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A theory-based randomised controlled trial to increase delivery of behaviour change interventions by healthcare professionals

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A B S T R A C T

Background: Public health policies require healthcare professionals to incorporate health behaviour change interventions (HBCIs) into routine consultations. This study tested whether an "if-then" planning intervention could enhance HBCI delivery.
Methods: A randomised controlled trial involving 1008 UK NHS healthcare professionals compared an intervention group, who formed "if-then" plans, with an active control group. Data were collected at one, two, twelve, and thirteen months. Primary and secondary outcomes included the proportion of patients receiving HBCIs, time spent delivering HBCIs, and healthcare professionals' perceived capabilities, opportunities, and motivations.
Results: The intervention group showed more sustained improvements in HBCI delivery over time compared to the control group, although the between-group difference at the final follow-up (T4) was not statistically significant. The intervention group significantly increased HBCI delivery between T1 and T2 (mean difference = 3.74; $p = .009$), and between T2 and T3 (mean difference = 4.45; $p < .001$), with delivery remaining higher at T4. The control group showed a significant increase only between T1 and T2 (mean difference = 8.79; $p < .001$). Statistically significant improvements were observed in psychological capability, reflective motivation, and automatic motivation to deliver HBCIs, particularly within the intervention group.
Discussion: The if-then planning intervention led to sustained improvements in HBCI delivery, with the intervention group showing significant increases between T1 and T2, and between T2 and T3, and maintaining higher delivery at T4. Although the final time point showed no significant between-group difference, findings support "if-then" planning as a practical strategy to integrate HBCIs into routine care.

1. Background

Public health policies are used internationally to compel healthcare professionals to deliver brief, opportunistic health behaviour change interventions during routine medical consultations (Meade et al., 2022; Practitioners, 2020; Public Health England, 2016; Whitlock et al., 2002). For the purposes of this study, these interventions include: (1) the delivery of health promotion advice (e.g., reducing alcohol intake, improving diet, increasing physical activity, and smoking cessation), and (2) referral or signposting to local support services (Public Health England, 2016). In the UK, the policy framework underpinning this expectation is known as Making Every Contact Count (MECC), which encourages healthcare professionals to use routine interactions as opportunities to support healthy lifestyle changes. Due to their frequent patient contact, healthcare professionals are an expected and trusted source of behaviour change advice (Keyworth et al., 2021a; McPhail and Schippers, 2012; Whitlock et al., 2002), and regardless of specialism, healthcare professionals appear to value providing behaviour change interventions as an essential clinical activity (Keyworth et al., 2019).

Understanding the appropriate intervention targets is essential for examining interventions that can be incorporated into time restricted medical consultations, considering the complexities of healthcare delivery in the continued recovery from public health emergencies. Our previous research showed healthcare professionals reported lower levels of automatic motivation (i.e. delivering behaviour change interventions through habit), compared to the other five domains of the capability, opportunity, and motivation model of behaviour (COM-B) (Keyworth et al., 2024a; Michie et al., 2011). In addition, automatic motivation, as well as three other domains of the COM-B model, namely physical opportunity, social opportunity, and reflective motivation, were associated

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with higher prevalence of delivering behaviour change interventions, and greater amount of reported time delivering interventions. Implementation intentions (Gollwitzer, 1993), which have been shown to be effective in changing health behaviours (Armitage, 2016; Armitage et al., 2014), may be one approach to supporting healthcare professionals to deliver behaviour change interventions to a higher proportion of patients. However, despite being brief enough to be deployed at scale with high public health 'reach' in healthcare settings, these have rarely been used in the context of healthcare professional behaviour change.

Implementation intentions, or "if-then" plans, work by making automatic links (i.e. impacting peoples' automatic motivation) in memory between a critical situation ("If I think a patient would benefit from a weight management intervention …") and an appropriate response ("… then I will signpost to a local support service") (Gollwitzer, 1993, 1999; Gollwitzer and Sheeran, 2025). Consequently, these if-then statements become automatic responses when individuals are faced with the situation. Implementation intentions are an effective method for a range of behaviours (Gollwitzer, 1999; Gollwitzer and Sheeran, 2006). Traditionally, when making if-then plans, individuals can generate their own solutions to the problems/situations. However, this is often challenging to complete as people may be unable to form solutions themselves. A volitional helpsheet (a form of implementation intentions) provides a list of situations that individuals may encounter, and offers a range of appropriate responses, or solutions, to the situation. Volitional help sheets have been found to be effective in a number of studies, including those investigating alcohol consumption, smoking, physical activity and self-harm (Armitage and Arden, 2010, 2012; O'Connor et al., 2017), but volitional help sheet-based interventions have not been tested in the context of supporting healthcare professional delivery of behaviour change interventions.

2. The current study

For the first time, the present study aims to test, in a large representative sample of healthcare professionals working in the UK's National Health Service (NHS), an implementation intention-based intervention to: (1) increase healthcare professional delivery of brief, opportunistic behaviour change interventions (i.e., health promotion advice and referral/signposting to support services) during routine healthcare consultations, (2) increase healthcare professionals perceptions of the proportion of patients that would benefit from behaviour change interventions, (3) increase the proportion of the consultation time spent delivering interventions, and (4) increase capabilities, opportunities, and motivations to deliver behaviour change interventions.

3. Methods

3.1. Study design

This was a randomised controlled trial. The between-persons factor was *group*, which had two levels: *Intervention* in which participants were asked to form implementation intentions (using the volitional help sheet) versus an *active control* in which participants were presented with the list of problems and solutions but were not asked to form implementation intentions. All measures were taken at baseline (T1; February–March 2022), and three subsequent follow-ups: Time 2 (April–May 2022), Time 3 (February–March 2023), and Time 4 (April–May 2023). The final follow-up (Time 4) occurred 13 months post-baseline. The main outcome was the proportion of patients to whom healthcare professionals delivered a behaviour change intervention as part of routine medical consultations. Other dependent variables were perceptions of the proportion of patients who healthcare professionals saw that would benefit from opportunistic behaviour change interventions, the proportion of the consultation time spent delivering interventions, and healthcare professionals' capabilities, opportunities, and motivations to deliver interventions. The trial was preregistered (ClinicalTrials.gov ID: NCT05820282) and follows the Consolidated Standards of Reporting Trials reporting guideline for social and psychological interventions (Montgomery et al., 2018). The follow-up intervals were selected to capture both the short- and long-term effects of the intervention. The one-month follow-up (T2) was designed to assess immediate changes in behaviour and psychosocial variables following the intervention. The twelve-month (T3) and thirteen-month (T4) follow-ups were included to evaluate the sustainability of any observed effects over time, with T4 providing a final data point beyond the one-year follow-up.

3.2. Participants and procedure

Healthcare professionals with a patient-facing role were recruited via a survey panel company (YouGov). A purposive sample of healthcare professionals intended to be representative of the National Health Service (NHS) workforce in the United Kingdom (Keyworth et al., 2024b) was invited to take part in an online questionnaire and were incentivised in accordance with YouGov's points system, whereby respondents accumulate points for taking part in online surveys, which can be exchanged for cash or entry into a prize draw. A range of patient-facing healthcare professionals were recruited and included: general practitioners (GPs); specialist doctors; nurses; midwives, and scientific, therapeutic and technical staff (e.g. pharmacists, psychologists, and speech and language therapists). The sampling frame aimed to obtain the widest possible variation in participants according to demographic characteristics. The anonymised data were collated by YouGov and sent securely to the research team for analysis. Baseline characteristics of the sample are presented in Table 1.

