: whereas attrition is low in our randomised controlled trial and only about 9% of participants drop out between baseline and endline, attrition in online surveys is relatively higher, with about 36% of participants dropping out. Contrary to our trial, there is some evidence that attrition is selective: regressing the likelihood to drop out on life satisfaction alongside age, gender, and income as controls, using robust standard errors clustered at the individual level, we find that a one-point increase in life satisfaction on a zero-to-ten scale significantly reduces the likelihood to drop out at the 10% level, albeit only by about one percentage point.<sup>27</sup> Although there is, therefore, some evidence for selective attrition, it seems to be a quantitatively minor issue. Finally, larger impacts could also be explained by the timing of the endline survey: the link to the survey is sent out shortly after the course has finished, whereas in our randomised controlled trial endline data are

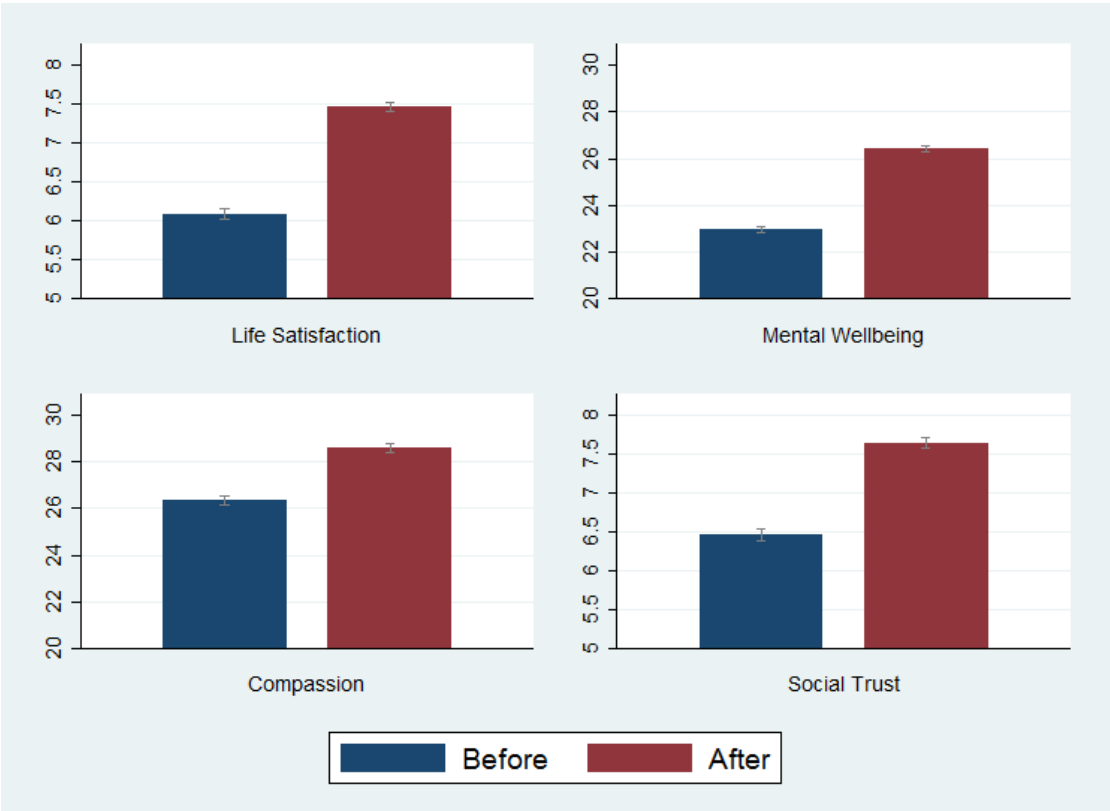
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<sup>27</sup> Results are available upon request.

collected *before* the last session starts. It is therefore possible that participants' euphoria of having finished the course is mixed up with actual course outcomes in online surveys, inflating *ex-post* course outcomes.

**Figure 4**

*Impacts on Self-Reported Outcomes in Online Surveys: Life Satisfaction, Mental Wellbeing, Compassion, and Social Trust*



*Notes:* Baseline and endline data from online surveys on the universe of courses during the period 2015 to 2019. Scores are in natural units. Life satisfaction and social trust are measured on scales from zero to ten; mental wellbeing by means of the Short Warwick-Edinburgh Mental Well-being Scale, which runs from seven to 35; and compassion by means of the Santa Clara Brief Compassion Scale, which runs from five to 35. Confidence intervals are 95%. *Sources:* Own data collection, own calculations.

### 3. Conclusion

We find that the "Exploring What Matters" course has significant, positive effects on the self-reported mental wellbeing and pro-sociality of course participants. The design of the impact evaluation as a randomised controlled trial – the gold standard for impact evaluation – makes these effects interpretable as causal.

Impacts on subjective wellbeing, mental health, and pro-sociality are large: the course increases life satisfaction on a zero-to-ten scale by about one point, more than being partnered as opposed to being single (+0.6) or being employed as opposed to being unemployed (+0.7) (Clark et al., 2018). It is comparable to the effect of ENHANCE, a 12-week course focusing primarily on positive habits, skills, and attitudes, which is probably the most comparable intervention (Kushlev et al., 2017).<sup>28</sup> However, the authors are able to track outcomes over a longer period of time, up to six months post-treatment. Finally, the effect on life satisfaction is somewhat larger than effects found in trials by the UK Big Lottery Fund, which funded a wide range of wellbeing programmes (fourteen portfolios, each consisting of three to 34 actual trials) from 2008 to 2015 at a volume of £200 million. Trials typically included community-based activities such as horticultural activities, cooking lessons, or sports events. As a conservative estimate, they increased life satisfaction on a zero-to-ten scale by, on average, 0.5 points for six months post-treatment (New Economics Foundation-Centre for Local Economic Strategies, 2013). Different from our intervention, however, these trials all targeted specific groups with mental health needs, including overweight adults, families with young children, or people with substance use disorders.

We find evidence that effects are sustained (or even enhanced) two months post-treatment. An analysis of mechanisms suggests that effects on participants mostly come about through changes in information and subsequent behaviour. Impacts on biomarkers are less clear: although they move consistently into the hypothesised direction, they are noisy and do not reach statistical significance at conventional levels.

One reason why we do not find significant effects on biomarkers at conventional levels may be power issues combined with relatively noisy measures. Another, related reason may be the composition of our sample: high levels of pro-inflammatory cytokines have been found for

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<sup>28</sup> The impact of this course has been evaluated using a waitlist randomisation design, as in our paper, and the authors found an impact of about 0.5 between baseline and posttest on life satisfaction measured on a one-to-five multi-item summed scale (the Satisfaction With Life Scale) (Heintzelman et al., 2019, Table 3). With the caveat that both measures of life satisfaction are not perfectly comparable, rescaling this item to a zero-to-ten scale yields an impact of about  $0.5 \times (11/5) = 1.1$ .

major depression; respondents in our sample, however, report, on average, only mild depressive symptomatology, pre-treatment. In fact, we find that only eight out of 133 respondents (about 6%) report strong depressive symptomatology, as indicated by PHQ-9 scores of fifteen or higher. Moreover, even amongst these, only about a third show associated elevated inflammation (Wium-Andersen and Nielsen, 2013). For cortisol, individual differences and timing of measurement matter; it has been found to be a rather short-term measure for stress (Miller et al., 2007). While effects on biomarkers turn out insignificant at conventional levels, the finding that they moved into the hypothesised direction therefore suggests a promising avenue for future exploration amongst individuals specifically with higher levels of depressive symptoms at baseline.

Our study has several shortcomings. The most important shortcoming is that significant effects on self-reported outcomes are not mirrored by significant effects on biomarkers. Impacts at endline may thus reflect participant's euphoria of having finished the course, placebo effects, or social desirability bias as course participants try to please course leaders. Although none of them can be excluded for sure, we argue that it is unlikely that our effects are primarily driven by these artefacts. First, recall that the atmosphere during data collection (including baseline, endline, and follow-up) is kept strictly neutral according to protocol, and that participants can meet and chat to others only *after* data collection has finished. This is to reduce measurement error from participants' euphoria or positive expectations regarding the course being mixed up with actual course outcomes. Second, there is evidence for sustained impacts: it is unlikely that placebo effects are sustained two months post-treatment. Moreover, impacts at follow-up are similar (if not slightly stronger) than at endline: it is unlikely that, two months after having completed the last survey, participants perfectly recall their previous responses. The similarity between endline and follow-up, therefore, points towards genuine responses. Finally, data collection is strictly anonymous, and there is little incentive for participants to answer in a strategic or socially desirable way. Likewise, anonymous online surveys from the universe of courses conducted point towards similar impacts. They also point against observer effects: for participants who complete online surveys, no field experiment is salient.

Another shortcoming is the waitlist randomisation design: the choice of this design is motivated by the fact that in our on-clinical local community context there exists no natural, credible control group that lends itself as a business-as-usual with which to compare the self-selected treatment group. At the same time, alternate double-blind impact evaluation designs with placebo control groups are difficult to implement in the context of rather lengthy, course-

based social-psychological interventions (Herbert and Gaudiano, 2005). Our waitlist randomisation design, therefore, balances these challenges while adhering as closely as possible to evidence-based practice. Nevertheless, it also has shortcomings. The most pressing shortcoming is that being waitlisted itself can be considered a treatment. Bias can go both ways: on the one hand, outcomes in the waitlisted control group may deteriorate, as individuals strategically postpone activities in anticipation of the course, which is impossible to verify. On the other hand, outcomes may improve, as participants themselves take action to bridge the waiting time. We find little evidence for either: between baseline and endline, there are little statistically significant differences in outcomes and covariates for the waitlisted control group, except for mindfulness and meditation (which the waitlisted control group seems to practice more at baseline). Excluding individuals for whom this behavioural change occurs between baseline and endline leaves our findings unchanged.<sup>29</sup>

Note that the absence of statistically significant differences in outcomes and covariates for the waitlisted control group also suggests that there is no time trend between baseline and endline, suggesting, in turn, that a time trend within a close timely spacing of two months between endline and follow-up is also unlikely. Together with our null finding on selective attrition, this lends credibility to our evidence on sustained impacts two months post-treatment.

Future research may build on and extend the evidence established in this trial, for example, by looking at long-term impacts that go beyond two months post-treatment. Seemingly small, one-off, social psychological interventions have been found to initiate positive behavioural change that may sustain or even reinforce itself over long periods of time (see Yeager and Walton (2011) or Wilson and Buttrick (2016) in the context of education, for example). Here, it may be interesting to look at behavioural spillovers (Dolan and Galizzi, 2015) or spillunders (Krupan et al., 2019) from one life domain to another (for example, whether higher personal wellbeing causally leads to more pro-social behaviour, see Dunn et al. (2008) or Aknin et al. (2013), for evidence on the reverse). Likewise, it may be interesting to look at different types of behavioural outcomes, in particular those in the area of revealed preferences. We found participants who were initially in more mental distress to benefit more from the course. A larger sample size could help stratifying results by demographics and other participant characteristics, providing useful insights into differential impacts in these areas. This could help targeting particular groups of people more effectively. It may also help resolve power issues with biomarkers in small samples.

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<sup>29</sup> Results are available upon request.

Finally, motivated by the growing literature on mentoring and advice-giving in social psychology rooted in self-perception theory (Bem, 1972) and advocacy (Aronson et al., 1991), studying the causal effect of the course on facilitators (i.e. the volunteers who lead the course) would be a promising avenue for future research.



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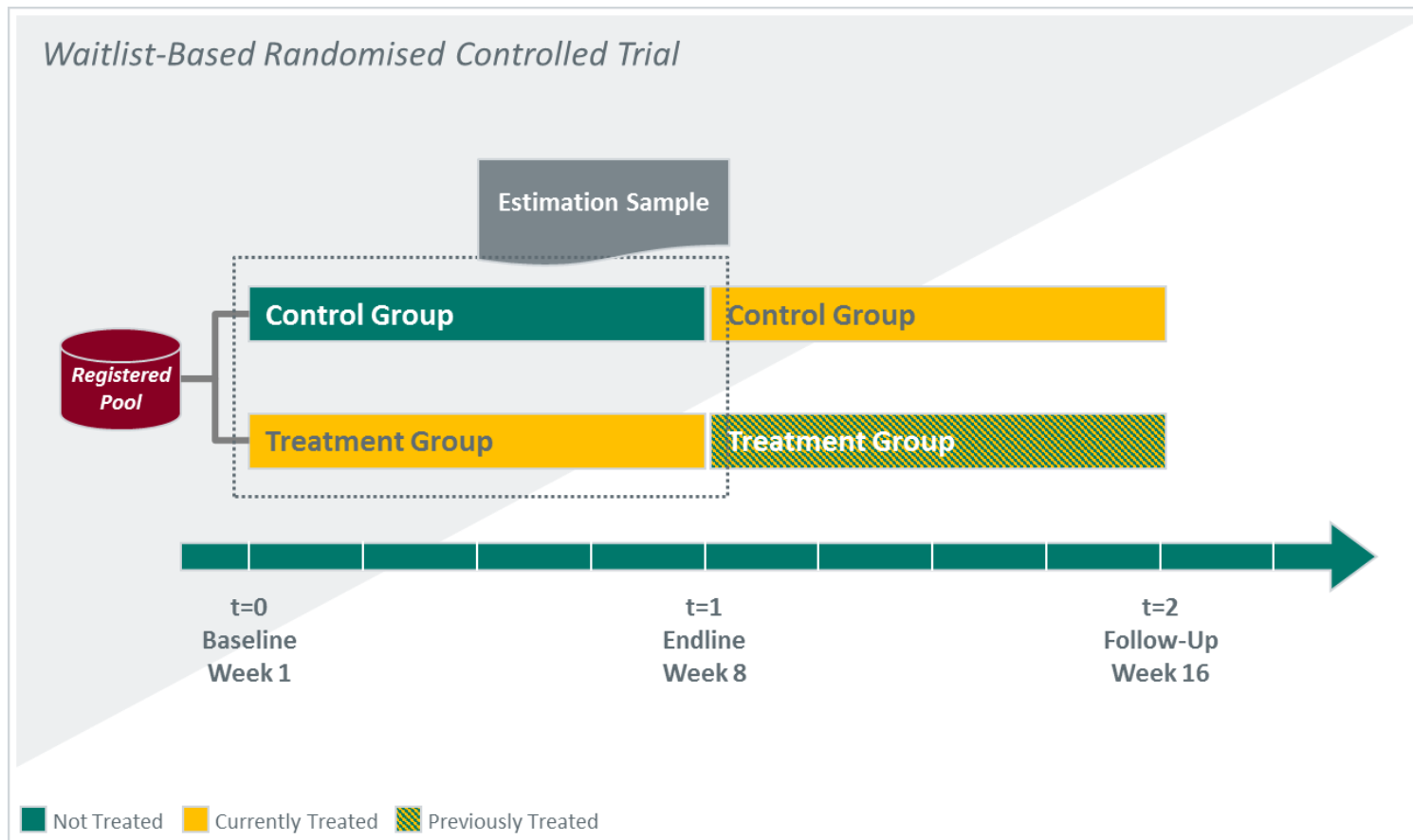
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## Appendix 1 Figures

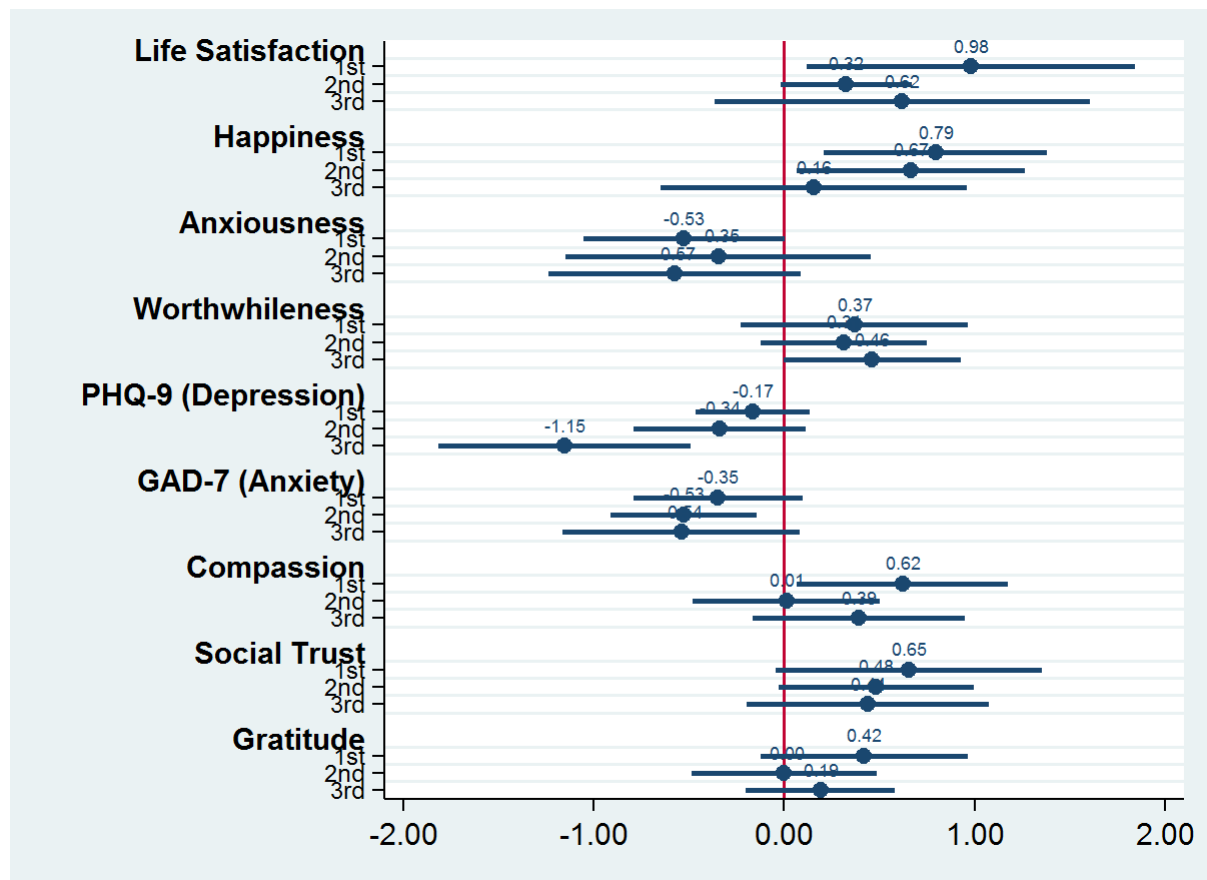
Figure 1

*Impact Evaluation Design*



**Figure 2**

*Impacts on Self-Reported Outcomes by Tercile: Subjective Wellbeing, Mental Health, and Pro-Sociality*

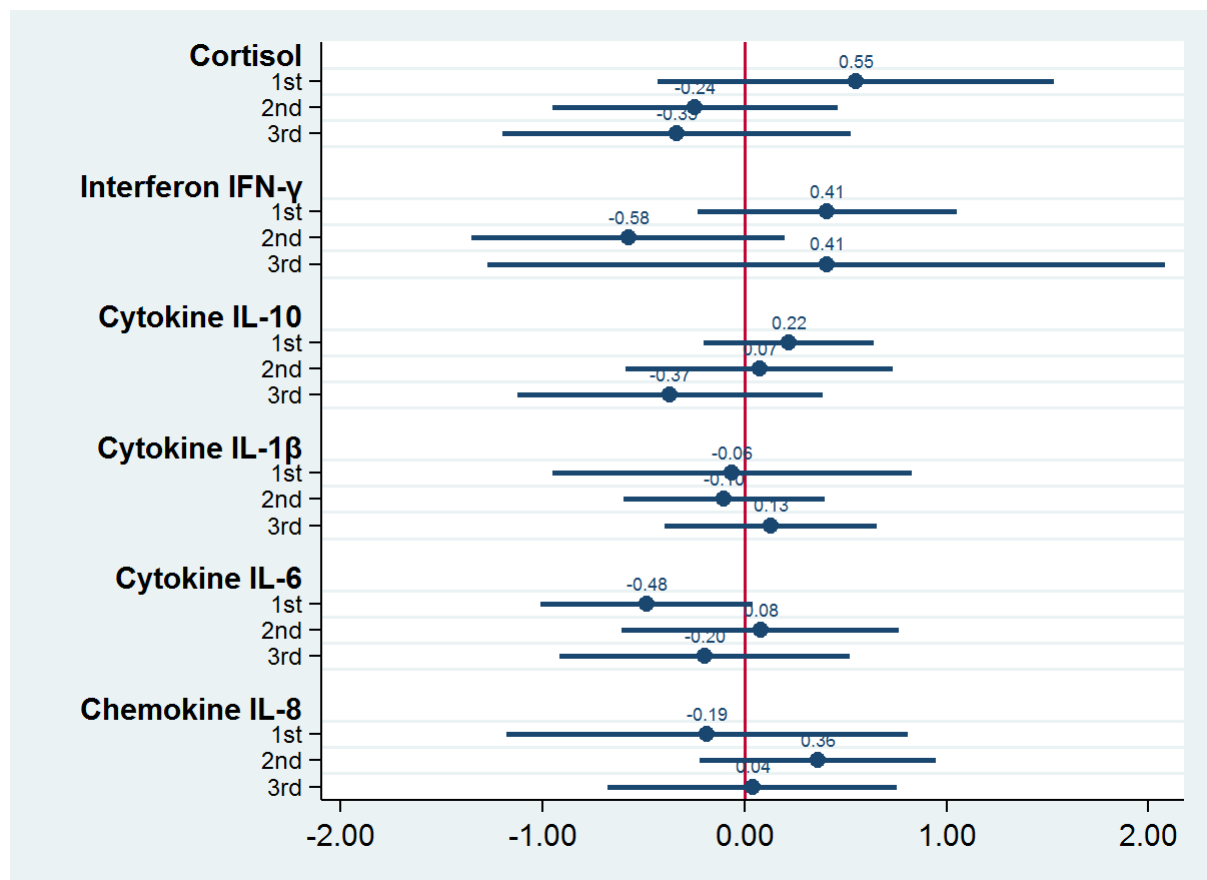


*Notes:* Sample is split by tercile of respective outcome distribution, pre-treatment. Coefficients are standardised, with mean zero and standard deviation one (z-scores), using control group mean and standard deviation. Controls include age, gender, marital status, education, employment, income, religion, religious practice, preference for meeting new people and making friends, health (including pregnancy), health-related behaviour (including smoking and medication usage), and course-set-specific fixed effects. Robust standard errors are clustered at the participant level. N=279 (146 respondents, of which 73 are in treatment and 73 in control). Confidence bands are 95%.

