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# Participants' perspectives on making and maintaining behavioural changes in a lifestyle intervention for type 2 diabetes prevention: a qualitative study using the theory domain framework

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## ABSTRACT

**Objectives:** In a qualitative substudy, we sought to elicit participants' perspectives of their behavioural change and maintenance of new behaviours towards intervention optimisation.

**Setting:** The intervention was delivered in leisure and community settings in a local authority, which according to the UK government statistics ranks as 1 of the 10 most socioeconomically deprived areas in England.

**Participants:** We recruited 218 adults aged 40–65 years at elevated risk of type 2 diabetes (Finnish Diabetes Risk Score≥11) to the intervention. Follow-up at 12 months was completed by 134 (62%). We recruited 15 participants, purposively sampled for physical activity increase, to the qualitative substudy.

**Intervention:** Lifestyle intervention can prevent type 2 diabetes, but translation to service provision remains challenging. The 'New life, New you' intervention aimed to promote physical activity, healthy eating and weight loss, and included supervised group physical activity sessions. Behavioural change and weight loss at 12-month follow-up were encouraging.

**Design:** We conducted 15 individual semistructured interviews. The Framework approach, with a comparison of emerging themes, was used in analysis of the transcribed data and complemented by the Theory Domains Framework.

**Results:** Themes emerging from the data were grouped as perceptions that promoted initiating, enacting and maintaining behavioural change. The data were then categorised in accordance with the Theory Domains Framework: intentions and goals; reinforcement; knowledge; social role and identity; social influences; skills and beliefs about capabilities; behavioural regulation, memory, emotion, attention and decision processes and environmental context and resources. Participant perceptions of intervention features that facilitated behavioural change processes were then similarly analysed.

**Conclusions:** Social influences, reference to social role and identity (eg, peer support), and intentions and goals (eg, to lose weight) were dominant themes across the three phases of behavioural change. Reinforcement, regulation and decision processes were more evident in the maintenance phase. The socioeconomic status of participants was reflected in the environmental context and resource theme. Analysis of phases and theoretical domains of behavioural change added depth and utility to inform intervention optimisation. We will develop the intervention with improved peer support and explicit monitoring of the behavioural change techniques used, prior to a definitive trial.

## ARTICLE SUMMARY

### Article focus

The 'New life, New you' intervention aims to promote physical activity, healthy eating and weight loss to prevent type 2 diabetes. In a nested interview study, we sought intervention participants' perspectives:

- On their behavioural change;
- On maintaining their new behaviours;
- On the intervention procedures.

### Key messages

- We identified the 'initiating, enacting and maintaining' phases of behavioural change.
- We found that social influences, intentions and goals were dominant themes in all phases of behavioural change, while the environmental context and resources reflected the participants' socioeconomic status.
- Intervention delivery (as group delivered activity sessions followed by reflection) promoted social support within the programme.

### Strengths and limitations of this study

This qualitative study:

- Highlighted intervention features that were perceived as beneficial across the phases of behavioural change;
- Identified options for further intervention development;
- Was limited by the small study size and primary focus on successful participants.

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## BACKGROUND

There is good evidence for the efficacy of lifestyle interventions for type 2 diabetes (T2D) prevention,[1] but translation of this research evidence-to-service provision remains challenging and the risk reduction seen in efficacy trials[2 3] has not been equalled in implementation studies[4] The UK National Institute for Clinical Excellence (NICE) has published, in July 2012, guidance on risk identification and preventive interventions for individuals at high risk of T2D.[1] The guidance recommends identifying adults at high risk of future T2D and the provision of evidence-based intensive lifestyle interventions to prevent or delay the onset of T2D. The recommendations also advocate the use of established behavioural change techniques to promote increased physical activity (PA), dietary modifications and weight loss. There is an appreciation in the guidance that socioeconomic deprivation affects T2D progression rates and a requirement for local government to commission preventive interventions.