Participants completed a series of questionnaires about their experiences delivering health behaviour change interventions during routine healthcare consultations, and were then randomly allocated to one of the two groups.

The data were collected in four waves between February 2022 and May 2023.[1] In total, 1008 healthcare professionals completed the first (recruitment; T1) questionnaire. After receiving informed consent, data were collected at baseline using a web-based survey. The interventions were placed after a series of questions capturing demographic variables and psychosocial measures; questions were presented in the same order to participants in both groups. Once the questionnaire had been completed, participants in the intervention group were presented with and completed a volitional help sheet for supporting healthcare professionals to increase behaviour change intervention delivery, while participants in the active control group were asked to identify situations and solutions, but were not asked to form implementation intentions. Both interventions were standardised, and presented within the web-based survey. Follow-up questionnaires were identical to the baseline survey, capturing demographic information, primary outcomes, and secondary outcomes. A total of 775 (77 % response rate) completed the second (T2) questionnaire, 646 (64 % response rate) completed the third (T3) questionnaire, and 584 (58 % response rate) completed the fourth (T4) questionnaire.

4. Measures

4.1. Sociodemographic variables

Measures of gender and age, healthcare setting (e.g. primary care, secondary care) as well as the number of patients seen by the healthcare

[1] In February 2022, there were a significant number of daily cases (around 45,000) and hospitalisations (over 1000 admissions) due to COVID-19, and by May 2023, there were significant decreases in both daily infections (around 1 in 65 people testing positive) and daily hospital admissions (around 1.52 admissions per 100,000 people) (34–36).

Table 1
Baseline characteristics of the sample.

Variable	Intervention (N = 503)		Active control (N = 505)		Difference between groups
Gender					
Men	135	(26.8)	132	(26.1)	.03 (p = .87)
Women	368	(73.2)	373	(73.9)	.03 (p = .87)
Age, years[a]	*M* = 45.17 *SD* = 11.98		*M* = 45.29 *SD* = 12.21		–
Ethnicity					
White	443	(88.1)	442	(87.5)	.00 (p = 1.00)
Black, Asian, Minority Ethnic/Prefer not to say	55	(10.9)	61	(12.1)	.05 (p = 82)
Healthcare professional group					
General Practitioners	21	(4.2)	22	(4.4)	.00 (p = 1.00)
Specialist doctors	65	(12.9)	63	(12.5)	.00 (p = 1.00)
Nurses and health visitors	197	(39.1)	197	(39.0)	.00 (p = 1.00)
Midwives	13	(2.6)	17	(3.4)	.00 (p = 1.00)
Ambulance staff	5	(1.0)	5	(1.0)	.00 (p = 1.00)
Scientific, therapeutic and technical staff	72	(14.3)	52	(10.3)	.76 (p = .38)
Nurses working in GP practices	25	(5.0)	21	(4.2)	.12 (p = .73)
Support to clinical staff	16	(3.2)	34	(6.7)	1.68 (p = .19)
Other HCHS staff/ unknown classifications	89	(17.8)	94	(18.6)	.03 (p = .86)
Setting					
NHS Acute Care	213	(42.3)	200	(39.6)	.08 (p = .77)
NHS Tertiary Care	43	(8.5)	46	(9.1)	.00 (p = 1.00)
NHS Community Care	115	(22.9)	115	(22.8)	.00 (p = 1.00)
NHS Primary Care	92	(18.3)	102	(20.2)	.10 (p = .74)
Other	40	(8.0)	42	(8.3)	.00 (p = 1.00)
How many service users do you see in a typical week?[a]	M = 34.56 SD = 30.78		M = 32.15 SD = 29.66		–
How many minutes do you spend on average with each service user?[a]	M = 31.90 SD = 20.10		M = 33.11 SD = 20.71		–
Of the service users you see in a typical working week, *what proportion do you think would benefit* from you Making Every Contact Count?[a]	*M* = 49.44 *SD* = 35.43		*M* = 48.84 *SD* = 35.87		–
Of the service users you see in a typical working week, who you think would benefit, *with what proportion* do you Make Every Contact Count?[a]	*M* = 37.09 *SD* = 35.62		*M* = 38.77 *SD* = 37.05		–
Of the service users you see in a typical working week who you think would benefit, *how much of their appointment time do you spend* with them making every contact count?[a]	*M* = 26.21 *SD* = 32.02		*M* = 26.86 *SD* = 33.36		–
Physical capability (T1)	*M* = 6.62 *SD* = 2.70		*M* = 6.73 *SD* = 2.59		–
Psychological capability (T1)	*M* = 6.67 *SD* = 2.50		*M* = 6.71 *SD* = 2.56		–
Physical opportunity (T1)	*M* = 37.14 *SD* = 36.07		*M* = 37.69 *SD* = 35.93		–
Social opportunity (T1)	*M* = 31.33 *SD* = 32.85		*M* = 35.30 *SD* = 34.00		–
Reflective motivation (T1)	*M* = 6.32 *SD* = 2.77		*M* = 6.54 *SD* = 2.68		–
Automatic motivation (T1)	*M* = 6.11 *SD* = 2.84		*M* = 6.37 *SD* = 2.82		–

[a] For the group allocation checks, MANOVA was used for continuous variables and chi-square was used for categorical variables. The MANOVA, and all of the associated univariate F tests were non-significant.

professional in a typical week were collected.

4.2. Behaviour

Participants were asked to rate (using a 0–100 % rating scale): (a) what proportion of patients they saw would benefit from opportunistic behaviour change interventions, (b) the proportion of times they delivered opportunistic behaviour change interventions to the patients they thought would benefit, and (c) how much of their contact time they spent delivering opportunistic behaviour change interventions to the patients they thought would benefit. Participants were provided with a brief explanation of what was meant by opportunistic behaviour change interventions prior to completing the survey, including examples such as offering healthy lifestyle advice or signposting to relevant services. The primary outcome was the proportion of times they delivered interventions to patients who they perceived would benefit from them. Participants were asked to rate the extent to which they delivered behaviour change interventions during routine consultations on 0–100 % scale using the item, "Of the service users you see in a typical working week, who you think would benefit, with what proportion do you Make Every Contact Count?". This phrasing was intended to reflect routine practice rather than a specific retrospective time period, and to capture how healthcare professionals use clinical judgement to tailor interventions based on perceived patient need or readiness.

4.3. Psychosocial variables

Keywoth et al.'s brief COM-B measure (Keyworth et al., 2020) was used to assess healthcare professionals' capabilities, opportunities and motivations in relation to Making Every Contact Count, which comprises six items designed to measure physical capability, psychological capability, physical opportunity, social opportunity, reflective motivation, and automatic motivation. Each item is accompanied with a brief definition of each construct (e.g., the physical opportunity item is accompanied with: What is physical opportunity? The environment provides the opportunity to engage in the activity concerned (e.g., sufficient time, the necessary materials, reminders). The physical opportunity and social opportunity items are measured using a 0–100 % rating scale, and the physical capability, psychological capability, reflective motivation, and

automatic motivation items are assessed on 11-point scales (strongly disagree[0]-strongly agree[10]). No other response options were provided on the 11-point scale, which was based on a validated COM-B questionnaire.

4.4. Intervention

In addition to completing the measures described above, participants were randomised to one of two groups. Participants in both groups were presented with a "volitional help sheet" at the end of the questionnaire, a tool for helping healthcare professionals to form implementation intentions (Armitage and Arden, 2010, 2012). The volitional help sheet was based on previous studies that supported implementation intention formation to support health behaviour change. The specific content of the volitional help sheet (i.e. the barriers and enablers to delivering behaviour change interventions) was based on a qualitative study carried out prior to the present study and the wider literature (Armitage, 2015; Keyworth et al., 2021b; O'Connor et al., 2017). This study involved semi-structured interviews with a diverse sample of NHS healthcare professionals and was analysed using reflexive thematic analysis. The themes generated from this analysis informed the development of the "if–then" statements used in the volitional help sheet (Vogt et al., 2023). The volitional help sheet consisted of nine critical situations and nine appropriate responses (labelled "solutions"). The barriers to delivering behaviour change items (i.e. "situations") were translated into "if" statements, for example: "If I believe I don't have a good enough relationship with a patient to talk about healthy lifestyle … "; the processes of change items were translated into "then" statements, for example, "then I would refer to a specialist healthcare professional or another member of my team."

Healthcare professionals in the experimental group were presented with a table with two columns and nine rows. Nine situations (barriers to delivering behaviour change interventions) were presented in the left-hand column and nine solutions (or appropriate responses; processes of change) were presented in the right hand column (as separate drop down menus). Participants in this group were asked to form implementation intentions by linking critical situations with appropriate responses by choosing an appropriate response from the drop-down menu for each critical situation. Participants were told they could make as many situation-solution links as they wanted. The volitional help sheet was framed from the healthcare professional's perspective, encouraging reflection on hypothetical but realistic situations encountered in routine practice. This approach aimed to support automatic motivation by strengthening mental links between common barriers and appropriate responses, rather than targeting specific patients. A sample version of the volitional help sheet, including the nine critical situations and corresponding responses, is presented in Supplementary File A.

Participants in the active control group were presented with a table with two columns containing the same situations and solutions that participants in the experimental group saw. Each situation and solution had a radio button (i.e. a tick box) next to it; participants in the active control group were asked to identify situations and solutions and place a tick next to each one they thought would be useful to them. Therefore, participants in the active control group were not asked to form implementation intentions.

4.5. Randomisation

Participants were allocated using simple randomisation based on a single sequence of random assignments (Roberts and Torgerson, 1998) to receive either implementation intention-based intervention for increasing healthcare professional delivery of behaviour change interventions during routine healthcare, or an active control group. Web-based randomisation and enrolment was conducted by a third party (YouGov) and concealed from the research team. Double masking was implemented to blind both the research team and participants to intervention allocation.

4.6. Analysis

To assess baseline equivalence between the intervention and active control groups at T1, we used multivariate analysis of variance (MANOVA) for continuous variables, including age, number of patients seen per week, average minutes spent with each patient, intervention delivery, perceptions of patient benefit, time spent delivering interventions, and measures of capability, opportunity, and motivation. For categorical variables, including gender, ethnicity, healthcare professional group, and setting, we used chi-squared tests. Means and standard deviations were calculated for healthcare professional delivery of behaviour change interventions (as well as secondary outcomes: the proportion of patients that would benefit from behaviour change interventions and the amount of time spent delivering interventions) at recruitment (T1), T2, T3, and T4. Mixed ANCOVAs (intervention group [2] x time [3] with baseline behaviour plus confounding factors: age, gender, ethnicity and healthcare professional group as the covariates) were used to examine associations between experimental group (experimental versus active control group) plus time on the reported delivery of behaviour change interventions plus secondary outcomes (one ANCOVA for each outcome).

Outcomes were interpreted using p-values to assess statistical significance and partial eta squared (η^2) as a measure of effect size, indicating the proportion of variance explained by each factor. Missing data were assessed using Little's Missing Completely at Random (MCAR) test (Little, 1988), which indicated that the data were consistent with the MCAR assumption (all p's $> .12$). Therefore, missing data were handled using the Expectation Maximization (EM) algorithm, which imputes missing values through maximum-likelihood estimation based on observed data (Dempster et al., 1977).

5. Results

Of the 1008 healthcare professionals enrolled into the study, 503 were randomly assigned to the intervention group and 505 to the control group (Fig. 1). Follow-up data collection occurred at one month (T2), twelve months (T3), and thirteen months (T4) after baseline (T1). At T1 (baseline), data were collected from all 503 intervention participants and all 505 control participants. At T2, follow-up data were collected from 386 intervention participants (76.7 %) and 389 control participants (77.0 %). At T3, data were collected from 316 intervention participants (62.8 %) and 330 control participants (65.3 %). At T4, 277 intervention participants (55.1 %) and 307 control participants (60.8 %) completed the follow-up.

5.1. Group allocation checks

MANOVA revealed no statistically significant differences between those who were randomized to the intervention group and those randomized to the active control group with respect to continuous variables, $F(11, 996) = 1.105$, $p = .35$, $\eta_p^2 = .01$, and categorical variables (all p's $> .19$; see Table 1).

5.2. Missing data

As described in the Analysis section, missing data were assessed using Little's Missing Completely at Random (MCAR) test. The test indicated that the data were consistent with the MCAR assumption ($p > .12$). Therefore, missing data were imputed using the Expectation Maximization algorithm.