*Sources:* Own data collection, own calculations.

**Figure 3**

*Impacts on Biomarkers by Tercile: Cortisol and Cytokines*



*Notes:* Sample is split by tertile of respective outcome distribution, pre-treatment. Coefficients are standardised, with mean zero and standard deviation one (z-scores), using control group mean and standard deviation. Controls include age, gender, marital status, education, employment, income, religion, religious practice, preference for meeting new people and making friends, health (including pregnancy), health-related behaviour (including smoking and medication usage), and course-set-specific fixed effects. Robust standard errors are clustered at the participant level. N=279 (146 respondents, of which 73 are in treatment and 73 in control). Confidence bands are 95%.

*Sources:* Own data collection, own calculations.

## Appendix 2 Tables

**Table 1a**

*Comparison of Understanding Society in London with Estimation Sample*

	Mean Understanding Society (London, Same Age Span)	Mean Estimation Sample, Pre-Treatment	Difference
<i>Subjective Wellbeing</i>			
Life Satisfaction	7.087	6.349	0.738***
<i>Demographic Characteristics</i>			
Age: 20-24	0.101	0.055	0.046*
25-34	0.212	0.267	-0.055
35-44	0.242	0.232	0.009
45-54	0.217	0.226	-0.009
55-64	0.136	0.178	-0.042
65-74	0.092	0.041	0.051**
Gender: Male	0.547	0.171	0.376***
Female	0.453	0.829	-0.376***
Marital Status: Single	0.346	0.390	-0.044
Married	0.530	0.199	0.331***
Separated	0.023	0.034	-0.011
Divorced	0.069	0.102	-0.034
Widowed	0.028	0.007	0.021
Domestic Partner (Understanding Society: Civic Partner)	0.003	0.247	-0.243***
Prefer not to Say	-	0.021	0.142

Income: £14,999 or Less	0.182	0.137	0.045
£15,000-£29,999	0.151	0.205	-0.055*
£30,000-£44,999	0.151	0.199	-0.048
£45,000-£59,999	0.137	0.130	0.007
£60,000-£74,999	0.109	0.116	-0.007
£75,000 or More	0.270	0.157	0.112***
Prefer not to Say	-	0.055	
		0.228	
<hr/>			
Observations	28,547	146	-
<hr/>			

Notes: See Table Supplementary Materials Table 1b for variable definitions.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 1b***Variable Definitions and Descriptive Statistics*

	Mean	Standard Deviation	Minimum	Maximum	Number of Observations	Remarks
<i>Self-Reported Outcomes</i>						
Life Satisfaction	6.570	1.669	1	10	279	“Overall, how satisfied are you with your life nowadays?”: (0) “Not at all” to (10) “Completely”
Happiness	6.376	1.989	1	10	279	“Overall, how happy did you feel yesterday?”: (0) “Not at all” to (10) “Completely”
Anxiousness	4.133	2.489	0	10	279	“Overall, how anxious did you feel yesterday?”: (0) “Not at all” to (10) “Completely”
Worthwhileness	7.194	1.827	1	10	279	“Overall, to what extent do you feel the things you do in your life are worthwhile?”: (0) “Not at all” to (10) “Completely”
PHQ-9 (Depression)	6.358	4.523	0	21	279	9-Item Patient-Health Questionnaire, see Kroenke et al. (2001)
GAD-7 (Anxiety)	6.057	4.640	0	20	279	7-Item Generalised-Anxiety-Disorder Questionnaire, see Spitzer et al. (2006)

Compassion	6.762	2.398	0	11.8	279	5-Item Santa Clara Brief Compassion Scale, see Hwang et al. (2008)
Social Trust	6.584	2.079	0	10	279	“Generally, would you say that most people can be trusted, or that you cannot be too careful in dealing with people?”: (0) “Cannot be too careful” to (10) “Most can be trusted”
Gratitude	6.222	0.890	0	7	279	“I have so much in life to be thankful for.”: (0) “Strongly disagree” to (10) “Strongly agree”
Information (a)	7.691	1.563	1	10	230	“I feel aware of what contributes to a happy and meaningful life.”: (0) “Not at all” to (10) “Completely”
Information (b)	7.374	1.738	1	10	230	“I know what really matters to me in life.”: (0) “Not at all” to (10) “Completely”
Information (c)	7.243	1.916	1	10	230	“I feel able to do things to improve my own wellbeing.”: (0) “Not at all” to (10) “Completely”
Information (d)	7.274	1.602	2	10	230	“I feel able to do things to improve the wellbeing of others.”: (0) “Not at all” to (10) “Completely”
Behaviour (a)	2.057	0.897	0	3	230	“In recent weeks, how often have you done the following? ...Noticed and felt grateful for good things”: (0) “Not at all”, (1) “Several days”, (2) “More than half the days”, (3) “Nearly every day”
Behaviour (b)	1.426	1.062	0	3	230	“...Practised mindfulness/meditation”: (0) “Not at all”, (1) “Several days”, (2) “More than half the days”, (3) “Nearly every day”
Behaviour (c)	1.570	0.868	0	3	230	“...Treated yourself in a kind way”: (0) “Not at all”, (1) “Several days”, (2) “More than half the days”, (3) “Nearly every day”

Behaviour (d)	1.661	0.813	0	3	230	“...Made time for something really important to you”: (0) “Not at all”, (1) “Several days”, (2) “More than half the days”, (3) “Nearly every day”
Behaviour (e)	1.561	0.800	0	3	230	“...Responded well to a difficult situation”: (0) “Not at all”, (1) “Several days”, (2) “More than half the days”, (3) “Nearly every day”
Behaviour (f)	1.248	0.801	0	3	230	“...Learnt or tried out something new”: (0) “Not at all”, (1) “Several days”, (2) “More than half the days”, (3) “Nearly every day”
Behaviour (g)	1.796	0.905	0	3	230	“...Gave time to one of your closest relationships”: (0) “Not at all”, (1) “Several days”, (2) “More than half the days”, (3) “Nearly every day”
Behaviour (h)	1.983	0.861	0	3	230	“...Connected with other people”: (0) “Not at all”, (1) “Several days”, (2) “More than half the days”, (3) “Nearly every day”
Behaviour (i)	1.765	0.808	0	3	230	“...Did something kind or helpful for others”: (0) “Not at all”, (1) “Several days”, (2) “More than half the days”, (3) “Nearly every day”
Behaviour (j)	1.343	0.966	0	3	230	“...Tried to increase happiness at work”: (0) “Not at all”, (1) “Several days”, (2) “More than half the days”, (3) “Nearly every day”
Behaviour (k)	0.896	0.845	0	3	230	“...Tried to increase happiness in the community”: (0) “Not at all”, (1) “Several days”, (2) “More than half the days”, (3) “Nearly every day”
Behaviour (l)	1.170	0.994	0	3	230	“...Thought about the difference you make in the world”: (0) “Not at all”, (1) “Several days”, (2) “More than half the days”, (3) “Nearly every day”
<i>Biomarkers</i>						
Cortisol	0.164	0.653	0.015	10.300	275	Cortisol in µg/dL
Interferon IFN-γ	7.978	26.302	0.061	205.826	243	Interferon IFN-γ in pg/mL



Cytokine IL-10	1.433	2.900	0.023	37.906	274	Anti-Inflammatory Cytokine IL-10 in pg/mL
Cytokine IL-1 $\beta$	245.730	221.421	6.083	1,306.554	275	Pro-Inflammatory Cytokine IL-1 $\beta$ in pg/mL
Cytokine IL-6	9.324	18.997	0.710	206.299	275	Pro-Inflammatory Cytokine IL-6 in pg/mL
Chemokine IL-8	1,389.868	886.035	127.297	6,783.128	275	Chemokine IL-8 in pg/mL
<i>Controls</i>						
Age: 20-24	0.050	0.219	0	1	279	-
25-34	0.265	0.442	0	1	279	-
35-44	0.233	0.423	0	1	279	-
45-54	0.237	0.426	0	1	279	-
55-64	0.176	0.381	0	1	279	-
65-74	0.039	0.195	0	1	279	-
Gender: Male	0.176	0.381	0	1	279	-
Female	0.824	0.381	0	1	279	-
Marital Status: Single	0.394	0.490	0	1	279	-
Married	0.201	0.401	0	1	279	-
Separated	0.036	0.186	0	1	279	-
Divorced	0.100	0.301	0	1	279	-
Widowed	0.007	0.085	0	1	279	-
Domestic Partner	0.247	0.432	0	1	279	-
Prefer not to Say	0.014	0.119	0	1	279	-
Educational Status: Secondary Degree	0.047	0.211	0	1	279	-
Vocational Degree	0.079	0.270	0	1	279	-
Tertiary Degree	0.384	0.487	0	1	279	-
Higher Than Tertiary Degree	0.484	0.501	0	1	279	-
Prefer not to Say	0.007	0.085	0	1	279	-
Employment Status: Working Full-Time for Employer	0.498	0.501	0	1	279	-
Working Full-Time for Self	0.151	0.358	0	1	279	-
Working Part-Time	0.194	0.396	0	1	279	-
Working Part-Time (Underemployed)	0.004	0.060	0	1	279	-
Unemployed	0.050	0.219	0	1	279	-
Out of Labour Force	0.068	0.252	0	1	279	-
Prefer not to Say	0.036	0.186	0	1	279	-
Income: £14,999 or Less	0.143	0.351	0	1	279	-

£15,000-£29,999	0.197	0.399	0	1	279	-
£30,000-£44,999	0.201	0.401	0	1	279	-
£45,000-£59,999	0.122	0.328	0	1	279	-
£60,000-£74,999	0.122	0.328	0	1	279	-
£75,000 or More	0.161	0.368	0	1	279	-
Prefer not to Say	0.054	0.226	0	1	279	-
Religion: None	0.563	0.497	0	1	279	-
Christian	0.222	0.416	0	1	279	-
Buddhist	0.082	0.276	0	1	279	-
Hindu	0.029	0.167	0	1	279	-
Jewish	0.007	0.085	0	1	279	-
Muslim	0.007	0.085	0	1	279	-
Sikh	0.007	0.085	0	1	279	-
Other	0.029	0.167	0	1	279	-
Prefer not to Say	0.054	0.226	0	1	279	-
Religious Practice: Never	0.516	0.501	0	1	279	-
Less Than Annually	0.090	0.286	0	1	279	-
At Least Annually	0.143	0.351	0	1	279	-
At Least Monthly	0.100	0.301	0	1	279	-
At Least Weekly	0.086	0.281	0	1	279	-
Prefer not to Say	0.065	0.246	0	1	279	-
Smoking: Yes	0.082	0.276	0	1	279	-
No	0.918	0.276	0	1	279	-
Pregnant: Yes	0.014	0.119	0	1	279	-
No	0.986	0.119	0	1	279	-
Medication: Yes	0.416	0.494	0	1	279	-
No	0.584	0.494	0	1	279	-
Important to Meet New People and Make Friends: Yes	0.799	0.401	0	1	279	“How important is it for you to be meeting new people and making friends?” (0) “Not at all important” to (10) “Extremely important” (=6+7+8+9+10)
No	0.201	0.401	0	1	279	(=0+1+2+3+4+5)