In line with NICE recommendations, the 'New life, New you' (NLNY) intervention includes risk assessment[5] and encourages and supports individual behavioural change: primarily to increase PA levels, while also promoting a healthy diet with weight loss where appropriate. NLNY was developed in Middlesbrough, which according to the UK government statistics ranks as 1 of the 10 most deprived areas in England based on the average index of multiple deprivation (IMD) rank of localities (Lower Super Output Areas) within the local authority.[6] A local scoping survey, conducted in the project planning stage, identified a mostly inactive population with high risk for T2D. The subsequent development of NLNY built on research evidence, contextual information from social marketing reports[7] and the expertise and experience of stakeholders. The Sport England Active People survey and related market segmentation was used as a focus to define the participant profile as hard-working middle-aged to older-aged adults in low-income groups.[8] The NLNY intervention centred on group-delivered PA sessions, each followed by reflection and advice, and was delivered by qualified fitness trainers (Register of exercise professionals REPS level 3)[9] as a local authority provision in leisure and community settings. This novel approach to intervention delivery incorporates ideas from experiential learning theory, which emphasises the role of concrete experience in promotion of future action.

Details of the NLNY pilot evaluation and results at 6 months have been published.[10 11] The NLNY pilot study results showed a high retention rate (178 of 218 recruited (82%) at 10 weeks and 132 of 218 (61%) at 12 months) and encouraging behavioural change and health-related outcomes (eg, 47% (of all recruits) reporting increased PA with mean (SD) weight loss of 4.2 (5.7) kg and reduction in waist circumference of 6.9 (5.7) cm in those completing 12-month follow-up).

We report a qualitative study conducted as part of the NLNY pilot evaluation, in line with recommendations of the Medical Research Council (MRC) framework for development and evaluation of complex interventions.[12] We aimed to: investigate participants' perspectives on the determinants of their individual behavioural change (ie, initiating, enacting and maintaining behavioural change); and elicit the salient features of the programme that encouraged people to remain involved and change their lifestyle. To inform the analysis, we used the Theoretical Domains Framework (TDF)—a framework that groups 84 component constructs from relevant behavioural theories into 14 theoretical domains according to commonalities.[13]

## METHODS

### Design and participants

The NLNY intervention comprised an individual assessment for future risk of T2D and for those at high risk a 10-week long-activity programme consisting of twice weekly sessions. The risk assessment was conducted by the NLNY trainers based on the Finnish Diabetes Risk Score[5] and measures of PA, diet, weight and waist circumference were taken. Each NLNY programme session comprised about an hour of activity followed by half an hour of group reflections. The activities were mostly physical, including gym-based activities and walks, but also included one or two cookery sessions designed to promote healthy eating and introduce dietary advice.[11] We describe the intervention design as a 'do and reflect' model[14 15]: demonstrating and rehearsing the activities was fundamental, as was inherent flexibility, so that participants could choose physical activities that were of interest to the majority within each group. The written project information supplied to participants, about diet and PA, was simple and easy to read and was distributed as required to complement the sessions. Among the behavioural change techniques used, goal setting, prompting rewards, self-monitoring, self-talk and rehearsing the activity were reinforced in the written information. Regular newsletters that included information about local activities as well as more general information and specific highlights of people's achievements were sent to participants throughout the study period. Following completion of the 10-week programme, participants were given a card that allowed free access to gym facilities for a year. The gym induction programme included optional use of the Technogym Wellness Key, which allowed individual gym routines to be programmed and monitored.[16 17]

To support people who completed the 10-week programme but requested further contact, the NLNY trainers developed a maintenance support strategy that allowed participants to access further NLNY 'drop-in' sessions. Throughout the programme and follow-up, participants were sent regular text and email reminders to encourage maintenance of lifestyle change. For evaluation and monitoring purposes, individual quantitative

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assessments were also completed at 6 and 12 months' follow-up.[10]

On the basis of the individual quantitative data from the NLNY pilot study, we purposively sampled participants to invite them for an interview.[10] In line with the research objectives, the sampling focus was on those who had achieved success in the primary NLNY quantitative outcome in terms of an increase in PA at 12 or 6 months. We then used age, gender and duration of follow-up to achieve maximum variation in the sample.[18] The NLNY evaluation team did not have access to participant contact details, so the interview invitations and arrangements were made by the NLNY trainers. A priority list of participants to invite was supplied to the trainers and most invitations to participate were by email or word of mouth. Availability of participants within the allocated interview time frame, which included both day and evening time slots, was a pragmatic inclusion criterion. The researcher who conducted the interviews did not know any of the participants before the interviews took place.

### