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Dose of Nature: Impact Evaluation Report

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Executive summary

This impact evaluation provides robust causal estimates of the impacts of a Dose of Nature prescription on mental health and wellbeing related outcomes. The programme is delivered by the charity Dose of Nature (DoN) in the London Borough of Richmond and targets people suffering from mental health challenges. A DoN prescription is an eight-week programme that introduces individuals referred by local GP services to the mental health benefits of spending time outside in nature. The programme consists of a psychologist's onboarding review, weekly nature visits led by a trained DoN Guide, which involves a combination of education about nature, first-hand experience, and practical and motivational support and encouragement around daily self-led nature visits.

The evaluation of the programme consists of a rigorous impact assessment based on a pairwise waitlist-based randomised controlled trial. The evaluation involves data collected over 2.5 years and responses from 375+ participants. It presents evidence on the causal effects of the DoN programme on mental health (covering both depression and anxiety), subjective wellbeing (covering both life satisfaction and sense of purpose in life), belonging, loneliness and social connection, social and nature-related variables (nature connectedness and frequency of nature-based activity). The analysis also estimates the benefit-cost ratios based on life satisfaction improvements using the WELLBY approach (HM Treasury, 2021).

The results indicate that the programme achieves its primary objective of treating mental illness. It produced substantial improvements in mental health, wellbeing, and pro-environmental behaviours. Participants receiving the programme showed markedly greater reductions in anxiety and depression relative to controls, with treatment effects of roughly five points on both GAD-7 and PHQ-9. Both groups improved over time, but the intervention consistently yielded additional, clinically meaningful benefits. These results also hold when we examine the subsample of participants that met clinical thresholds for anxiety and depression at the point of referral.

The programme also significantly increased life satisfaction and the perceived worthwhileness of daily activities, with treated participants improving by around 1.6 points more than controls. These effects point to the programme's potential to support individual flourishing in addition to addressing mental health challenges. The effects were observed after accounting for individual fixed effects, supporting the robustness of the findings and reinforcing that the gains reflect genuine programme impact rather than pre-existing differences.

Mediation analyses indicates that improvements in social connectedness, belonging, and reduced loneliness partially explain the mental health benefits arising from programme participation: together, these social pathways

accounted for approximately one-third of the treatment effect on both anxiety and depression.

Exploratory analyses further indicates that increases in nature connectedness and participation in nature-based activities also contribute to outcomes, though they explain a smaller proportion of the overall effect. Importantly, substantial direct effects remain in all models, indicating that while social and nature-related mechanisms are meaningful contributors, the programme's impacts operate through other pathways as well.

Finally, programme participation reliably increases both private- and public-sphere pro-environmental behaviours, with treated participants showing significantly greater behavioural gains over time than those in the control condition. These results highlight positive environmental spillovers arising from the programme.

Conducting a social welfare analysis based on individual life-satisfaction benefits (Wellbeing-Years or WELLBYs) and costs per participant, in line with HM Treasury Green Book guidance, we calculate a benefit-cost ratio of 8.3, meaning that the benefits of a DoN prescription are more than eight times greater than its costs. This suggests a high value-for-money.

In sum, the results of the evaluation point to the efficacy of Dose of Nature innovative nature prescription programme: it delivers on both its primary aims to treat mental illbeing while also yielding a host of additional benefits for both the individual participants and for society more broadly. The evaluation also represents some of the first causal evidence on the potential for a nature engagement to act as a treatment for mental illbeing and encourage pro-environmental behaviour, reflecting important contributions to the evidence base on the individual and societal benefits of nature engagement.

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1 Programme details

1.1 Programme outline

Dose of Nature is a registered charity in the UK that operates across several boroughs in London. The current programme evaluation focuses on their green prescription programme implemented in the Borough of Richmond, their largest current programme delivery area.

Programme participants are referred by GPs. They consist of patients presenting with a range of mental health conditions including depression, anxiety, obsessive compulsive disorder, attention deficit disorder, post-traumatic stress disorder, and psychosis. The severity of their mental health issues ranges from mild to moderate (including clients accessing mental health services for the first time), to chronic and enduring presentations (including clients who have experienced significant functional impairment in employment and community engagement).