5.3. Descriptive data

Across the total sample ($N = 1008$), the proportion of patients to

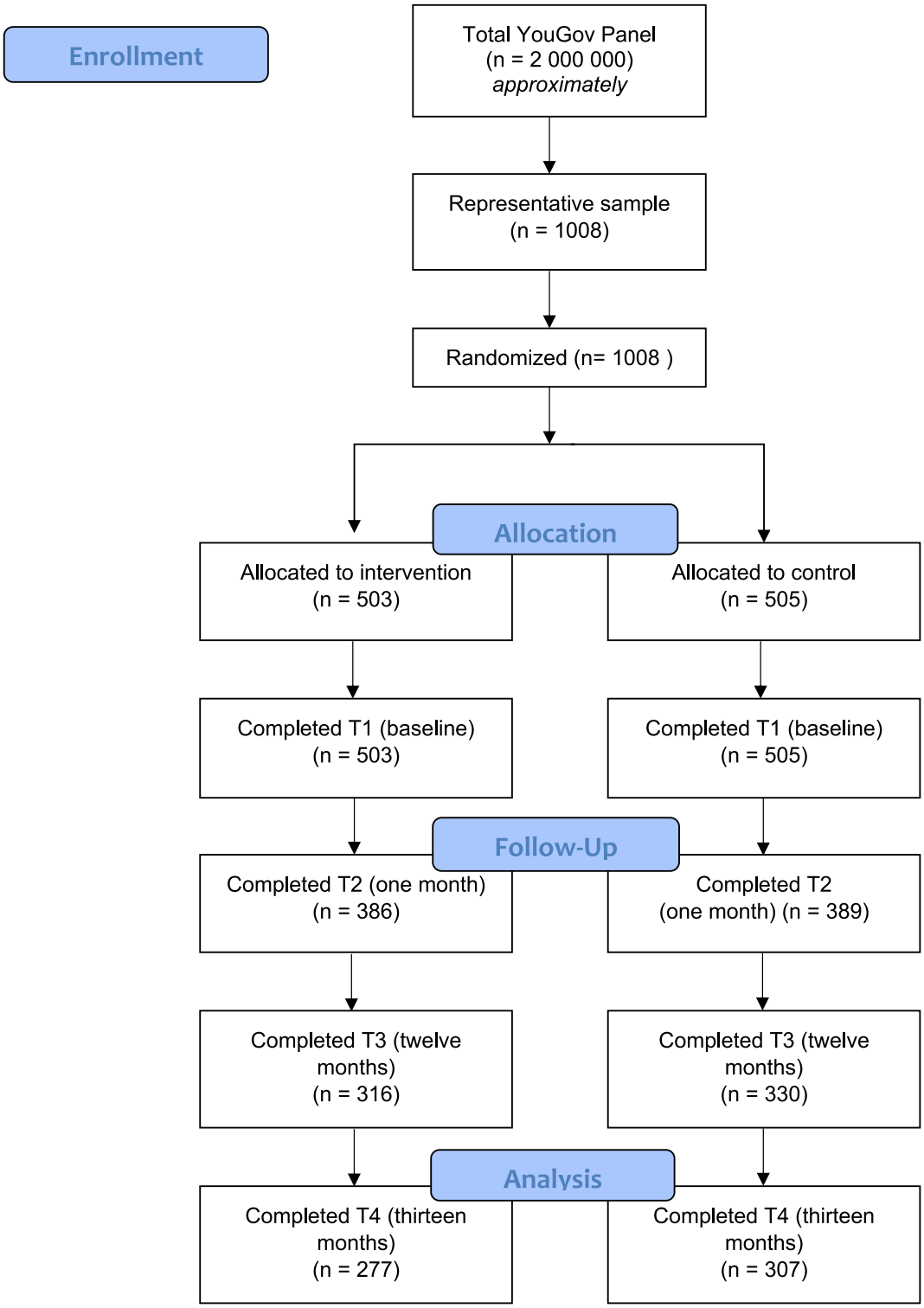

Fig. 1. Participant flow diagram.

whom healthcare professionals delivered behaviour change interventions increased from recruitment (M = 37.93, SD = 36.34) to T2 (M = 38.60, SD = 33.24) to T3 (M = 40.17, SD = 30.90), to T4 (M = 40.58, SD = 30.54). Paired-samples t-tests revealed no statistically significant differences between adjacent timepoints in healthcare professionals' delivery of behaviour change interventions to patients perceived to benefit (all p-values >.05). The proportion of patients whom healthcare professionals believed would benefit from a behaviour change intervention increased from recruitment (M = 49.14, SD = 35.63) to T2 (M = 50.62, SD = 32.75) to T3 (M = 53.43, SD = 30.75), and then dropped marginally from T3 to T4 (M = 51.55, SD = 31.29). Paired-samples t-tests revealed a significant increase in perceived patient benefit between T2 and T3 (p = .003), followed by a significant decrease between T3 and T4 (p = .029). No significant change was observed between T1 and T2 (p = .171). The proportion of the consultation time spent delivering behaviour change interventions increased marginally from recruitment (M = 26.54, SD = 32.69), to T2 (M = 26.93, SD = 30.14), to T3 (M = 28.71, SD = 28.54), then dropped

marginally from T3 to T4 ($M = 26.46$, $SD = 27.12$). Paired-samples t-tests revealed a significant increase in time spent delivering behaviour change interventions between T2 and T3 ($p = .045$), followed by a significant decrease between T3 and T4 ($p = .010$). No significant change was observed between T1 and T2 ($p = .682$).

Physical capabilities decreased marginally from recruitment ($M = 6.68$, $SD = 2.65$) to T2 ($M = 6.63$, $SD = 2.37$), then increased by T3 ($M = 6.70$, $SD = 2.27$). It then dropped marginally by T4 ($M = 6.57$, $SD = 2.22$) to below recruitment levels. Paired-samples t-tests revealed a significant increase in physical capability between T3 and T4 ($p = .039$), but no significant changes between T1 and T2 (p = .528) or T2 and T3 ($p = .348$). Psychological capabilities dropped marginally from recruitment ($M = 6.69$, $SD = 2.53$) to T2 ($M = 6.65$, $SD = 2.24$), then increased by T3 ($M = 6.78$, $SD = 2.16$). It then dropped marginally by T4 ($M = 6.61$, $SD = 2.21$) to below recruitment levels. Paired-samples t-tests revealed a significant decrease in psychological capability between T2 and T3 ($p = .030$), followed by a significant increase between T3 and T4 ($p = .004$). No significant change was observed between T1 and T2 ($p = .601$).

Physical opportunities decreased marginally from recruitment ($M = 37.41$, $SD = 35.98$), to T2 ($M = 37.09$, $SD = 32.71$), then increased by T3 ($M = 40.29$, $SD = 31.66$), and increased further by T4 ($M = 40.78$, $SD = 29.81$). Paired-samples t-tests revealed a significant increase in physical opportunity between T2 and T3 ($p = .002$), but no significant changes between T1 and T2 ($p = .766$) or T3 and T4 ($p = .563$). Social opportunities increased marginally from recruitment ($M = 33.32$, $SD = 33.47$), to T2 ($M = 34.06$, $SD = 30.64$), then dropped marginally by T3 ($M = 33.41$, $SD = 29.31$). It then increased by T4 ($M = 34.97$, $SD = 28.41$). Paired-samples t-tests revealed no statistically significant differences in social opportunity between adjacent timepoints (all p's $> .05$).

Reflective motivation decreased from recruitment ($M = 6.43$, $SD = 2.72$), to T2 ($M = 6.35$, $SD = 2.59$), then increased to T3 ($M = 6.56$, $SD = 2.41$). It then dropped marginally by T4 ($M = 6.41$, $SD = 2.46$) to below recruitment levels. Paired-samples t-tests revealed a significant decrease in reflective motivation between T2 and T3 ($p < .001$), followed by a significant increase between T3 and T4 ($p = .008$). No significant change was observed between T1 and T2 ($p = .239$). Automatic motivation decreased from recruitment ($M = 6.24$, $SD = 2.83$), to T2 ($M = 6.11$, $SD = 2.66$), then increased to T3 ($M = 6.31$, $SD = 2.57$). It then dropped marginally by T4 ($M = 6.26$, $SD = 2.51$) to below recruitment levels. Paired-samples t-tests revealed a significant decrease in automatic motivation between T2 and T3 ($p < .001$), but no significant changes between T1 and T2 ($p = .073$) or T3 and T4 ($p = .334$).

5.4. Effects of the intervention

In order to investigate the effects of the intervention on reported delivery of behaviour change interventions, as well as secondary variables (perception of patient benefit of interventions, time spent delivering interventions, and perceptions of capabilities, opportunities, and motivations), mixed ANCOVAs were carried out (group [2] x time [3] with baseline behaviour plus: age, gender, ethnicity and healthcare professional group as the covariates). Table 2 presents mean (SD) proportions of delivery of behaviour change interventions by group (experimental versus active control). Table 3 presents perceptions of patient benefit, and time spent delivering interventions by group. Table 4 presents perceptions of capabilities, opportunities, and motivations to deliver interventions by group.

Table 2
Descriptive data for delivery of behaviour change interventions by group (entire sample).

	Active control group (n = 505)		Intervention group (n = 503)	
	Mean	SD	Mean	SD
Baseline (T1)	38.77	37.05	37.09	35.62
One month (T2)	41.09	34.20	36.11	32.09
Twelve months (T3)	41.42	31.24	38.91	30.52
Thirteen months (T4)	40.74	30.88	40.42	30.22

5.5. Main analyses

Participants who reported delivering health behaviour change interventions to 100 % of eligible patients at baseline were excluded from the main analyses to account for potential ceiling effects (n = 147, 14.6 %). This ensured sufficient variability in reported intervention delivery rates prior to assessing the effects of the intervention on all study outcomes.

Among the 438 participants in the intervention group included in the main analyses, 357 (81.5 %) formed at least one implementation intention using the volitional help sheet, indicating meaningful engagement with the intervention.

5.6. Primary outcome: intervention delivery

With respect to *intervention delivery*, mixed ANCOVA found no significant group, $F(1, 842) = .08$, $p = .78$, $\eta_p^2 = .000$, or time effect, $F(3, 840) = 2.61$, $p = .051$, $\eta_p^2 = .009$. However, there was a significant time by group effect on intervention delivery, $F(3, 840) = 3.54$, $p = .014$, $\eta_p^2 = .012$. An independent samples *t*-test comparing intervention delivery between the intervention and control groups at each time point revealed a statistically significant difference at Time 2, $t(859) = -2.03$, $p = .043$, with the control group reporting higher levels of intervention delivery than the intervention group. No significant between-group differences were observed at Time 1 ($t(859) = .448$, $p = .654$), Time 3 ($t(859) = -.702$, $p = .483$), or Time 4 ($t(859) = 1.023$, $p = .307$). At the final follow-up (13 months), the intervention group reported higher intervention delivery than the control group, but this difference was not statistically significant. With respect to within-group differences, follow-up t-tests revealed a significant increase in intervention delivery in the intervention group between T1 ($M = 27.76$, $SD = 27.96$) and T2 ($M = 31.50$, $SD = 29.41$), $t(437) = -2.62$, $p = .009$, and between T2 and T3 ($M = 35.95$, $SD = 29.06$), $t(437) = -3.19$, $p < .001$. However, the difference between T3 and T4 ($M = 37.40$, $SD = 28.55$) was not significant, $t(437) = -1.12$, $p = .263$. In the control group, a significant increase in intervention delivery was observed between T1 ($M = 26.91$, $SD = 27.74$) and T2 ($M = 35.70$, $SD = 31.21$), $t(422) = -5.87$, $p < .001$, but no significant change occurred between T2 and T3 ($M = 37.34$, $SD = 29.00$), $t(422) = -1.20$, $p = .231$, or between T3 and T4 ($M = 35.43$, $SD = 27.89$), $t(422) = 1.53$, $p = .127$. Descriptive data for delivery of behaviour change interventions by group (with ceiling effects removed) are presented in Table 5, with between and within group differences presented in Supplementary File B (Fig. 1).

Table 3
Descriptive data for perceptions of patient benefit, and time spent delivering interventions by group (entire sample).

	Active control group (n = 505)		Intervention group (n = 503)	
	Mean	SD	Mean	SD
Perception of patient benefit (T1)	48.84	35.87	49.44	35.43
Perception of patient benefit (T2)	51.84	32.93	49.39	32.55
Perception of patient benefit (T3)	54.44	31.21	52.42	30.28
Perception of patient benefit (T4)	51.77	31.77	51.33	30.84
Time spent delivering interventions (T1)	26.86	33.36	26.21	32.02
Time spent delivering interventions (T2)	28.67	31.25	25.18	28.91
Time spent delivering interventions (T3)	28.63	28.18	28.78	28.92
Time spent delivering interventions (T4)	26.92	27.88	25.99	26.34

Table 4
Descriptive data for perceptions of capabilities, opportunities, and motivations to deliver behaviour change interventions (entire sample).

Variable	Active control group (n = 505)		Intervention group (n = 503)	
	Mean	SD	Mean	SD
Physical capability (T1)	6.73	2.59	6.62	2.70
Physical capability (T2)	6.71	2.38	6.55	2.36
Physical capability (T3)	6.65	2.27	6.74	2.27
Physical capability (T4)	6.54	2.23	6.61	2.20
Psychological capability (T1)	6.71	2.56	6.67	2.50
Psychological capability (T2)	6.70	2.25	6.60	2.23
Psychological capability (T3)	6.69	2.19	6.87	2.13
Psychological capability (T4)	6.58	2.23	6.64	2.19
Physical opportunity (T1)	37.69	35.93	37.14	36.07
Physical opportunity (T2)	37.29	34.43	36.89	33.02
Physical opportunity (T3)	40.67	32.03	39.91	31.32
Physical opportunity (T4)	40.09	29.28	41.47	30.34
Social opportunity (T1)	35.30	34.00	31.33	32.85
Social opportunity (T2)	35.08	30.98	33.04	30.29
Social opportunity (T3)	33.28	29.12	33.54	29.53
Social opportunity (T4)	35.73	28.60	34.21	28.23
Reflective motivation (T1)	6.54	2.68	6.32	2.77
Reflective motivation (T2)	6.40	2.59	6.31	2.60
Reflective motivation (T3)	6.53	2.47	6.59	2.35
Reflective motivation (T4)	6.44	2.48	6.39	2.43
Automatic motivation (T1)	6.37	2.82	6.11	2.84
Automatic motivation (T2)	6.17	2.65	6.04	2.68
Automatic motivation (T3)	6.33	2.60	6.30	2.55
Automatic motivation (T4)	6.28	2.52	6.23	2.50

Table 5
Descriptive data for delivery of behaviour change interventions by group (ceiling effects removed).

	Active control group (n = 423)		Intervention group (n = 438)	
	Mean	SD	Mean	SD
Intervention delivery (T1)	26.91	27.74	27.76	27.96
Intervention delivery (T2)	35.70	31.21	31.50	29.41
Intervention delivery (T3)	37.34	29.00	35.95	29.06
Intervention delivery (T4)	35.43	27.89	37.40	28.55

5.7. Secondary outcomes: perceptions of patient benefit and time spent delivering interventions

With respect to *perceptions of patient benefit*, mixed ANCOVA found no significant group, $F(1, 842) = .02$, $p = .88$, $\eta_p^2 = .000$, time, $F(3, 840) = 1.58$, $p = .19$, $\eta_p^2 = .006$, or time by group effect, $F(3, 840) = 2.53$, $p = .056$, $\eta_p^2 = .009$. With respect to *time spent delivering interventions*, mixed ANCOVA found no significant group, $F(1, 842) = .25$, $p = .36$, $\eta_p^2 = .000$, time, $F(3, 840) = 2.16$, $p = .091$, $\eta_p^2 = .008$, or time by group effect, $F(3, 840) = 1.82$, $p = .14$, $\eta_p^2 = .006$. Descriptive data for perceptions of patient benefit, and time spent delivering interventions by group (with ceiling effects removed) are presented in Table 6, with between and within group differences presented in Supplementary File B (Figs. 2 and 3).

Table 6
Descriptive data for perceptions of patient benefit, and time spent delivering interventions by group (ceiling effects removed).

	Active control group (n = 423)		Intervention group (n = 438)	
	Mean	SD	Mean	SD
Perception of patient benefit (T1)	40.62	32.10	43.75	32.84
Perception of patient benefit (T2)	48.41	31.59	46.12	31.68
Perception of patient benefit (T3)	51.73	30.37	49.91	29.43
Perception of patient benefit (T4)	47.91	30.88	48.64	29.91
Time spent delivering interventions (T1)	19.39	25.96	19.92	26.04
Time spent delivering interventions (T2)	24.36	27.98	21.04	25.21
Time spent delivering interventions (T3)	26.08	26.35	25.78	26.69
Time spent delivering interventions (T4)	23.57	25.26	23.64	24.56

5.8. Secondary outcomes: perceived capabilities, opportunities and motivations to deliver interventions

For physical opportunity, mixed ANCOVA found no significant group, $F(1, 842) = .58$, $p = .45$, $\eta_p^2 = .001$, time, $F(3, 840) = .1.24$, $p = .29$, $\eta_p^2 = .004$, or time by group effect, $F(3, 840) = .90$, $p = .44$, $\eta_p^2 = .003$, on physical opportunity scores. For social opportunity, mixed ANCOVA found no significant group, $F(1, 842) = .32$, $p = .56$, $\eta_p^2 < .001$, time, $F(3, 840) = .34$, $p = .79$, $\eta_p^2 = .001$, or time by group effect, $F(3, 840) = .42$, $p = .74$, $\eta_p^2 = .001$, on social opportunity scores. Paired-samples t-tests revealed no significant changes in physical or social opportunity scores between any time points in either group.

For reflective motivation, mixed ANCOVA found no significant group, $F(1, 842) = .06$, $p = .78$, $\eta_p^2 < .001$, time, $F(3, 840) = 1.60$, $p = .19$, $\eta_p^2 = .006$, or time by group effect, $F(3, 840) = 1.19$, $p = .31$, $\eta_p^2 = .004$. Paired-samples t-tests revealed a significant increase in reflective motivation in the intervention group between T2 ($M = 6.11$, $SD = 2.56$) and T3 ($M = 6.40$, $SD = 2.34$), $t(437) = -3.33$, $p < .001$, followed by a significant decrease between T3 and T4 ($M = 6.20$, $SD = 2.40$), $t(437) = 2.53$, $p = .012$. No significant changes were observed in the control group. For automatic motivation, mixed ANCOVA found no significant group, $F(1, 842) = .39$, $p = .53$, $\eta_p^2 < .001$, time, $F(3, 840) = 2.60$, $p = .051$, $\eta_p^2 = .009$, or time by group effect, $F(3, 840) = 1.12$, $p = .34$, $\eta_p^2 = .004$, on automatic motivation scores. Paired-samples t-tests revealed a significant increase in automatic motivation in the intervention group between T2 ($M = 6.04$, $SD = 2.68$) and T3 ($M = 6.26$, $SD = 2.51$), $t(437) = -2.33$, $p = .020$. In the control group, a significant increase was also observed between T2 ($M = 6.17$, $SD = 2.65$) and T3 ($M = 6.33$, $SD = 2.60$), $t(422) = -2.26$, $p = .025$. No significant changes were observed between T1 and T2 or between T3 and T4 in either group.

For physical capability, mixed ANCOVA found no significant group, $F(1,842) = .06$, $p = .82$, $\eta_p^2 < .001$, time, $F(3, 840) = .1.91$, $p = .13$, $\eta_p^2 = .007$, or time by group effect, $F(3, 840) = .65$, $p = .58$, $\eta_p^2 = .002$, on physical capability scores. Paired-samples t-tests revealed no significant changes in physical capability scores between any time points in either group. For psychological capability, mixed ANCOVA found no significant group, $F(1, 842) = .06$, $p = .381$, $\eta_p^2 < .001$, or time by group effect, $F(3, 840) = 1.06$, $p = .37$, $\eta_p^2 = .004$. However, there was a significant time effect, $F(3, 840) = 2.94$, $p < .05$, $\eta_p^2 = .010$, on psychological capability scores. Follow-up t-tests showed a significant increase in psychological capability in the intervention group between T2 ($M = 6.48$, $SD = 2.21$) and T3 ($M = 6.72$, $SD = 2.13$), $t(437) = -2.73$, $p = .007$, and a significant decrease between T3 and T4 ($M = 6.51$, $SD = 2.17$), $t(437) = 2.23$, $p = .026$. In contrast, the control group showed no significant differences in psychological capability between any time points. Descriptive data for perceptions of capabilities, opportunities, and motivations to deliver behaviour change interventions (with ceiling effects removed) are presented in Table 7, with between and within group differences presented in Supplementary File B (Figs. 4–9).

5.8.1. Subgroup analyses

This section presents exploratory subgroup comparisons, distinct from the primary analyses which focused on intervention and control groups at each time point. Follow-up subgroup mixed ANCOVAs were conducted according to whether healthcare professionals were GPs and nurses ($n = 426$), versus "other" ($n = 435$), to examine any significant interactions between time and group on reported delivery of behaviour change interventions, as well as secondary variables (perception of patient benefit of interventions, time spent delivering interventions, and perceptions of capabilities, opportunities, and motivations), mixed ANCOVAs were carried out (group [2] x time [3] with baseline

Table 7
Descriptive data for perceptions of capabilities, opportunities, and motivations to deliver behaviour change interventions (ceiling effects removed).

Variable	Active control group (n = 423)		Intervention group (n = 438)	
	Mean	SD	Mean	SD
Physical capability (T1)	6.54	2.61	6.40	2.72
Physical capability (T2)	6.52	2.41	6.40	2.36
Physical capability (T3)	6.55	2.26	6.59	2.28
Physical capability (T4)	6.42	2.23	6.49	2.20
Psychological capability (T1)	6.50	2.58	6.45	2.51
Psychological capability (T2)	6.56	2.26	6.48	2.21
Psychological capability (T3)	6.56	2.21	6.72	2.13
Psychological capability (T4)	6.43	2.23	6.51	2.17
Physical opportunity (T1)	31.25	32.95	32.72	33.88
Physical opportunity (T2)	32.60	29.83	33.77	31.61
Physical opportunity (T3)	37.65	31.00	36.88	30.17
Physical opportunity (T4)	36.71	27.78	38.93	29.53
Social opportunity (T1)	29.45	30.74	26.93	29.92
Social opportunity (T2)	30.86	28.64	29.70	28.23
Social opportunity (T3)	31.58	28.04	31.45	28.57
Social opportunity (T4)	32.46	26.92	32.26	27.31
Reflective motivation (T1)	6.22	2.67	6.01	2.76
Reflective motivation (T2)	6.16	2.59	6.11	2.56
Reflective motivation (T3)	6.33	2.46	6.40	2.34
Reflective motivation (T4)	6.18	2.51	6.20	2.40
Automatic motivation (T1)	6.03	2.81	5.74	2.80
Automatic motivation (T2)	5.88	2.61	5.81	2.65
Automatic motivation (T3)	6.10	2.59	6.03	2.54
Automatic motivation (T4)	6.02	2.52	6.01	2.54

behaviour plus: age, gender, ethnicity and healthcare professional group as the covariates). As these analyses were not specified in the pre-registration, they should be considered exploratory. GPs and nurses were grouped together due to their shared characteristics of frequent patient contact and central roles in delivering behaviour change interventions. This grouping reflects their prominence within the NHS workforce and allowed us to explore differences in intervention effectiveness compared to other professional groups. The "other" group comprised specialist doctors, midwives, scientific, therapeutic and technical staff (e.g., pharmacists, psychologists, speech and language therapists), ambulance staff, support to clinical staff, and other HCHS staff/unknown classifications.