**Table 1c**

## Balancing Properties Between Treatment and Control Group

	Mean Treatment Group, Pre-Intervention	Mean Control Group, Pre-Intervention	Difference
<i>Self-Reported Outcomes</i>			
Life Satisfaction	6.384	6.315	0.068
Happiness	6.151	6.288	-0.137
Anxiousness	4.233	4.438	-0.205
Worthwhileness	6.932	7.041	-0.110
PHQ-9 (Depression)	6.726	7.151	-0.425
GAD-7 (Anxiety)	6.110	6.671	-0.562
Compassion	6.523	6.792	-0.268
Social Trust	6.288	6.507	-0.219
Gratitude	6.205	6.178	0.027
Information (a)	7.479	7.469	0.010
Information (b)	7.188	7.224	-0.037
Information (c)	7.271	6.796	0.475
Information (d)	6.896	7.224	-0.329
Behaviour (a)	2.021	2.020	0.000
Behaviour (b)	1.333	1.429	-0.095
Behaviour (c)	1.417	1.449	-0.032
Behaviour (d)	1.667	1.571	0.095
Behaviour (e)	1.354	1.571	-0.217
Behaviour (f)	1.167	1.204	-0.037
Behaviour (g)	1.875	1.837	0.038
Behaviour (h)	1.854	2.061	-0.207
Behaviour (i)	1.521	1.816	-0.295*
Behaviour (j)	1.208	1.347	-0.139
Behaviour (k)	0.625	0.776	-0.151
Behaviour (l)	0.938	1.122	-0.185

*Biomarkers*

Cortisol	0.263	0.172	0.091
Interferon IFN- $\gamma$	9.613	7.510	2.103
Cytokine IL-10	1.783	1.397	0.387
Cytokine IL-1 $\beta$	256.544	284.884	-28.340
Cytokine IL-6	9.809	10.131	-0.322
Chemokine IL-8	1,379.952	1,603.446	-223.494

*Controls*

Age: 20-24	0.041	0.068	-0.027
25-34	0.288	0.247	0.041
35-44	0.233	0.233	-0.000
45-54	0.247	0.205	0.041
55-64	0.164	0.192	-0.027
65-74	0.027	0.055	-0.027
Gender: Male	0.178	0.164	0.014
Female	0.822	0.836	-0.014
Marital Status: Single	0.342	0.438	-0.096
Married	0.205	0.192	0.014
Separated	0.027	0.041	-0.014
Divorced	0.110	0.096	0.014
Widowed	0.000	0.014	-0.014
Domestic Partner	0.274	0.219	0.055
Prefer not to Say	0.041	0.000	0.041*
Educational Status: Secondary Degree	0.055	0.041	0.014
Vocational Degree	0.082	0.068	0.014
Tertiary Degree	0.425	0.356	0.068
Higher Than Tertiary Degree	0.425	0.534	-0.110
Prefer not to Say	0.014	0.000	0.014
Employment Status: Working Full-Time for Employer	0.534	0.466	0.068
Working Full-Time for Self	0.137	0.164	-0.027
Working Part-Time	0.151	0.219	-0.068
Working Part-Time (Underemployed)	0.014	0.000	0.014
Unemployed	0.055	0.041	0.014
Out of Labour Force	0.055	0.096	-0.041
Prefer not to say	0.055	0.014	0.041

Income: £14,999 or Less	0.137	0.137	-0.000
£15,000-£29,999	0.219	0.192	0.027
£30,000-£44,999	0.164	0.233	-0.068
£45,000-£59,999	0.082	0.178	-0.096*
£60,000-£74,999	0.123	0.110	0.014
£75,000 or More	0.192	0.123	0.068
Prefer not to Say	0.082	0.027	0.055
Religion: None	0.548	0.589	-0.041
Christian	0.192	0.247	-0.055
Buddhist	0.110	0.055	0.055
Hindu	0.041	0.014	0.027
Jewish	0.014	0.000	0.014
Muslim	0.014	0.000	0.014
Sikh	0.014	0.000	0.014
Other	0.014	0.041	-0.027
Prefer not to Say	0.055	0.055	-0.000
Religious Practice: Never	0.521	0.521	-0.000
Less Than Annually	0.068	0.110	-0.041
At Least Annually	0.164	0.123	0.041
At Least Monthly	0.082	0.110	-0.027
At Least Weekly	0.082	0.096	-0.014
Prefer not to Say	0.082	0.041	0.041
Smoking: Yes	0.082	0.110	-0.027
No	0.918	0.890	0.027
Pregnant: Yes	0.000	0.027	-0.027
No	1.000	0.973	0.027
Medication: Yes	0.397	0.438	-0.041
No	0.603	0.562	0.041
Important to Meet New People and Make Friends: Yes	0.726	0.808	-0.082
No	0.274	0.192	0.082
Observations	73	73	-

Notes: T-tests used robust standard errors clustered at individual level. See Supplementary Materials Table 1b for variable definitions.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 2a***Main Results – Self-Reported Outcomes (Regression Table for Figure 2)*

	Subjective Wellbeing				Mental Health		Pro-Sociality		
	Life Satisfaction (1)	Happiness (2)	Anxiousness (3)	Worthwhileness (4)	PHQ-9 (Depression) (5)	GAD-7 (Anxiety) (6)	Compassion (7)	Social Trust (8)	Gratitude (9)
Treatment*Post	0.633*** (0.152)	0.596*** (0.173)	-0.468** (0.190)	0.491*** (0.154)	-0.497*** (0.135)	-0.424*** (0.119)	0.383*** (0.145)	0.531*** (0.160)	0.286** (0.136)
Treatment	0.0947 (0.168)	0.0313 (0.163)	0.0306 (0.174)	-0.0682 (0.162)	0.0132 (0.168)	-0.0622 (0.159)	-0.275* (0.153)	-0.181 (0.197)	0.000337 (0.172)
Post	-0.0182 (0.103)	-0.141 (0.126)	0.0370 (0.134)	-0.0518 (0.109)	-0.00930 (0.0863)	0.0680 (0.0915)	-0.101 (0.0958)	-0.0782 (0.102)	-0.0734 (0.0965)
Age: 20-24									
25-34	-0.437 (0.278)	-0.409 (0.330)	-0.0941 (0.329)	0.214 (0.261)	-0.464 (0.337)	-0.546 (0.374)	0.228 (0.321)	0.425 (0.465)	0.0929 (0.276)
35-44	-0.719** (0.318)	-0.573* (0.343)	0.0531 (0.373)	-0.109 (0.305)	-0.470 (0.337)	-0.246 (0.382)	-0.263 (0.365)	-0.430 (0.466)	-0.0309 (0.328)
45-54	-0.784** (0.355)	-0.643* (0.372)	-0.289 (0.403)	0.131 (0.318)	-0.497 (0.348)	-0.391 (0.390)	-0.211 (0.359)	0.126 (0.530)	0.351 (0.324)
55-64	-0.502 (0.342)	-0.382 (0.374)	-0.209 (0.414)	0.00985 (0.309)	-0.536 (0.399)	-0.433 (0.393)	-0.271 (0.414)	0.292 (0.538)	-0.0480 (0.339)
65-74	-0.968 (0.594)	-0.838* (0.486)	-0.0171 (0.564)	-0.444 (0.555)	-0.549 (0.511)	-0.0981 (0.469)	-1.258* (0.734)	-0.373 (0.735)	-0.817 (0.513)
Gender: Male									
Female	0.140 (0.209)	0.0599 (0.196)	-0.0526 (0.238)	0.209 (0.254)	-0.0558 (0.220)	0.0898 (0.218)	0.875*** (0.250)	0.238 (0.211)	0.257 (0.188)
Marital Status: Single									
Partnered	0.0655 (0.168)	-0.170 (0.172)	0.190 (0.186)	0.0624 (0.163)	0.00306 (0.173)	0.107 (0.184)	-0.103 (0.195)	-0.120 (0.226)	-0.140 (0.173)
Married	0.106	-0.282	-0.0888	-0.0236	-0.109	-0.194	0.0670	0.203	0.145

Separated	(0.214) -0.0139 (0.404)	(0.189) -0.840** (0.366)	(0.227) 0.0225 (0.381)	(0.195) 0.0868 (0.363)	(0.204) 0.0442 (0.353)	(0.216) -0.0811 (0.338)	(0.215) 0.0234 (0.405)	(0.255) -0.0862 (0.347)	(0.202) -0.131 (0.381)
Divorced	-0.446 (0.345)	-0.527* (0.311)	0.0501 (0.301)	-0.756** (0.314)	0.274 (0.360)	-0.0524 (0.298)	0.567* (0.294)	-0.502 (0.328)	-0.168 (0.320)
Widowed	0.550 (0.639)	0.109 (0.519)	0.646 (0.582)	0.685 (0.611)	0.463 (0.600)	-1.357*** (0.513)	1.440* (0.759)	0.639 (0.646)	1.445*** (0.517)
Prefer not to Say	0.832** (0.366)	0.452 (0.483)	-0.611 (0.511)	-0.104 (0.733)	-0.460 (0.471)	-0.803*** (0.292)	-0.565 (0.506)	-1.120 (1.153)	0.721** (0.289)
Educational Status: Secondary Degree									
Vocational Degree	0.302 (0.547)	0.600 (0.477)	-0.447 (0.478)	0.0765 (0.552)	0.268 (0.506)	0.240 (0.437)	-0.374 (0.446)	-0.579 (0.434)	-0.642 (0.642)
Tertiary Degree	0.534 (0.507)	0.501 (0.390)	-0.0735 (0.362)	0.246 (0.369)	-0.396 (0.408)	-0.126 (0.361)	-0.327 (0.252)	-0.595* (0.306)	-0.401 (0.356)
Higher Than Tertiary Degree	0.305 (0.475)	0.355 (0.359)	0.226 (0.350)	-0.0663 (0.354)	-0.00718 (0.395)	0.214 (0.344)	-0.230 (0.241)	-0.700** (0.304)	-0.513 (0.335)
Prefer not to Say	0.226 (0.686)	0.637 (0.652)	-3.393*** (0.587)	0.157 (0.651)	-2.001*** (0.608)	-1.533** (0.640)	0.582 (0.542)	-0.142 (0.726)	-0.396 (0.559)
Employment Status: Working Full-Time for Employer									
Working Full-Time for Self	0.0604 (0.240)	-0.110 (0.227)	0.302 (0.250)	0.211 (0.276)	0.280 (0.252)	0.334 (0.233)	0.0169 (0.306)	0.00683 (0.236)	0.0378 (0.292)
Working Part-Time	0.0458 (0.294)	0.183 (0.224)	-0.0633 (0.254)	-0.0667 (0.248)	-0.00339 (0.289)	-0.304 (0.252)	-0.173 (0.254)	-0.0294 (0.323)	-0.479* (0.257)
Working Part-Time (Underemployed)	-2.141*** (0.764)	-1.984** (0.828)	-0.439 (0.765)	-0.992 (1.012)	-0.00678 (0.744)	0.157 (0.713)	0.0789 (0.767)	-0.697 (1.398)	-2.194*** (0.701)
Unemployed	-1.566*** (0.408)	-1.144*** (0.386)	0.609 (0.433)	-1.045** (0.439)	0.812** (0.395)	0.265 (0.343)	0.290 (0.371)	-0.273 (0.569)	-0.800** (0.400)
Out of Labour Force	-0.113 (0.409)	0.284 (0.385)	-0.0572 (0.409)	0.169 (0.397)	0.0950 (0.380)	-0.347 (0.302)	0.103 (0.308)	0.00220 (0.433)	-0.121 (0.440)
Prefer not to say	-0.507 (0.388)	-0.396 (0.445)	0.419 (0.357)	-0.369 (0.469)	-0.190 (0.306)	-0.707*** (0.270)	-0.400 (0.279)	-0.686* (0.411)	0.0153 (0.343)

Income: £14,999 or Less

£15,000-£29,999	-0.0517 (0.290)	-0.239 (0.328)	0.410 (0.321)	-0.337 (0.320)	-0.0432 (0.279)	0.258 (0.275)	-0.121 (0.276)	-0.118 (0.405)	0.0925 (0.280)
£30,000-£44,999	-0.0803 (0.303)	-0.347 (0.315)	0.535 (0.329)	-0.126 (0.363)	0.0525 (0.311)	0.527* (0.293)	-0.288 (0.306)	-0.0209 (0.369)	-0.121 (0.356)
£45,000-£59,999	0.476 (0.324)	0.0785 (0.365)	0.268 (0.400)	-0.216 (0.389)	-0.106 (0.324)	0.100 (0.316)	-0.160 (0.368)	-0.113 (0.472)	0.457 (0.351)
£60,000-£74,999	0.333 (0.352)	0.276 (0.365)	0.325 (0.369)	-0.234 (0.359)	-0.237 (0.352)	0.0933 (0.370)	0.0205 (0.350)	-0.134 (0.420)	-0.0376 (0.323)
£75,000 or More	0.159 (0.352)	0.000426 (0.356)	0.0371 (0.342)	-0.219 (0.403)	-0.300 (0.332)	0.0649 (0.297)	0.0655 (0.367)	0.389 (0.403)	0.113 (0.332)
Prefer not to Say	0.834** (0.359)	0.575 (0.398)	-0.228 (0.363)	0.542 (0.439)	-0.328 (0.309)	0.0827 (0.330)	0.268 (0.415)	1.195** (0.484)	0.484 (0.378)
Religion: None									
Christian	-0.267 (0.307)	-0.366 (0.236)	-0.0735 (0.243)	-0.0667 (0.237)	-0.184 (0.262)	0.0929 (0.262)	-0.0942 (0.199)	-0.713*** (0.239)	-0.178 (0.248)
Buddhist	0.341 (0.339)	0.160 (0.324)	-0.230 (0.320)	0.223 (0.316)	-0.355 (0.385)	-0.191 (0.337)	0.538* (0.274)	-0.274 (0.347)	0.00938 (0.317)
Hindu	-0.0841 (0.555)	-0.000969 (0.470)	-0.192 (0.759)	-0.211 (0.448)	-0.0174 (0.519)	0.291 (0.485)	-0.331 (0.494)	-0.269 (0.620)	-0.444 (0.557)
Jewish	0.628 (0.481)	-0.0508 (0.418)	-1.205** (0.481)	0.708 (0.507)	-0.340 (0.544)	0.0246 (0.480)	1.695*** (0.476)	1.359*** (0.482)	0.530 (0.476)
Muslim	-1.270** (0.560)	-0.831* (0.454)	0.250 (0.479)	0.153 (0.646)	-0.0160 (0.532)	0.428 (0.444)	1.622*** (0.550)	-0.841* (0.495)	-3.467*** (0.551)
Sikh	0.260 (0.582)	-0.299 (0.513)	0.149 (0.465)	0.311 (0.508)	0.597 (0.706)	0.235 (0.649)	-1.125** (0.451)	-0.515 (0.587)	-1.369*** (0.459)
Other	-0.449 (0.344)	-0.241 (0.339)	0.234 (0.408)	-0.269 (0.435)	-0.639 (0.397)	-0.203 (0.403)	-0.662 (0.557)	-1.669** (0.679)	-1.139 (0.824)
Prefer not to Say	-0.420 (0.317)	-0.695* (0.378)	0.827*** (0.224)	-0.792*** (0.235)	1.357*** (0.333)	1.145*** (0.386)	-0.0592 (0.262)	-0.353 (0.445)	-0.293 (0.325)
Religious Practice: Never									
Less Than Annually	0.130 (0.291)	0.434* (0.231)	-0.0805 (0.268)	0.251 (0.300)	-0.386 (0.257)	-0.333 (0.237)	-0.296 (0.316)	-0.0603 (0.320)	-0.128 (0.321)



At Least Annually	0.00521 (0.275)	-0.179 (0.230)	0.483** (0.237)	0.0319 (0.263)	0.290 (0.312)	0.182 (0.279)	-0.0124 (0.210)	0.114 (0.244)	0.299 (0.275)
At Least Monthly	0.154 (0.320)	0.202 (0.304)	-0.0144 (0.308)	0.580* (0.339)	-0.153 (0.296)	-0.129 (0.348)	-0.186 (0.324)	0.368 (0.352)	0.622* (0.365)
At Least Weekly	0.230 (0.366)	0.147 (0.336)	0.177 (0.342)	0.128 (0.314)	0.209 (0.333)	0.0621 (0.352)	0.328 (0.299)	0.708** (0.355)	0.803** (0.321)
Prefer not to Say	-0.0879 (0.452)	0.0410 (0.418)	0.979*** (0.261)	-0.0982 (0.382)	-0.0190 (0.520)	0.101 (0.464)	-0.0827 (0.229)	-0.379 (0.424)	0.286 (0.307)
Smoking: Yes									
No	0.271 (0.224)	0.204 (0.240)	0.0723 (0.348)	0.482* (0.260)	-0.405 (0.263)	-0.262 (0.252)	-0.00821 (0.256)	0.0993 (0.242)	0.401 (0.277)
Pregnant: Yes									
No	-0.411 (0.728)	-0.370 (0.469)	-0.0892 (0.609)	-0.222 (0.662)	-0.497 (0.696)	-0.410 (0.652)	-0.252 (0.362)	0.221 (0.368)	-0.168 (0.384)
Medication: Yes									
No	-0.0356 (0.149)	0.212 (0.138)	-0.311* (0.173)	0.134 (0.157)	-0.259 (0.169)	-0.279* (0.157)	-0.0975 (0.165)	-0.0661 (0.169)	-0.0421 (0.152)
Preference for Socialising: Yes									
No	-0.237 (0.185)	-0.224 (0.168)	-0.0720 (0.175)	-0.302 (0.213)	0.317* (0.169)	0.332* (0.180)	-0.396** (0.165)	-0.308* (0.175)	-0.178 (0.163)
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Set Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	279	279	279	279	279	279	279	279	279
R Squared	0.422	0.330	0.329	0.303	0.381	0.353	0.354	0.319	0.405

Notes: Robust standard errors clustered at individual level in parentheses. See Supplementary Materials Table 1b for variable definitions.

\*\*\* p<0.01, \*\* p<0.05, \*

p<0.1

**Table 2b***Main Results – Biomarkers (Regression Table for Figure 4)*

	Stress	Immune Response				
	Cortisol (1)	Interferon IFN- $\gamma$ (2)	Cytokine IL- 10 (3)	Cytokine IL- 1 $\beta$ (4)	Cytokine IL- 6 (5)	Chemokine IL-8 (6)
Treatment*Post	0.0248 (0.252)	0.207 (0.246)	0.0623 (0.172)	-0.0738 (0.171)	-0.0873 (0.179)	0.0731 (0.200)
Treatment	0.175 (0.207)	-0.393* (0.201)	-0.0426 (0.198)	0.0416 (0.192)	0.0283 (0.175)	-0.158 (0.192)
Post	-0.302** (0.132)	-0.124 (0.171)	-0.149 (0.112)	-0.203** (0.0964)	-0.0589 (0.119)	-0.288** (0.123)
Age: 20-24						
25-34	-0.454 (0.486)	0.0213 (0.284)	0.303 (0.359)	0.398 (0.536)	0.444 (0.297)	0.496 (0.464)
35-44	-0.339 (0.499)	-0.437 (0.313)	0.180 (0.378)	0.236 (0.560)	0.318 (0.355)	0.409 (0.502)
45-54	-0.602 (0.496)	-0.255 (0.310)	0.139 (0.425)	0.871 (0.581)	0.743** (0.335)	0.903* (0.510)
55-64	-0.449 (0.548)	-0.167 (0.319)	0.160 (0.428)	0.955* (0.547)	0.797** (0.365)	1.014** (0.490)
65-74	-0.0713 (0.720)	-0.918* (0.502)	0.586 (0.501)	0.855 (0.739)	0.494 (0.426)	0.934 (0.662)
Gender: Male						
Female	-0.726*** (0.244)	-0.527** (0.245)	-0.212 (0.224)	-0.269 (0.213)	-0.476** (0.199)	-0.385* (0.224)
Marital Status: Single						
Partnered	-0.278 (0.232)	-0.530** (0.208)	-0.0175 (0.264)	-0.210 (0.254)	-0.293 (0.212)	-0.181 (0.227)
Married	0.0976 (0.479)	-0.417 (0.384)	-0.268 (0.333)	0.0717 (0.571)	0.325 (0.411)	-0.249 (0.622)
Separated	0.478 (0.349)	-0.663** (0.310)	-0.292 (0.316)	-0.686* (0.412)	-0.00438 (0.331)	-0.287 (0.370)
Divorced	1.871** (0.849)	1.183* (0.659)	-0.0915 (0.540)	0.126 (0.712)	0.286 (0.636)	0.506 (0.676)
Widowed	-0.275 (0.242)	-0.0468 (0.231)	-0.0890 (0.181)	0.213 (0.233)	0.0978 (0.199)	-0.00300 (0.236)
Prefer not to Say	-0.913 (0.755)	-0.262 (0.499)	0.00989 (0.689)	-0.310 (0.533)	-0.761** (0.293)	0.0821 (0.732)
Educational Status: Secondary Degree						
Vocational Degree	-0.801* (0.471)	0.781 (0.611)	0.429 (0.350)	0.596 (0.558)	0.591 (0.510)	0.863* (0.515)
Tertiary Degree	-0.372 (0.369)	-0.0111 (0.372)	0.917*** (0.257)	0.417 (0.323)	0.275 (0.383)	0.525* (0.315)
Higher Than Tertiary Degree	-0.270	0.0780	0.627***	0.584**	0.337	0.601**

	(0.359)	(0.352)	(0.231)	(0.273)	(0.345)	(0.255)
Prefer not to Say	0.0317	0.271	0.0535	-1.100	0.840	-0.103
	(0.839)	(0.549)	(0.612)	(0.730)	(0.667)	(0.587)
Employment Status: Working Full-Time for Employer						
Working Full-Time for Self	-0.121	0.149	0.557**	0.322	0.360	-0.173
	(0.268)	(0.254)	(0.265)	(0.321)	(0.307)	(0.313)
Working Part-Time	-0.551*	0.439*	0.0576	-0.0869	0.0854	-0.157
	(0.280)	(0.255)	(0.262)	(0.291)	(0.261)	(0.276)
Working Part-Time (Underemployed)	0.265	0.383	2.392**	1.383	0.0683	-0.0903
	(1.231)	(0.684)	(1.005)	(0.998)	(0.855)	(1.053)
Unemployed	0.479	0.823	1.200**	0.680	0.684	0.780*
	(0.648)	(0.594)	(0.534)	(0.486)	(0.416)	(0.456)
Out of Labour Force	-0.450	0.257	0.0806	0.330	0.297	0.0438
	(0.393)	(0.302)	(0.402)	(0.361)	(0.298)	(0.380)
Prefer not to say	-0.249	0.110	0.521	0.748*	-0.121	0.0141
	(0.502)	(0.276)	(0.432)	(0.436)	(0.375)	(0.331)
Income: £14,999 or Less						
£15,000-£29,999	0.192	0.124	0.216	-0.465	0.136	0.0999
	(0.420)	(0.365)	(0.292)	(0.391)	(0.316)	(0.362)
£30,000-£44,999	-0.0639	0.384	0.663**	-0.000538	0.402	-0.0239
	(0.400)	(0.399)	(0.284)	(0.391)	(0.338)	(0.382)
£45,000-£59,999	0.135	0.320	0.812**	-0.0331	0.222	0.419
	(0.442)	(0.440)	(0.376)	(0.382)	(0.389)	(0.390)
£60,000-£74,999	0.393	0.467	0.444	-0.163	0.280	0.253
	(0.472)	(0.410)	(0.298)	(0.346)	(0.353)	(0.332)
£75,000 or More	-0.138	0.414	0.744**	-0.107	0.356	0.307
	(0.410)	(0.375)	(0.375)	(0.387)	(0.345)	(0.368)
Prefer not to Say	0.311	0.297	-0.367	-0.734	-0.150	-0.0152
	(0.514)	(0.432)	(0.478)	(0.573)	(0.588)	(0.503)
Religion: None						
Christian	0.244	0.0628	0.138	-0.0853	-0.141	-0.00697
	(0.305)	(0.255)	(0.263)	(0.286)	(0.265)	(0.320)
Buddhist	0.0665	0.0452	-0.223	-0.152	-0.139	-0.168
	(0.420)	(0.314)	(0.422)	(0.419)	(0.475)	(0.489)
Hindu	0.464	0.171	0.161	-0.321	-0.911**	-0.0799
	(0.509)	(0.453)	(0.482)	(0.495)	(0.437)	(0.525)
Jewish	-0.124	0.207	-0.163	0.271	1.124**	0.949*
	(0.862)	(0.521)	(0.506)	(0.523)	(0.531)	(0.563)
Muslim	0.893	1.048*	0.996**	1.790***	0.548	1.086*
	(0.706)	(0.540)	(0.485)	(0.547)	(0.525)	(0.586)
Sikh	0.128	-0.963**	-1.073**	-1.571***	-1.294***	-0.702
	(0.566)	(0.477)	(0.439)	(0.464)	(0.487)	(0.481)
Other	-0.0458	-0.207	-0.187	-0.0504	-0.829	-0.338
	(0.449)	(0.469)	(0.453)	(0.552)	(0.523)	(0.663)
Prefer not to Say	0.279	0.0557	-0.352	0.163	-0.304	0.219
	(0.478)	(0.347)	(0.291)	(0.407)	(0.301)	(0.267)

Religious Practice:						
Never						
Less Than Annually	-0.250 (0.325)	0.0682 (0.317)	-0.0493 (0.301)	0.0371 (0.330)	0.190 (0.421)	0.0898 (0.368)
At Least Annually	-0.470 (0.308)	-0.0300 (0.249)	0.228 (0.308)	0.239 (0.276)	-0.0887 (0.231)	-0.0759 (0.301)
At Least Monthly	-0.794** (0.350)	-0.196 (0.317)	0.384 (0.374)	0.953** (0.384)	0.504 (0.355)	0.463 (0.426)
At Least Weekly	-0.209 (0.495)	0.242 (0.366)	-0.209 (0.371)	0.0878 (0.428)	0.465 (0.429)	0.120 (0.468)
Prefer not to Say	-0.539 (0.429)	0.229 (0.286)	0.632** (0.242)	0.620* (0.361)	0.457 (0.373)	0.433 (0.331)
Smoking: Yes						
No	0.144 (0.408)	0.226 (0.265)	0.225 (0.222)	0.211 (0.221)	0.193 (0.267)	0.0950 (0.284)
Pregnant: Yes						
No	0.549 (0.540)	0.458 (0.371)	1.163*** (0.407)	-0.133 (0.413)	0.227 (0.340)	0.490 (0.611)
Medication: Yes						
No	-0.0400 (0.148)	-0.00962 (0.162)	-0.0461 (0.170)	0.0589 (0.175)	-0.0168 (0.161)	-0.124 (0.167)
Preference for Socialising: Yes						
No	-0.184 (0.192)	0.000524 (0.192)	-0.235 (0.185)	-0.173 (0.210)	0.117 (0.199)	-0.210 (0.212)
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Set Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	265	236	269	275	268	274
R-Squared	0.246	0.217	0.272	0.302	0.279	0.246

Notes: Robust standard errors clustered at individual level in parentheses. See Supplementary Materials Table 1b for variable definitions.

\*\*\* p<0.01, \*\* p<0.05,

\* p<0.1

**Table 3a***Mechanisms – Changes in Information*

	Information			
	(a)	(b)	(c)	(d)
Treatment*Post	0.694*** (0.195)	0.651*** (0.193)	0.605*** (0.183)	0.549** (0.224)
Treatment	0.0878 (0.231)	0.0330 (0.206)	0.243 (0.199)	-0.279 (0.222)
Post	-0.0592 (0.111)	-0.0747 (0.132)	-0.0386 (0.128)	-0.0608 (0.157)
Age: 20-24				
25-34	0.0729 (0.288)	0.156 (0.298)	0.00778 (0.275)	0.0941 (0.268)
35-44	-0.0832 (0.302)	0.0241 (0.334)	-0.0846 (0.322)	-0.0138 (0.318)
45-54	-0.0166 (0.286)	0.178 (0.331)	-0.342 (0.383)	0.0810 (0.328)
55-64	0.0555 (0.335)	0.275 (0.371)	-0.259 (0.328)	0.115 (0.356)
65-74	-0.924* (0.483)	0.119 (0.577)	-1.079** (0.453)	-0.998* (0.558)
Gender: Male				
Female	-0.00456 (0.261)	-0.0359 (0.220)	0.0165 (0.270)	0.681*** (0.259)
Marital Status: Single				
Partnered	-0.143 (0.185)	0.140 (0.217)	0.102 (0.214)	-0.0331 (0.197)
Married	0.182 (0.313)	1.054*** (0.315)	0.297 (0.483)	-0.306 (0.425)
Separated	-0.425 (0.354)	-0.0748 (0.322)	-0.141 (0.344)	-0.272 (0.347)
Divorced	1.412** (0.636)	1.397** (0.647)	1.715*** (0.603)	2.593*** (0.646)
Widowed	-0.275 (0.236)	0.148 (0.191)	-0.0927 (0.198)	-0.178 (0.196)
Prefer not to Say	0.337 (0.497)	0.544* (0.296)	0.920** (0.354)	0.414 (0.347)
Educational Status: Secondary Degree				
Vocational Degree	0.0323 (0.540)	-0.0426 (0.544)	-0.417 (0.535)	-0.0506 (0.295)
Tertiary Degree	-0.100 (0.255)	-0.0912 (0.330)	-0.562** (0.283)	-0.414 (0.257)
Higher Than Tertiary Degree	-0.0892 (0.258)	-0.437 (0.317)	-0.645** (0.272)	-0.490** (0.223)
Prefer not to Say	0.259 (0.767)	-0.158 (0.717)	-0.691 (0.599)	-0.445 (0.722)

Employment Status: Working  
Full-Time for Employer

Working Full-Time for Self	0.108 (0.308)	0.215 (0.277)	0.137 (0.292)	0.207 (0.250)
Working Part-Time	-0.269 (0.268)	-0.362 (0.240)	0.00442 (0.262)	-0.372 (0.238)
Working Part-Time (Underemployed)	-0.915 (0.778)	-0.597 (0.682)	-1.766** (0.753)	-0.940 (0.645)
Unemployed	0.0802 (0.399)	-0.457 (0.424)	-0.486 (0.537)	-0.557 (0.387)
Out of Labour Force	0.256 (0.316)	0.337 (0.306)	0.425 (0.399)	0.0206 (0.338)
Prefer not to say	-0.540 (0.669)	-0.594 (0.463)	-0.193 (0.376)	-0.737 (0.496)
Income: £14,999 or Less				
£15,000-£29,999	0.0127 (0.346)	-0.132 (0.332)	0.104 (0.379)	-0.625** (0.303)
£30,000-£44,999	-0.0758 (0.406)	-0.182 (0.370)	-0.109 (0.411)	-0.631** (0.296)
£45,000-£59,999	-0.0151 (0.395)	0.000390 (0.338)	0.181 (0.392)	-0.758** (0.321)
£60,000-£74,999	0.0808 (0.366)	-0.226 (0.333)	0.403 (0.385)	-0.533* (0.319)
£75,000 or More	-0.0782 (0.459)	-0.550 (0.371)	-0.00954 (0.446)	-0.789** (0.382)
Prefer not to Say	0.801 (0.497)	0.596 (0.410)	0.934* (0.478)	0.277 (0.406)
Religion: None				
Christian	0.345 (0.238)	0.164 (0.243)	0.272 (0.236)	0.237 (0.238)
Buddhist	0.443 (0.344)	0.000895 (0.376)	0.136 (0.315)	0.366 (0.313)
Hindu	-0.486 (0.506)	-0.775 (0.524)	-0.314 (0.487)	-0.177 (0.469)
Jewish	0.459 (0.648)	0.677 (0.564)	0.386 (0.561)	0.794 (0.502)
Muslim	-0.146 (0.713)	0.144 (0.632)	0.250 (0.624)	-0.374 (0.573)
Sikh	-0.196 (0.569)	0.522 (0.484)	0.101 (0.536)	-0.0574 (0.472)
Other	-0.465 (0.502)	0.0813 (0.399)	-0.114 (0.468)	0.0230 (0.460)
Prefer not to Say	-0.466 (0.368)	-0.186 (0.353)	0.0743 (0.306)	0.187 (0.293)
Religious Practice: Never				
Less Than Annually	-0.201 (0.372)	0.145 (0.336)	0.144 (0.342)	0.110 (0.319)
At Least Annually	-0.592* (0.330)	-0.237 (0.310)	-0.0981 (0.290)	-0.0421 (0.274)

At Least Monthly	0.0339 (0.291)	0.291 (0.328)	0.310 (0.273)	0.0420 (0.305)
At Least Weekly	0.165 (0.300)	0.602* (0.317)	0.244 (0.367)	-0.324 (0.307)
Prefer not to Say	-0.405 (0.416)	-0.0783 (0.345)	-0.345 (0.418)	-0.00899 (0.235)
Smoking: Yes				
No	0.0436 (0.291)	0.396 (0.284)	0.378 (0.294)	0.239 (0.243)
Pregnant: Yes				
No	-1.101** (0.497)	-0.687 (0.538)	-0.832 (0.652)	-0.706** (0.313)
Medication: Yes				
No	-0.0431 (0.199)	-0.243 (0.196)	-0.169 (0.185)	-0.165 (0.162)
Preference for Socialising: Yes				
No	-0.0856 (0.175)	-0.0995 (0.183)	-0.0840 (0.185)	-0.253 (0.182)
Constant	Yes	Yes	Yes	Yes
Set Fixed Effect	Yes	Yes	Yes	Yes
Observations	230	230	230	230
R-Squared	0.357	0.328	0.316	0.352

Notes: Robust standard errors clustered at individual level in parentheses. The dependent variables are (a) awareness of what contributes to a happy and meaningful life, (b) knowledge of what really matters to oneself in life, (c) feeling of being able to do things to improve one's own wellbeing, and (d) feeling of being able to improve the wellbeing of others. See Supplementary Materials Table 1b for variable definitions.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 3b***Mechanisms – Changes in Behaviour*

	Behaviour											
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
Treatment*Post	0.752*** (0.211)	0.823*** (0.226)	0.616*** (0.216)	0.387* (0.229)	0.282 (0.230)	0.430* (0.252)	0.309 (0.228)	0.465** (0.210)	0.653*** (0.226)	0.409* (0.210)	0.361* (0.206)	0.232 (0.185)
Treatment	-0.152 (0.218)	-0.157 (0.246)	-0.100 (0.207)	0.0180 (0.225)	-0.267 (0.202)	-0.0341 (0.258)	-0.153 (0.204)	-0.265 (0.224)	-0.665** (0.265)	-0.154 (0.220)	-0.300 (0.192)	-0.0330 (0.210)
Post	-0.0894 (0.126)	-0.209* (0.126)	0.0345 (0.130)	0.0274 (0.169)	0.137 (0.158)	0.0947 (0.171)	-0.172 (0.120)	0.0122 (0.134)	0.0365 (0.125)	-0.0116 (0.141)	0.380*** (0.142)	0.119 (0.122)
Age: 20-24												
25-34	0.0605 (0.377)	0.840** (0.325)	-0.142 (0.341)	0.0523 (0.373)	0.0416 (0.278)	-0.0401 (0.521)	-0.0515 (0.365)	0.612 (0.398)	0.213 (0.339)	0.391 (0.257)	0.953*** (0.297)	0.460 (0.335)
35-44	0.143 (0.400)	0.725* (0.432)	-0.203 (0.385)	-0.0407 (0.399)	-0.544* (0.326)	-0.375 (0.530)	-0.351 (0.372)	0.276 (0.426)	0.242 (0.365)	0.461 (0.321)	1.172*** (0.344)	0.270 (0.381)
45-54	0.241 (0.411)	0.817* (0.453)	-0.332 (0.407)	-0.196 (0.408)	-0.0590 (0.348)	-0.290 (0.582)	-0.232 (0.397)	0.172 (0.456)	0.412 (0.362)	0.367 (0.317)	1.353*** (0.356)	0.606 (0.369)
55-64	-0.0673 (0.418)	0.798* (0.478)	0.0693 (0.453)	-0.200 (0.433)	-0.463 (0.359)	-0.562 (0.590)	-0.421 (0.401)	0.521 (0.455)	0.440 (0.428)	0.241 (0.377)	0.921** (0.386)	0.187 (0.392)
65-74	-1.309** (0.548)	-0.153 (0.512)	-0.446 (0.648)	0.126 (0.694)	-0.618 (0.524)	-0.422 (0.642)	-1.589*** (0.535)	0.0126 (0.572)	-0.315 (0.505)	0.580 (0.737)	1.234** (0.565)	0.428 (0.481)
Gender: Male												
Female	0.625** (0.253)	0.159 (0.291)	0.210 (0.237)	-0.0320 (0.251)	0.339 (0.221)	0.124 (0.288)	0.220 (0.263)	0.473* (0.277)	0.869*** (0.253)	0.535** (0.250)	0.805*** (0.213)	0.489** (0.215)
Marital Status: Single												
Partnered	0.0707 (0.198)	0.173 (0.251)	-0.0316 (0.225)	0.412* (0.217)	0.369** (0.183)	0.318 (0.239)	0.717*** (0.225)	0.285 (0.251)	0.0894 (0.228)	-0.237 (0.227)	0.180 (0.192)	-0.140 (0.184)
Married	0.243 (0.490)	-0.00998 (0.488)	0.870 (0.546)	0.367 (0.469)	0.198 (0.473)	0.155 (0.501)	0.123 (0.479)	0.0803 (0.608)	0.238 (0.687)	0.814* (0.482)	-0.406 (0.462)	-0.0452 (0.380)
Separated	-0.0316	0.268	0.0684	0.207	0.0177	0.0919	-0.113	-0.199	-0.0403	-0.121	0.335	0.0212



	(0.430)	(0.396)	(0.383)	(0.405)	(0.393)	(0.424)	(0.292)	(0.366)	(0.516)	(0.364)	(0.378)	(0.417)
Divorced	0.648	1.563**	-0.321	-0.390	-0.405	-1.749***	2.955***	1.334**	-0.173	-0.728	0.899	0.561
	(0.543)	(0.676)	(0.736)	(0.763)	(0.630)	(0.617)	(0.621)	(0.605)	(0.681)	(0.848)	(0.604)	(0.604)
Widowed	-0.0707	0.274	0.0231	0.218	0.166	0.198	0.323	0.103	0.139	-0.0987	-0.0504	-0.0780
	(0.228)	(0.267)	(0.201)	(0.221)	(0.185)	(0.255)	(0.223)	(0.214)	(0.244)	(0.197)	(0.205)	(0.221)
Prefer not to Say	1.095**	-0.478	1.376**	0.853**	-0.944*	1.625*	-0.627*	-0.851**	-0.425	-0.287	0.739***	-0.437
	(0.498)	(0.802)	(0.551)	(0.386)	(0.494)	(0.914)	(0.376)	(0.427)	(0.375)	(0.330)	(0.265)	(0.399)
Educational Status: Secondary Degree												
Vocational Degree	-0.445	0.262	-1.038**	-0.962	-0.449	-0.404	0.550	-0.905*	-0.290	0.226	-0.385	-0.349
	(0.568)	(0.404)	(0.523)	(0.621)	(0.465)	(0.469)	(0.375)	(0.521)	(0.466)	(0.510)	(0.415)	(0.586)
Tertiary Degree	-0.407	0.219	-1.002***	-0.663*	-0.630*	-0.115	0.465	-0.598	-0.407	0.470	-0.109	-0.277
	(0.425)	(0.375)	(0.364)	(0.388)	(0.347)	(0.368)	(0.329)	(0.373)	(0.291)	(0.344)	(0.217)	(0.417)
Higher Than Tertiary Degree	-0.599	0.0252	-1.196***	-0.871**	-0.561*	-0.310	0.153	-0.935**	-0.868***	0.0449	-0.335	-0.0122
	(0.405)	(0.354)	(0.327)	(0.364)	(0.314)	(0.338)	(0.324)	(0.385)	(0.275)	(0.326)	(0.208)	(0.400)
Prefer not to Say	-0.488	-1.570*	0.139	-0.637	-1.980***	0.249	1.329**	0.0421	0.800	-0.552	-0.266	-0.284
	(0.681)	(0.836)	(0.603)	(0.708)	(0.593)	(0.633)	(0.582)	(0.665)	(0.785)	(0.626)	(0.515)	(0.690)
Employment Status: Working Full-Time for Employer												
Working Full-Time for Self	0.317	-0.122	0.291	0.218	0.470*	0.127	-0.0472	0.146	0.149	0.499*	0.526*	0.338
	(0.315)	(0.306)	(0.291)	(0.289)	(0.245)	(0.317)	(0.299)	(0.298)	(0.362)	(0.293)	(0.295)	(0.307)
Working Part-Time	0.103	-0.215	-0.0963	0.0229	-0.129	0.197	-0.0404	-0.381	0.0183	-0.118	-0.329	0.188
	(0.270)	(0.315)	(0.253)	(0.274)	(0.222)	(0.323)	(0.241)	(0.275)	(0.319)	(0.285)	(0.231)	(0.259)
Working Part-Time (Underemployed)	-0.721	1.675	-4.005***	-2.464***	-0.0200	-3.579***	-1.730**	-0.0992	0.579	0.00843	0.476	-0.428
	(0.871)	(1.117)	(0.884)	(0.862)	(0.769)	(1.182)	(0.743)	(0.871)	(0.856)	(0.731)	(0.684)	(0.771)
Unemployed	-0.633	-0.0557	-0.181	-0.242	0.195	0.513	0.0428	-0.276	0.283	-0.955**	0.315	0.212
	(0.384)	(0.557)	(0.405)	(0.395)	(0.439)	(0.486)	(0.389)	(0.461)	(0.389)	(0.369)	(0.448)	(0.341)
Out of Labour Force	0.863*	0.0516	0.783	0.500	0.242	0.610	0.582	0.212	0.419	0.126	0.328	0.670
	(0.484)	(0.437)	(0.511)	(0.487)	(0.513)	(0.515)	(0.363)	(0.413)	(0.442)	(0.542)	(0.531)	(0.433)
Prefer not to say	0.00643	0.283	-0.0814	0.339	-0.527*	-0.500	0.149	-1.303***	-0.526	-0.506	-0.417	-0.540
	(0.352)	(0.542)	(0.378)	(0.384)	(0.294)	(0.381)	(0.266)	(0.373)	(0.456)	(0.378)	(0.425)	(0.399)
Income: £14,999 or Less												
£15,000-£29,999	-0.241	-0.0169	-0.364	-0.142	-0.353	0.0478	-0.366	0.0143	-0.00364	-0.149	-0.175	-0.195
	(0.410)	(0.443)	(0.380)	(0.391)	(0.353)	(0.388)	(0.363)	(0.357)	(0.343)	(0.327)	(0.314)	(0.375)
£30,000-£44,999	-0.0761	0.161	-0.0125	-0.131	0.241	-0.235	-0.578*	-0.197	-0.0511	-0.0348	-0.557*	0.0248