The programme comprises:

- An initial assessment with a DoN psychologist to explore the participant's presenting difficulties and needs and an introduction to the evidence base around the mental health benefits of nature engagement.
- Following assessment, the psychologist matches each participant with a trained DoN volunteer Guide who has received training in supporting individuals to improve their mental wellbeing through nature engagement. Once matched, the Guide contacts the participant to establish a schedule for weekly nature-based sessions over the subsequent 8-week period. During these weekly sessions, the Guide facilitates a variety of exercises and activities designed to foster connection with nature while providing further psychoeducation regarding its therapeutic benefits.
- Participants are additionally encouraged to engage in daily nature visits throughout the programme duration.
- Upon completion of the 8-week intervention, clients participate in a review session with the same DoN psychologist before being offered an optional referral to DoN's group activity sessions[1].

1.2 Differentiating features

DoN conceptualises their intervention as 'a mental health recovery programme' rather than 'a support programme', with the objective of achieving significant and

[1] These concluding elements, the final review and optional group referral**,** fall outside the scope of the current programme evaluation.

sustained improvements in participants' mental health and wellbeing. The programme aims to facilitate substantial behavioural change, enabling clients to establish new habits and adopt lifestyle modifications that persist beyond programme completion. It has several notable features that distinguish its approach from many green social prescribing projects:

- The programme's direct referral pathway from GPs contrasts with other social prescribing projects which are typically accessed through link workers or social prescribers.
- Nature engagement constitutes the primary therapeutic intervention, instead of functioning predominantly as a setting for social activity.
- Psychoeducation represents a core component of the intervention and assumes a more prominent role than in most other nature-based interventions or green social prescribing initiatives.
- The provision of one-to-one sessions in locations proximate to clients' residences, scheduled at times convenient to participants achieves enhanced accessibility compared to traditional group-based interventions and contributes to high engagement rates.
- While the weekly sessions are delivered by volunteer guides, the DoN programme model maintains clinical oversight, with psychologists conducting assessments, providing ongoing review, and holding clinical responsibility for all clients, in addition to recruiting, training and supervising the volunteer workforce.

These features were incorporated into the programme with the intention of supporting high levels of engagement from the participants that are referred to the programme.

2 Evaluation details

2.1 Background set-up

The programme evaluation is based on data collected between July 2023 and October 2025 as part of a pairwise randomised waitlist evaluation. The evaluation is based on a detailed pre-registered protocol co-designed by the authors with the charity. All referrals to the charity from Richmond were eligible to participate in the evaluation except for those who indicated that they were unable to complete the programme within the experimental protocol timeline, did not consent to participate in the study or were referred as an emergency case by the GP practice. The participants were not paid for their participation. We

exceeded the registered target sample size of 350 with a total of 378 participants providing data for our primary outcomes of interest.

2.2 Experimental protocol

Upon referral, all clients were contacted with an initial phone call to welcome them to the programme and ask them to complete an onboarding survey (baseline survey, t=0) shared via an online link to be able to arrange an initial meeting with the psychologist. Once two clients had completed the onboarding survey, they formed a participant pool.

A DoN administrator who was trained by the authors on the importance of randomisation for causal inference in the research design then randomly allocated one client to the 'treatment group' and one to the 'waitlist group' (via a coin flip). The clients then both received a second phone call. The client in the treatment group received a call to set up a meeting with the psychologist as soon as possible. The client in the waitlist group received a call to set up a meeting with the psychologist in 8-weeks' time, with the timeline communicated as the normal average waiting time (which was the case pre-programme evaluation).

The client in the treatment group then met the psychologist, was matched with a DoN guide and started their 8-week nature visit programme. At the end of the programme, once the client in the treatment group finished the last nature visit, they received a phone call to ask them to complete a shorter version of the onboarding survey (endline survey, t=1) before arranging the follow-up meeting with the psychologist.

Meanwhile, the client in the waitlist control group received a phone call with a reminder of their upcoming appointment with the psychologist and was asked to complete the equivalent survey to the endline in the control group (baseline survey 2, t=1) with the communicated reason for completing another survey being to give psychologist most recent information and tailor programme to their individual needs. The waitlist control client then started the intervention programme following the same patterns as the treatment group client. See Figure 1 for a visual illustration of the experimental protocol.

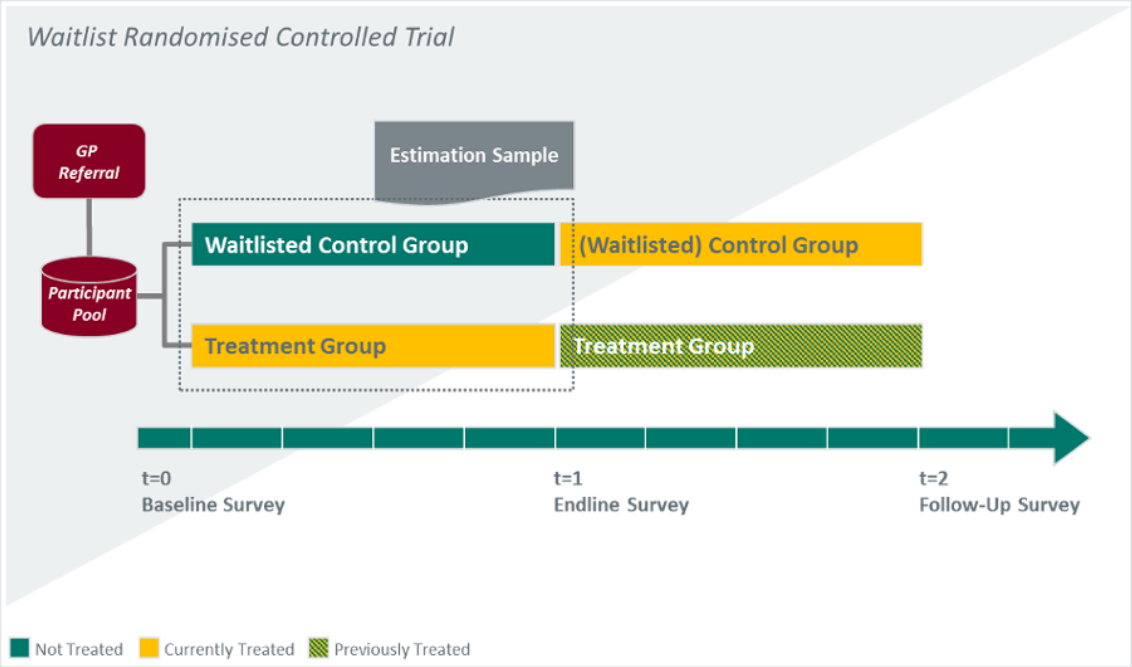

Figure 1. Experimental Protocol

2.3 Measures

Clients responded to two surveys as part of the initial evaluation: a baseline and an endline survey. All data were collected via the survey platform Qualtrics.

The baseline survey collected data on our primary outcome variables: depression as captured by the standard measures PHQ-9 and anxiety assessed by GAD-7. Overall, GAD-7 and PHQ-9 scores are calculated following standard procedures. For both GAD-7 and PHQ-9 scores we assign scores of 0, 1, 2, and 3, to the response categories of 'not at all', 'several days', 'more than half the days', and 'nearly every day', respectively, and add together the scores for the seven questions. That is, higher scores on either GAD-7 or PHQ-9 generally imply *lower* mental health. A score of 8 if taken as the cut-off point for clinical anxiety. For PHQ-9 scores we again add up the score for each question. A total score of 10 represents the cut-off point for clinical depression. We also included two subjective wellbeing measures assessing life satisfaction and the worthwhileness of a person's activities (the evaluative measures of wellbeing from the UK's Annual Population Survey). We additionally included measures of loneliness, socialising, belonging and connectedness (as assessed in the UK's Community Life Survey), measures on nature connectedness and nature activity (as assessed in the Natural England's People and Nature Survey) and measures of pro-environmental behaviour which assessed engagement in common private and public sphere pro-environmental actions.

In the baseline survey, we also collected socio-demographic and administrative information, including measures capturing the client's age, gender, marital status, sexuality, number of children in their household, religious status, education, ethnicity, work status, income and the details of an emergency contact. The endline survey contained all the measures included in the baseline aside from the administrative and sociodemographic characteristics.

3 Analysis

3.2 Hypotheses

The study set out to examine the following wellbeing pre-registered hypotheses:

- Participation in the Dose of Nature Programme will positively impact on mental health outcomes as measured by the PHQ-9 & GAD-7.
- Participation in the Dose of Nature Programme will positively impact on subjective wellbeing as assessed by life satisfaction and feelings of the worthwhileness of activities.
- The impact of participating in the Dose of Nature Programme on mental health will be mediated by feelings of belonging, loneliness and social connectedness.