5.8.2. GPs or nurses only

There was one main finding with respect to *intervention delivery*. Mixed ANCOVA found no significant group, $F(1, 413) = .004$, $p = .95$, $\eta_p^2 < .001$, or time effect, $F(3, 411) = 1.01$, $p = .39$, $\eta_p^2 = .007$. Consistent with main analyses, there was a significant time by group effect, $F(3, 411) = 4.31$, $p = .005$, $\eta_p^2 = .030$ on intervention delivery. Follow-up *t*-tests to assess differences between each of the follow-ups between groups showed that there were significant differences across groups, such that significant increases in intervention delivery were observed between T1 ($M = 30.14$, $SD = 27.69$) and T2 ($M = 34.19$, $SD = 29.28$), $t(211) = -2.02$, $p < .05$, and between T2 and T3 ($M = 38.77$, $SD = 29.88$), $t(211) = -2.15$, $p < .05$ in the intervention group. In the control group a significant increase in intervention delivery was observed between T1 ($M = 30.17$, $SD = 28.27$) and T2 ($M = 38.49$, $SD = 31.16$), $t(213) = -3.75$, p < .001, and a significant decrease in intervention delivery was observed between T3 ($M = 39.20$, $SD = 28.97$) and T4 ($M = 35.67$, $SD = 25.73$)), $t(213) = 2.06$, $p < .05$.

5.8.3. Other hcp

There were three key findings. First, with respect to *time spent delivering interventions*, mixed ANCOVA found no significant group, $F(1, 423) = .03$, $p = .86$, $\eta_p^2 < .001$, or time by group effect, $F(3, 421) = .50$, $p = .61$, $\eta_p^2 = .004$. However, there was a significant time effect, $F(3, 421) = 2.70$, $p = .045$, $\eta_p^2 = .019$. Follow-up *t*-tests showed a significant increase in time spent delivering interventions in the intervention group between T2 ($M = 20.13$, $SD = 26.07$) and T3 ($M = 23.93$, $SD = 25.23$) $t(225) = -2.49$, $p = .014$. In the control group, a significant increase was observed in the control group between T1 ($M = 15.86$, $SD = 23.33$) and T2 ($M = 22.13$, $SD = 27.19$), $t(208) = -3.49$, $p < .001$.

Second, for physical capability, mixed ANCOVA found no significant group, $F(1, 423) = .05$, $p = .82$, $\eta_p^2 < .001$, or time by group effect, $F(3, 421) = .40$, $p = .71$, $\eta_p^2 = .005$. However, there was a significant time effect, $F(3, 421) = 2.77$, $p = .041$, $\eta_p^2 = .019$. Follow-up t-tests showed a significant increase in physical capability in the intervention group between T2 ($M = 6.21$, $SD = 2.43$) and T3 ($M = 6.58$, $SD = 2.32$), $t(208) = -2.60$, $p = .010$. In the control group, a significant decrease in physical capability was observed in the control group between T3 ($M = 6.52$, $SD = 2.25$) and T4 ($M = 6.25$, $SD = 2.30$), $t(208) = 2.36$, $p = .019$.

Third, for psychological capability, mixed ANCOVA found no significant group, $F(1, 423) = .06$, $p = .581$, $\eta_p^2 < .001$, or time by group effect, $F(3, 421) = .36$, $p = .78$, $\eta_p^2 = .003$. Consistent with the main analyses, there was a significant time effect, $F(3, 421) = 3.57$, $p = .014$, $\eta_p^2 = .025$, on psychological capability scores. Follow-up t-tests showed a significant increase in psychological capability in the intervention group between T1 ($M = 6.22$, $SD = 2.63$) and T3 ($M = 6.35$, $SD = 2.35$).

6. Discussion

The aim of the present study was to assess the effectiveness of an implementation intention-based intervention on the delivery of health behaviour change interventions by healthcare professionals. At the final follow-up (13 months), the intervention group reported higher intervention delivery than the control group, but this difference was not statistically significant. Whilst healthcare professionals in both groups demonstrated increased delivery of health behaviour change interventions, the intervention group showed more sustained improvements in intervention delivery, with significant within-group increases at time 2 and time 3, and higher delivery at time 4 despite the lack of statistical significance. Although the control group outperformed the intervention group at T2, this effect was not sustained. Importantly, engagement with the volitional help sheet was strong, with over 80 % of intervention participants forming at least one if-then plan. This suggests that the task was acceptable and feasible for healthcare professionals in a large-scale digital format, supporting its potential for scalable implementation. Despite largely non-significant differences, the intervention group outperformed the control group on most outcomes, suggesting a consistent pattern of benefit across a broad range of measures. To the best of our knowledge, this is the first study showing implementation intention-based interventions can lead to sustained increases in healthcare professionals' delivery of behaviour change interventions. This suggests that a theory-based intervention based on implementation intentions may be an effective means to increase healthcare professional delivery of behaviour change interventions in routine healthcare practice.

Further, with respect to our secondary measures, over time, both groups reported increases in perceived patient benefit for interventions and time spent delivering interventions. Statistically significant improvements were observed in psychological capability and reflective motivation within the intervention group, and in automatic motivation across both groups. However, due to non-significant interaction effects among the secondary outcomes, we were unable to determine whether these improvements were directly attributable to the intervention. Participants in the active control group were presented with the same situations and solutions as the experimental group, but they were not required to form implementation intentions. As such, the active control condition may have led to underestimates of the effect of the intervention. It is possible that with a passive control group, the between-group difference at the final time point might have reached statistical significance. Therefore, it may be that simply engaging healthcare professionals in some form of structured reflection, whether through implementation intentions or by identifying useful strategies,

contributes to increases in other important measures of intervention delivery.

6.1. Sub-group analyses

Subgroup analyses revealed variability in the intervention's effectiveness across different healthcare professionals, highlighting the potential role of context. Significant increases in intervention delivery were observed among GPs and nurses, while other healthcare professionals showed improvements in other outcomes, particularly regarding time spent delivering interventions and physical capability. Although the intervention group showed improvements, the control group also demonstrated similar changes, suggesting that structured reflection may have played a role.

These findings align with previous research indicating that the impact of implementation intentions varies depending on the healthcare professional involved (such as nurses or GPs compared to other healthcare professional groups). For instance, nurses and GPs often have more frequent patient interactions than other healthcare professionals, which could affect how they implement behaviour change interventions (Keyworth et al., 2018; Taylor et al., 2011). Future research should further explore how different healthcare professional roles influence the outcomes of if-then planning interventions to better tailor strategies to specific contexts and enhance their effectiveness.

6.2. Comparison with previous research

Meta-analyses and prior research generally support the effectiveness of implementation intentions in promoting sustained behaviour change (Gollwitzer and Sheeran, 2006; McWilliams et al., 2019). The present study extends the literature by showing this can be applied to healthcare professional delivery of health behaviour change interventions. Our findings indicate that implementation intentions may facilitate improvements over time and offer advantages compared to an active comparator, highlighting their potential utility in healthcare professional contexts. To our knowledge, this is the first study examining the use of implementation intentions for supporting healthcare professional delivery of behaviour change interventions, and supports the findings in other health domains, such as smoking (Armitage, 2016), physical activity (Armitage and Arden, 2010) and self-harm (Armitage et al., 2016). While some variability in findings was observed amongst our secondary outcomes, prior research suggests that the impact of implementation intentions can depend on the context in which they are used, the type of behaviour being targeted (Gollwitzer and Sheeran, 2006; Webb and Sheeran, 2006), as well as the complexity of the target behaviour (Hagger and Luszczynska, 2014). These findings highlight the promise of implementation intentions in healthcare settings while underscoring the need for further research to optimise their application and address potential contextual barriers.