	(0.372)	(0.396)	(0.413)	(0.418)	(0.325)	(0.400)	(0.308)	(0.365)	(0.391)	(0.377)	(0.308)	(0.358)
£45,000-£59,999	0.158	0.00964	0.209	0.340	0.285	0.173	0.192	0.371	0.205	0.393	-0.170	-0.0240
	(0.405)	(0.453)	(0.428)	(0.404)	(0.370)	(0.424)	(0.391)	(0.463)	(0.420)	(0.423)	(0.362)	(0.372)
£60,000-£74,999	-0.0111	-0.239	0.407	0.224	0.163	-0.0547	0.320	0.0509	0.195	0.0671	-0.668*	-0.238
	(0.398)	(0.459)	(0.443)	(0.407)	(0.384)	(0.427)	(0.363)	(0.446)	(0.456)	(0.368)	(0.377)	(0.361)
£75,000 or More	-0.0332	0.0728	0.162	-0.0191	0.537	0.413	-0.342	-0.236	-0.0108	-0.209	-0.307	0.142
	(0.410)	(0.488)	(0.455)	(0.424)	(0.353)	(0.450)	(0.414)	(0.415)	(0.420)	(0.416)	(0.358)	(0.356)
Prefer not to Say	0.549	0.0841	0.956**	0.838*	1.145***	0.452	0.155	1.186***	0.474	0.300	-0.0796	0.381
	(0.434)	(0.547)	(0.482)	(0.462)	(0.377)	(0.422)	(0.377)	(0.413)	(0.531)	(0.495)	(0.441)	(0.493)
Religion: None												
Christian	0.103	-0.269	0.235	0.0498	0.0838	-0.241	-0.130	-0.451*	0.384	0.345	-0.0223	-0.356
	(0.265)	(0.379)	(0.278)	(0.270)	(0.243)	(0.287)	(0.228)	(0.253)	(0.299)	(0.217)	(0.233)	(0.261)
Buddhist	0.112	0.0917	0.594*	0.374	0.696*	-0.276	0.378	0.0405	0.783*	0.101	-0.0270	-0.128
	(0.390)	(0.460)	(0.302)	(0.397)	(0.357)	(0.369)	(0.338)	(0.422)	(0.414)	(0.389)	(0.355)	(0.377)
Hindu	-0.453	-0.784	-0.186	0.00196	0.229	0.163	0.685	0.112	-0.0664	0.298	-0.449	-0.383
	(0.624)	(0.698)	(0.682)	(0.660)	(0.726)	(0.616)	(0.563)	(0.595)	(0.811)	(0.660)	(0.516)	(0.539)
Jewish	0.796	0.301	-0.790	-0.517	-0.498	-0.0696	-1.648***	-1.546***	-0.606	0.0573	0.581	1.073**
	(0.535)	(0.621)	(0.548)	(0.495)	(0.506)	(0.549)	(0.504)	(0.531)	(0.566)	(0.592)	(0.555)	(0.522)
Muslim	0.391	0.526	0.777	0.442	0.662	0.205	0.717	0.486	2.033***	-0.0307	0.0806	-0.550
	(0.668)	(0.694)	(0.564)	(0.552)	(0.533)	(0.644)	(0.534)	(0.555)	(0.564)	(0.597)	(0.545)	(0.567)
Sikh	-1.409***	-0.150	0.423	0.449	0.395	0.685	-0.232	0.182	0.306	0.172	1.073**	-0.181
	(0.684)	(0.539)	(0.432)	(0.661)	(0.484)	(0.594)	(0.508)	(0.488)	(0.660)	(0.503)	(0.435)	(0.586)
Other	0.0638	-0.387	0.0783	-0.0547	-0.547	-0.313	-0.693**	-1.202**	0.125	0.0788	-0.786**	-0.0784
	(0.534)	(0.524)	(0.403)	(0.451)	(0.406)	(0.443)	(0.298)	(0.588)	(0.567)	(0.403)	(0.360)	(0.413)
Prefer not to Say	-0.0936	-0.652*	0.0356	-0.138	-0.0559	-0.546**	-0.268	0.0207	0.00176	0.522**	-0.191	0.382
	(0.384)	(0.332)	(0.222)	(0.407)	(0.330)	(0.265)	(0.321)	(0.307)	(0.363)	(0.263)	(0.335)	(0.314)
Religious Practice: Never												
Less Than Annually	-0.156	0.433	-0.0293	-0.352	-0.412	0.0686	-0.318	-0.0204	-0.0182	-0.0536	0.197	0.128
	(0.365)	(0.420)	(0.342)	(0.310)	(0.305)	(0.384)	(0.297)	(0.315)	(0.385)	(0.307)	(0.339)	(0.446)
At Least Annually	0.108	0.00657	-0.195	-0.211	0.0345	0.0440	-0.152	0.00826	-0.185	-0.0167	0.123	0.0115
	(0.317)	(0.331)	(0.253)	(0.283)	(0.239)	(0.307)	(0.237)	(0.282)	(0.291)	(0.264)	(0.258)	(0.264)
At Least Monthly	0.576	1.108***	0.457	-0.0822	0.0512	0.544	-0.389	0.0615	-0.382	0.174	0.467*	0.490*
	(0.404)	(0.398)	(0.313)	(0.370)	(0.308)	(0.332)	(0.298)	(0.384)	(0.374)	(0.323)	(0.272)	(0.289)
At Least Weekly	0.647*	0.883	0.117	0.371	0.246	1.007**	0.265	0.559	0.0327	0.182	0.322	0.565
	(0.337)	(0.535)	(0.372)	(0.359)	(0.381)	(0.403)	(0.316)	(0.392)	(0.368)	(0.331)	(0.346)	(0.410)

Prefer not to Say	0.323 (0.473)	0.996*** (0.325)	-0.149 (0.229)	-0.0530 (0.476)	0.207 (0.271)	0.660* (0.351)	0.0938 (0.329)	-0.165 (0.317)	0.160 (0.387)	0.526 (0.331)	0.941*** (0.268)	0.801* (0.408)
Smoking: Yes												
No	0.732* (0.414)	0.211 (0.393)	0.749** (0.363)	0.491 (0.317)	-0.234 (0.385)	-0.211 (0.411)	0.645** (0.293)	0.310 (0.348)	0.698** (0.301)	-0.0389 (0.319)	-0.0755 (0.353)	-0.238 (0.333)
Pregnant: Yes												
No	-0.548 (0.832)	-0.262 (0.385)	-0.852 (0.727)	0.263 (0.960)	0.637 (0.798)	0.919* (0.508)	0.376 (0.898)	0.0602 (0.699)	0.230 (0.698)	-0.230 (0.327)	0.205 (0.688)	-0.356 (0.665)
Medication: Yes												
No	-0.0356 (0.179)	-0.00986 (0.203)	-0.0374 (0.179)	0.0517 (0.180)	0.193 (0.146)	0.116 (0.199)	0.137 (0.174)	-0.103 (0.188)	0.217 (0.213)	0.132 (0.189)	0.0377 (0.141)	0.203 (0.178)
Preference for Socialising: Yes												
No	-0.0740 (0.200)	0.147 (0.238)	0.166 (0.194)	-0.0932 (0.213)	-0.287 (0.174)	-0.194 (0.215)	0.181 (0.216)	0.0495 (0.235)	0.0574 (0.221)	-0.293* (0.167)	-0.343** (0.148)	0.0298 (0.181)
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Set Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	230	230	230	230	230	230	230	230	230	230	230	230
R Squared	0.336	0.316	0.376	0.263	0.339	0.294	0.399	0.313	0.307	0.298	0.442	0.306

Notes: Robust standard errors clustered at individual level in parentheses. The dependent variables are the frequency in recent weeks of (a) noticing and feeling grateful for good things, (b) practising mindfulness or meditation, (c) treating oneself in a kind way, (d) making time for something really important for oneself, (e) responding well to difficult situations, (f) learning or trying out something new, (g) giving time to one of oneself's closest relationships, (h) connecting with other people, (i) doing something kind or helpful for others, (j) trying to increase happiness at work, (k) trying to increase happiness in the community, and (l) thinking about the difference one makes to the world. See Supplementary Materials Table 1b for variable definitions.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 4***Absence of Time Trend for Control Group*

	Mean Control Group, Pre-Intervention	Mean Control Group, Post-Intervention	Difference
<i>Self-Reported Outcomes</i>			
Life Satisfaction	6.315	6.271	0.044
Happiness	6.288	5.957	0.331
Anxiousness	4.438	4.500	-0.062
Worthwhileness	7.041	6.971	0.070
PHQ-9 (Depression)	7.151	7.057	0.094
GAD-7 (Anxiety)	6.671	7.086	-0.414
Compassion	6.792	6.657	0.135
Social Trust	6.507	6.386	0.121
Gratitude	6.178	6.114	0.064
Information (a)	7.469	7.271	0.198
Information (b)	7.224	6.943	0.282
Information (c)	6.796	6.629	0.167
Information (d)	7.224	7.171	0.053
Behaviour (a)	2.020	1.829	0.192*
Behaviour (b)	1.429	1.129	0.300***
Behaviour (c)	1.449	1.471	-0.022
Behaviour (d)	1.571	1.514	0.057
Behaviour (e)	1.571	1.586	-0.014
Behaviour (f)	1.204	1.129	0.076
Behaviour (g)	1.837	1.629	0.208*
Behaviour (h)	2.061	1.929	0.133
Behaviour (i)	1.816	1.786	0.031
Behaviour (j)	1.347	1.314	0.033
Behaviour (k)	0.776	0.986	-0.210*
Behaviour (l)	1.122	1.214	-0.092

*Biomarkers*

Cortisol	0.172	0.102	0.070
Interferon IFN- $\gamma$	7.510	7.733	-0.223
Cytokine IL-10	1.397	1.433	-0.037
Cytokine IL-1 $\beta$	284.884	214.072	70.813***
Cytokine IL-6	10.131	8.783	1.348
Chemokine IL-8	1,603.446	1,287.056	316.390***

*Controls*

Age: 20-24	0.068	0.057	0.011
25-34	0.247	0.243	0.004
35-44	0.233	0.229	0.004
45-54	0.205	0.214	-0.009*
55-64	0.192	0.200	-0.008*
65-74	0.055	0.057	-0.002
Gender: Male	0.164	0.171	-0.007
Female	0.836	0.829	0.007
Marital Status: Single	0.438	0.443	-0.005
Married	0.192	0.200	-0.008
Separated	0.041	0.043	-0.002
Divorced	0.096	0.100	-0.004
Widowed	0.014	0.014	-0.001
Domestic Partner	0.219	0.200	0.019
Prefer not to Say	0.000	0.000	0.000
Educational Status: Secondary Degree	0.041	0.043	-0.002
Vocational Degree	0.068	0.071	-0.003
Tertiary Degree	0.356	0.357	-0.001
Higher Than Tertiary Degree	0.534	0.529	0.006
Prefer not to Say	0.000	0.000	0.000
Employment Status: Working Full-Time for Employer	0.466	0.457	0.009
Working Full-Time for Self	0.164	0.171	-0.007
Working Part-Time	0.219	0.229	-0.009
Working Part-Time (Underemployed)	0.000	0.000	0.000
Unemployed	0.041	0.043	-0.002
Out of Labour Force	0.096	0.086	0.010

Prefer not to say	0.014	0.014	-0.001
Income: £14,999 or Less	0.137	0.143	-0.006
£15,000-£29,999	0.192	0.186	0.006
£30,000-£44,999	0.233	0.229	0.004
£45,000-£59,999	0.178	0.171	0.007
£60,000-£74,999	0.110	0.114	-0.005*
£75,000 or More	0.123	0.129	-0.005*
Prefer not to Say	0.027	0.029	-0.001
Religion: None	0.589	0.586	0.003
Christian	0.247	0.243	0.004
Buddhist	0.055	0.057	-0.002
Hindu	0.014	0.014	-0.001
Jewish	0.000	0.000	0.000
Muslim	0.000	0.000	0.000
Sikh	0.000	0.000	0.000
Other	0.041	0.043	-0.002
Prefer not to Say	0.055	0.057	-0.002
Religious Practice: Never	0.521	0.529	-0.008
Less Than Annually	0.110	0.100	0.010
At Least Annually	0.123	0.114	0.009
At Least Monthly	0.110	0.114	-0.005
At Least Weekly	0.096	0.100	-0.004
Prefer not to Say	0.041	0.043	-0.002
Smoking: Yes	0.110	0.086	0.024
No	0.890	0.914	-0.024
Pregnant: Yes	0.027	0.029	-0.001
No	0.973	0.971	0.001
Medication: Yes	0.438	0.429	0.010
No	0.562	0.571	-0.010
Importance of Meeting New People and Making Friends: Yes	0.808	0.814	-0.006
No	0.192	0.186	0.006
Observations	73	70	-

Notes: T-tests used robust standard errors clustered at individual level. See Supplementary Materials Table 1b for variable definitions.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## **Appendix 3**

### **Action for Happiness Course Materials**

The recruitment process of course leaders is documented at:

[http://www.actionforhappiness.org/media/498423/exploring\\_what\\_matters\\_course\\_leader.pdf](http://www.actionforhappiness.org/media/498423/exploring_what_matters_course_leader.pdf)

The course materials for course participants can be found at:

[http://www.actionforhappiness.org/media/508643/exploring\\_what\\_matters.pdf](http://www.actionforhappiness.org/media/508643/exploring_what_matters.pdf)

The course materials for course leaders can be found at:

[http://www.actionforhappiness.org/media/519959/course\\_leader\\_guide.pdf](http://www.actionforhappiness.org/media/519959/course_leader_guide.pdf)

# **Appendix 4**

## **Impact Evaluation Materials**

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