The study was additionally interested in the impacts of participation on nature connectedness, nature-based activities and pro-environmental behaviour (as exploratory outcomes of interest).

3.2 Analytical approach

We investigate the impacts of programme participation using a difference-in-differences (DiD) approach that accounts for baseline outcomes. We estimate its impacts in a range of different ways to examine the robustness of our findings. We first present estimates based on fixed effects regression, as well as both simple and multiple linear regression analysis (the latter adjusting for participants socio-demographic covariates).

3.3 Results

3.3.1 Impacts on mental health outcomes

Looking descriptively at the treatment group alone (N=316 observations from 158 participants) we estimate mean differences between baseline and endline of -6.74 (SD= 5.13) for anxiety (GAD-7) and 7.63 (SD=5.65) for depression (PHQ-9).

We then estimated difference-in-differences analyses with individual fixed effects examined treatment effects on anxiety (GAD-7) and depression (PHQ-9) symptoms among 776 observations from 378 individuals. Results revealed significant treatment effects, with the treatment group showing approximately 5 points greater improvement compared to controls on both outcomes (GAD-7: b = -4.90, SE = 0.53, p < .001; PHQ-9: b = -4.99, SE = 0.56, p < .001). While both groups demonstrated significant improvement over time (GAD-7: b = -1.83, SE = 0.34, p < .001; PHQ-9: b = -2.64, SE = 0.36, p < .001), likely reflecting natural recovery, the treatment group's additional reduction represents a clinically meaningful benefit beyond this baseline trend. The models demonstrated strong fit (Within R^2 = .43-.48, Adjusted R^2 = .58-.63), with individual fixed effects controlling for time-invariant characteristics, suggesting the treatment produced substantial reductions in both anxiety and depression symptoms. See Table 1 for more details.

Table 1
Fixed Effects Regression Results for Treatment Effects on Mental Health Outcomes

Variable	GAD-7 Total	PHQ-9 Total
Time	-1.83***	-2.64***
	(0.34)	(0.36)
Treatment × Time	-4.90***	-4.99***
	(0.53)	(0.56)
N	776	776
Fixed effects	378	378
Within R^2	.43	.48
Adjusted R^2	.58	.63
RMSE	2.61	2.74

Note. Standard errors are in parentheses. GAD-7 = Generalized Anxiety Disorder 7-item scale; PHQ-9 = Patient Health Questionnaire 9-item scale; RMSE = root mean square error. Individual fixed effects included. Treatment variable removed due to collinearity with fixed effects. *** $p < .001$

We additionally ran the analysis restricting the samples of those who met the clinical thresholds for anxiety at the point of initial referral to the programme. That is those that had an initial score of 8+ for GAD-7 and 10+ for PHQ-9. Looking at the treatment group data, 252 observations from 126 participants representing the clinically anxious and 242 observations from 121 participants representing the clinically depressed. Descriptives indicate a mean difference of 7.9 (SD=4.69) between baseline and endline in the treatment group for GAD-7 scores and -9.1 (SD= 5.1) for PHQ-9 scores.

We then carried out the fixed effects difference-in difference analysis for both outcomes. Across 538 to 540 observations, both models revealed robust treatment effects, with the treatment group exhibiting substantially greater improvement over time relative to controls. For GAD-7, the treatment-by-time interaction indicated an additional reduction of 4.53 points (SE = 0.62, $p < .001$), while PHQ-9 showed a 5.18-point additional decrease (SE = 0.67, $p < .001$). Both groups improved significantly over time (GAD-7: $b = -3.36$, $p < .001$; PHQ-9: $b = -3.92$, $p < .001$), consistent with natural recovery, but the amplified reductions in the treatment group represent meaningful clinical gains beyond this baseline trend. Model performance was strong (Within $R^2 \approx .57$ for GAD-7; .60 for PHQ-9), and individual fixed effects effectively accounted for stable person-level factors. Overall, results indicate that the treatment produced substantial reductions in both anxiety and depression symptoms above for participants who met clinical anxiety and depression thresholds at the point of referral. See Table 2.