To further support the uptake of implementation-intention strategies among a broader range of healthcare professionals, several practical approaches may be beneficial. These may include peer role modelling, mentoring to support the integration of newly acquired skills into routine practice, and structured training programmes (Hatfield et al., 2020). Follow-up training opportunities to support continued use of if-then planning in clinical practice, for example, could help maintain engagement and skill retention over time. Improving patient awareness of behaviour change strategies may increase receptivity and encourage more collaborative intervention efforts (Hooker et al., 2018). Embedding these strategies into organisational practice may help overcome systemic barriers and promote sustained behaviour change.

6.3. Implications and future research

Whilst implementation intention-based interventions in healthcare settings may be a practical and feasible way of supporting healthcare professionals to increase the frequency of behaviour change interventions during routine medical consultations, further work is required to understand the contextual factors that may increase the likelihood of intervention effectiveness for psychological drivers of healthcare professional behaviour. The mixed results for some of our outcomes suggest that a multifaceted approach may be necessary to fully address the barriers healthcare professionals face when delivering behaviour change interventions (Parchment et al., 2023; Vogt et al., 2023). This may include combining implementation intentions with other strategies such as communication skills training, environmental prompts, or organisational support. Contextual factors such as time constraints, access to referral pathways, and the nature of patient–professional relationships may also influence intervention effectiveness. For example, professionals working in primary care may perceive more opportunities for repeated patient contact, which could enhance intervention uptake.

There are several areas for future research. First, there is growing evidence suggesting that repeated administration of implementation intentions may increase the effectiveness of behaviour change interventions (Chapman and Armitage, 2010; Conner et al., 2019). There may be value in incorporating implementation intentions into regular training for healthcare professionals to sustain and enhance their effectiveness over an even longer period, as observed in the present study. Future research could therefore aim to explore the impact of repeated implementation intentions over time. Second, investigating the optimal frequency and timing of these repeated interventions could provide insights into how to maximize their effectiveness. Researchers could also examine the specific contextual factors within healthcare settings that might influence the continued success of implementation intentions (Vogt et al., 2023) and help facilitate their integration into healthcare professionals' day-to-day practice and routine. This approach would offer insight into potentially tailoring interventions to better fit the unique challenges faced by healthcare professionals in a constantly changing healthcare environment (Keyworth et al., 2023). In addition, future research could explore the cost-effectiveness of implementation-intention interventions, particularly in relation to the economic burden of treating non-communicable diseases (NCDs) (World Health Organization, 2023), to assess their scalability and sustainability in routine healthcare practice. Third, integrating objective measures of health behaviour change intervention delivery (such as patient data or observations) alongside self-reported data could further strengthen the validity of future studies and offer a more comprehensive understanding of how to effectively support healthcare professionals in delivering interventions. Finally, there were promising findings regarding changes over time in several key outcomes, with increases observed in both the intervention and control groups. At 13 months, intervention delivery remained higher in the intervention group than the control group, although this difference was not statistically significant. Importantly, once participants who were already delivering behaviour change interventions (100 % of the time they thought patients would benefit from them) were accounted for, a clear effect of the intervention emerged, though it was not sustained at 13 months, the final follow-up. Our findings therefore suggest that implementation intentions meaningfully enhance intervention delivery. Future research could further explore ways to sustain these effects over the long term, including the potential role of repeated implementation intention formation.

6.4. Strengths and limitations

A key strength of this intervention is its cost-effectiveness and potential for widespread implementation in healthcare settings. Given that the intervention requires minimal resources and can be administered at scale, it has the potential to be integrated into routine healthcare training without significant financial or logistical burden. Interventions based on implementation intentions are practical tools that can be used across different healthcare contexts, demonstrating its wide potential

reach to enhance behaviour change intervention delivery across diverse healthcare professional environments.

There are also limitations to the present research. Whilst there are promising findings with respect to positive effects of key outcomes over time, there are limitations to this study. Whilst some variation was observed in the secondary outcomes, the large and diverse sample helps mitigate concerns about statistical power and generalisability of the sample. Notably, nurses and health visitors comprised the largest proportion of participants, reflecting their prevalence in the NHS workforce. While this aligns with the intended representativeness of the sample, it may have influenced the overall findings, particularly given their frequent patient contact and established role in delivering behaviour change interventions. Subgroup analyses were conducted to explore differences by provider type, but future research could further investigate how professional role and context shape the effectiveness of implementation intention-based interventions. In addition, acute care providers represented around 40 % of the sample in both intervention and control groups. Given that intervention delivery may vary depending on the clinical setting, with acute care often involving time-pressured and episodic interactions, this may have influenced the overall findings. Future research could explore how setting-specific factors shape the feasibility and impact of implementation intention-based interventions. The use self-reported outcome measures is a limitation, and the addition of objective measures may strengthen future research. Self-report data are subject to recall bias and may not accurately reflect actual behaviour. We did not collect patient-reported outcomes or objective recordings of provider-patient interactions, which limits our ability to confirm whether and how behaviour change interventions were delivered. Our key outcome measure was the proportion of times healthcare professionals delivered opportunistic behaviour change interventions to the patients they thought would benefit, rather than the overall proportion of all patients. While this reflects real-world practice, it may not fully align with the MECC principle of offering interventions universally. Future research could benefit from incorporating objective measures (e.g., patient-reported outcomes or observational data) to validate healthcare professional behaviour and reduce reliance on subjective judgement. The study was also focused on a single healthcare system in one country. Comparative studies across different countries and healthcare settings may help to understand the broader applicability of the intervention, and help to understand common barriers and enablers to delivering behaviour change interventions.

7. Conclusions

Our findings provide promising evidence that an implementation intention-based intervention can enhance the delivery of behaviour change interventions over time. The intervention showed promising effects compared to an active control group, supporting its potential utility in real-world practice. While a single administration may not be sufficient to fully overcome barriers to sustained implementation, the observed improvements suggest that implementation intentions are a valuable tool for supporting healthcare professionals. Future strategies should explore the benefits of repeated administration and combining implementation intentions with additional support measures to maximize long-term effectiveness. These findings contribute to the existing literature and offer practical insights for integrating implementation intentions into public health strategies, highlighting the potential for tailored interventions to strengthen healthcare practice.

CRediT authorship contribution statement

Chris Keyworth: Writing – review & editing, Writing – original draft, Funding acquisition, Formal analysis, Conceptualization. **Christopher J. Armitage:** Writing – review & editing, Funding acquisition, Conceptualization. **Judith Johnson:** Writing – review & editing, Funding acquisition. **Tracy Epton:** Writing – review & editing, Formal analysis, Conceptualization. **Katharina S. Vogt:** Writing – review & editing. **Mark Conner:** Writing – review & editing, Writing – original draft, Formal analysis, Conceptualization.

Ethical approval

Ethical approval for this study was granted by the University of Leeds Research Ethics Committee (Ref: PSYC-398). All participants gave written informed consent before taking part.

Declaration of competing interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2025.118729.

Data availability

Data will be made available on request.

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