Table 2
Fixed Effects Regression Results for Treatment Effects on Mental Health Outcomes among Clinical Population

Variable	GAD-7 Total	PHQ-9 Total
Time	*-3.36* ***	*--3.92* ***
	(0.43)	(0.45)
Treatment × Time	*--4.53* ***	*-5.18* ***
	(0.62)	(0.67)
N	538	540
Fixed effects	262	264
Within R^2	.57	.6
Adjusted R^2	.56	.61
RMSE	*2.57*	*2.75*

Note. Standard errors are in parentheses. GAD-7 = Generalized Anxiety Disorder 7-item scale; PHQ-9 = Patient Health Questionnaire 9-item scale; RMSE = root mean square error. Individual fixed effects included. *** $p < .001$

3.3.2 Impacts on subjective wellbeing outcomes

Turning to SWB measures and looking only at the treatment group (n=316 observations from 158 participants) we see mean differences between baseline and endline of 2.51 (SD=2.32) in life satisfaction and 2.69 (SD=2.3) in worthwhileness of activities.

Then estimating the effects based on a difference-in-difference analysis with fixed effects, we find significant improvements in SWB from programme participation. More specifically, the treatment group showing approximately 1.6 points greater improvement compared to controls on both well-being outcomes (life satisfaction: b = 1.61, SE = 0.21, p < .001; worthwhileness of activities: b = 1.59, SE = 0.22, p < .001). Both groups exhibited significant increases in well-being over time (life satisfaction: b = 1.08, SE = 0.14, p < .001; worthwhileness: b = 0.93, SE = 0.14, p < .001), suggesting general improvement trajectories. However, the treatment group's additional gains represent substantial benefits beyond these baseline trends. The models demonstrated strong fit (Within R^2 = .41-.45, Adjusted R^2 = .57-.62), with individual fixed effects controlling for time-invariant characteristics, indicating the treatment produced meaningful enhancements in both dimensions of SWB. See Table 3.

Table 3
Fixed Effects Regression Results for Treatment Effects on SWB Outcomes

Variable	Life Satisfaction	Life Worthwhileness
Time	1.08***	0.93***
	(0.14)	(0.14)
Treatment × Time	1.61***	1.59***
	(0.21)	(0.22)
N	776	776
Fixed effects	378	378
Within R^2	.45	.41
Adjusted R^2	.57	.62
RMSE	1.05	1.05

Note. Standard errors are in parentheses. RMSE = root mean square error. Individual fixed effects included. Treatment variable removed due to collinearity with fixed effects. *** p < .001.

3.3.3 Mediating role of social connectedness, belonginess, loneliness

We first use a multiple mediator analysis to examine whether social mechanisms explained the treatment effect on anxiety symptoms (GAD-7) among 703

observations from 343 individuals. Three social pathways were tested simultaneously: social connectedness, loneliness, and sense of belonging. The treatment significantly improved all three social mediators (social connectedness: b = 1.18, SE = 0.23, p < .001; loneliness reduction: b = -0.56, SE = 0.10, p < .001; belonging: b = 0.29, SE = 0.10, p = .003).

Each mediator independently predicted anxiety when controlling for treatment and the other mediators (social connectedness: b = -0.48, SE = 0.11, p < .001; loneliness: b = 1.35, SE = 0.26, p < .001; belonging: b = -0.83, SE = 0.29, p = .005). The total indirect effect through these three social mechanisms was -1.57 points, accounting for 32.1% of the total treatment effect (b = -4.90, p < .001). Loneliness emerged as the strongest individual mediator (15.6% of total effect), followed by social connectedness (11.6%) and belonging (4.9%). However, the direct effect remained substantial (b = -3.61, SE = 0.53, p < .001), indicating that approximately two-thirds (67.9%) of the therapeutic benefit operated through non-social mechanisms. These findings suggest that while reducing loneliness, enhancing social connections, and fostering belonging are meaningful therapeutic pathways to reduced anxiety, the treatment's primary mechanisms lie elsewhere. See Table 4.

Table 4
Multiple Mediator Model: Social Mechanisms Mediating Treatment Effect on Anxiety (GAD-7)

Pathway	Coefficient	SE	p	% of Total Effect
Path A (Treatment →)				
Social connectedness	1.18	0.23	<.001	
Loneliness	-0.56	0.10	<.001	
Belonging	0.29	0.10	.003	
Path B (→ GAD-7)				
Social connectedness	-0.48	0.11	<.001	
Loneliness	1.35	0.26	<.001	
Belonging	-0.83	0.29	.005	
Indirect Effects				
Via Social connectedness	-0.57			11.6%
Via Loneliness	-0.76			15.6%
Via Belonging	-0.24			4.9%
Total Indirect Effect	**-1.57**			**32.1%**
Direct Effect	**-3.61**	**0.53**	**<.001**	**67.9%**
Total Effect	**-4.90**	**0.53**	**<.001**	**100%**

Note. N = 703 observations from 343 individuals (complete data across all mediators). Path A represents treatment effects on each mediator. Path B

represents mediator effects on anxiety, controlling for treatment and other mediators. Indirect effects calculated as Path A × Path B for each mediator. Treatment increased social connectedness and belonging, and reduced loneliness. Higher social connectedness and belonging, and lower loneliness, were each independently associated with reduced anxiety. All models include individual fixed effects.

We then use a multiple mediator analysis to examine whether social mechanisms explained the treatment effect on depression symptoms (PHQ-9) among 703 observations from 343 individuals. Each mediator independently predicted depression when controlling for treatment and the other mediators (social connectedness: b = -0.41, SE = 0.12, p < .001; loneliness: b = 1.86, SE = 0.26, p < .001; belonging: b = -0.59, SE = 0.30, p = .050). The total indirect effect through these three social mechanisms was -1.70 points, accounting for 34.0% of the total treatment effect (b = -4.99, p < .001). Loneliness emerged as the strongest individual mediator (21.0% of total effect), followed by social connectedness (9.6%) and belonging (3.4%). However, the direct effect remained substantial (b = -3.56, SE = 0.55, p < .001), indicating that approximately two-thirds (66.0%) of the therapeutic benefit on depression operated through non-social mechanisms. See Table 5.

Table 5

Multiple Mediator Model: Social Mechanisms Mediating Treatment Effect on Depression (PHQ-9)

Pathway	Coefficient	SE	p	% of Total Effect
Path A (Treatment →)				
Social connectedness	1.18	0.23	<.001	
Loneliness	-0.56	0.10	<.001	
Belonging	0.29	0.10	.003	
Path B (→ PHQ-9)				
Social connectedness	-0.41	0.12	<.001	
Loneliness	1.86	0.26	<.001	
Belonging	-0.59	0.30	.050	
Indirect Effects				
Via Social connectedness	-0.48			9.6%
Via Loneliness	-1.05			21.0%
Via Belonging	-0.17			3.4%
Total Indirect Effect	**-1.70**			**34.0%**
Direct Effect	**-3.56**	**0.55**	**<.001**	**66.0%**
Total Effect	**-4.99**	**0.56**	**<.001**	**100%**

Note. N = 703 observations from 343 individuals (complete data across all mediators). Path A represents treatment effects on each mediator. Path B represents mediator effects on depression, controlling for treatment and other mediators. Indirect effects calculated as Path A × Path B for each mediator. Treatment increased social connectedness and belonging, and reduced loneliness. Higher social connectedness and belonging, and lower loneliness, were each independently associated with reduced depression. All models include individual fixed effects.

3.3.4 Mediating role of nature connectedness and nature-based activities

In an exploratory analysis, we then examine the programme's impacts on nature connectedness and nature-based activities as well as investigating their role as mediators of the programme's impacts on mental health outcomes. This analysis involves 731 observations from 356 individuals. We tested the two nature related pathways – frequency of nature-based activities and nature connectedness simultaneously. The treatment significantly improved nature related mediators (nature connectedness: b = 0.46, SE = 0.06, p < .001; nature-based activities: b = 0.97, SE = 0.17, p < .001).

Each mediator independently predicted anxiety when controlling for treatment and the other mediator (nature connectedness: b = -1.94, SE = 0.48, p < .001; nature-based activities: b = -0.33, SE = 0.17, p < .05). The total indirect effect through these two nature mechanisms was -1.21 points, accounting for 24.7% of the total treatment effect (b = -4.90, p < .001). Nature connectedness emerged as the strongest individual mediator (18.1% of total effect) while nature-based activities accounted for just 6.6%. However, as with the social mediation analysis the direct effect remained substantial (b = -3.65, SE = 0.57, p < .001), indicating that approximately three-quarters (75.3%) of the programme's positive impacts operated through other mechanisms. See Table 6.

Table 6
Multiple Mediator Model: Nature-Related Mechanisms Mediating Treatment Effect on Anxiety (GAD-7)

Pathway	Coefficient	SE	p	% of Total Effect
Path A (Treatment →)				
Nature connectedness	0.46	0.06	<.001	
Nature-based activities	0.97	0.17	<.001	
Path B (→ GAD-7)				
Nature connectedness	-1.94	0.48	<.001	
Nature-based activities	-0.33	0.17	.049	
Indirect Effects				
Via Nature connectedness	-0.89			18.1%
Via Nature-based activities	-0.32			6.6%
Total Indirect Effect	**-1.21**			**24.7%**
Direct Effect	**-3.65**	**0.57**	**<.001**	**75.3%**
Total Effect	**-4.90**	**0.53**	**<.001**	**100%**

Note. N = 731 observations from 356 individuals (complete data across all mediators). Path A represents treatment effects on each mediator. Path B represents mediator effects on anxiety, controlling for treatment and other mediators. Indirect effects calculated as Path A × Path B for each mediator. Treatment increased nature connectedness and nature-based activities. Higher nature connectedness and more frequent nature-based activities were each independently associated with reduced anxiety. All models include individual fixed effects.

Turning to depression, again, of the two nature related mediators only nature connectedness independently predicted depression when controlling for treatment and the other mediator (nature connectedness: b = -1.78, SE = 0.50, p < .001; nature-based activities: b = -0.27, SE = 0.18, p = .135). The total indirect effect through these two nature mechanisms was -1.07 points, accounting for 21.5% of the total treatment effect (b = -4.99, p < .001). Again, nature connectedness emerged as the strongest of the two individual mediators (16.3% of total effect) compared to nature-based activities which accounted for 5.2%. Again, the direct effect remained substantial (b = -3.72, SE = 0.60, p < .001), accounting for 78.5% of the improvements in depression attributable to the programme. See Table 7.

Table 7
Multiple Mediator Model: Nature-Related Mechanisms Mediating Treatment Effect on Depression (PHQ-9)

Pathway	Coefficient	SE	p	% of Total Effect
Path A (Treatment →)				
Nature connectedness	0.46	0.06	<.001	
Nature-based activities	0.97	0.17	<.001	
Path B (→ PHQ-9)				
Nature connectedness	-1.78	0.50	<.001	
Nature-based activities	-0.27	0.18	.135	
Indirect Effects				
Via Nature connectedness	-0.82			16.3%
Via Nature-based activities	-0.26			5.2%
Total Indirect Effect	**-1.07**			**21.5%**
Direct Effect	**-3.72**	**0.60**	**<.001**	**78.5%**
Total Effect	**-4.99**	**0.56**	**<.001**	**100%**

Note. N = 731 observations from 356 individuals (complete data across all mediators). Path A represents treatment effects on each mediator. Path B represents mediator effects on depression, controlling for treatment and other mediators. Indirect effects calculated as Path A × Path B for each mediator. Treatment increased nature connectedness and nature-based activities. Higher nature connectedness was independently associated with reduced depression, while nature-based activities did not show a significant independent association. All models include individual fixed effects.

3.3.5 Impacts on pro-environmental behaviour

Finally, in exploratory analysis, we examine whether engaging in the DoN programme influences participants' engagement in both private and public sphere pro-environmental actions. Looking first at the treatment group (n=316 observations from 158 participants), we see a mean difference of 0.41 (SD=0.68) in the case of private sphere pro-environmental behaviours and a mean difference of 0.39 (SD=1) for public-sphere pro-environmental behaviours.

We then carry out a difference-in difference analyses involving 755 observations from 369 participants in the private sphere models and 733 observations from 358 participants in the public sphere ones.

For private sphere pro-environmental behaviours, the results indicate a significant treatment × time interaction, $\beta = 0.30$, SE = 0.07, $p < .001$, demonstrating that participants in the treatment condition showed greater

increases in pro-environmental behaviour across the study period relative to controls. A main effect of time was also observed, β = 0.11, SE = 0.04, p = .017, indicating overall improvement across both groups, whereas the baseline treatment effect was nonsignificant. See Table 8.

A similar pattern emerged for public-sphere pro-environmental behaviours. The treatment × time interaction was significant, β = 0.28, SE = 0.09, p = .002, again showing that the intervention led to larger gains in pro-environmental behaviour over time compared to the control group. The main effect of time was marginally significant, β = 0.11, SE = 0.06, p = .063, while the baseline treatment effect was nonsignificant. Together, these findings demonstrate that the intervention produced reliable and meaningful increases in both private and public sphere pro-environmental behaviour.

Table 8
Fixed Effects Regression Results for Treatment Effects on Pro-Environmental Behaviours

Variable	Private Sphere PEBs	Public Sphere PEBs
Time	0.11*	0.11
	(0.04)	(0.06)
Treatment × Time	0.30***	0.28**
	(0.07)	(0.09)
N	755	733
Fixed effects	369	358
Within R^2	.14	.08
Adjusted R^2	.65	.59
RMSE	0.33	0.44

Note. Standard errors are in parentheses. PEBs = pro-environmental behaviours; RMSE = root mean square error. Individual fixed effects included. Treatment variable removed due to collinearity with fixed effects. * $p < .05$. ** $p < .01$. *** $p < .001$

3.4 WELLBY valuation

Table 3 has shown a significant, strong positive treatment effect of about 1.6 points on life satisfaction (measured on a zero-to-ten Likert scale). We can use this impact to conduct a social welfare analysis, following HM Treasury Green Book guidance, including its Supplementary Guidance on Wellbeing.

We conservatively assume that the benefits per participant are 1.6 life-satisfaction points for eight weeks only (the exact duration of the programme, which is most likely a lower bound). Note that a Wellbeing-Year (or WELLBY, i.e. one point of life-satisfaction on a zero-to-ten Likert scale for one individual for one year) is monetarily valued by HM Treasury at GBP 16,950 (in 2024 prices). Hence, we obtained monetised benefits per participant of about 1.6 x (8/52) x GBP 16,950 = GBP 4,172.

The costs per participant are estimated by DoN to be about GBP 500.

This yields a benefit-cost ratio of GBP 4,172 / GBP 500 = 8.3, meaning that the benefits of the programme are more than eight times larger than its costs. The programme, therefore, is high value for money, considering common benefit-cost ratios used by UK Government. To compare, Oparina et al. (2025, CEP Discussion Paper 1982) obtain a benefit cost-ratio for the nationwide NHS Talking Therapies for Anxiety and Depression programme of about 5.5.

With an impact on life satisfaction of 1.6 points, DoN compares very favourably to other local-community interventions aimed at improving mental health and wellbeing. For instance, Krekel et al. (2021) evaluate the impacts of the "Exploring What Matters" course by Action for Happiness, estimating an impact on life satisfaction of about 1.04 points – smaller though not too dissimilar from the Don prescription. Cotofan et al. (2025) look at the impacts of participating in GoodGym, estimating impacts of about 0.43 life-satisfaction points. While these other programmes are aimed at improving mental health and wellbeing, a noticeable difference is that they do not have a strict focus on individuals with low mental health (but also target general-population participants). The stronger impacts of a DoN prescription on life satisfaction (as well as other mental health outcomes) can be explained by the relatively low starting point of participants compared to general-population participants.

4 Conclusion

The current impact evaluation is based on a robust pre-registered randomised waitlist control trial spanning 2.5 years and involving 375+ participants and evaluating the Dose of Nature prescription being offered by the charity in the London Borough of Richmond. The evaluation details the programmes effects on a range of different wellbeing and nature related outcomes.

First and of foremost importance, the analysis finds that engaging in the programme had significant and substantial positive impacts on anxiety and depression among its participants, both in the overall group and the subsamples that reflected those that met clinical thresholds for anxiety and depression at the point of referral. The programme achieved its primary objectives. It also enhanced their life satisfaction and their sense of the extent to which their

activities are worthwhile, pointing to its potential to support individual flourishing in addition to addressing mental health challenges.

The programme also had positive impacts on participant's' perceptions of their social situation and how they relate to nature. Participants showed increased social connectedness, sense of belonging and decreased loneliness. They also reported increased nature connectedness and the frequency of engagement in nature-based activities. These social and nature-related variables reflect important mechanisms behind the programme's impacts on mental health.

Finally, the programme has a positive impact on participants' propensity to engage in pro-environmental behaviours, highlighting positive societal spillovers arising from programme participation.

Together the evaluation points to the efficacy of the Dose of Nature programme, which delivers on both its primary aims to treat mental illbeing while also yielding a host of additional benefits for both the individual participants and for society more broadly.

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Figure credit: Dr Christian Krekel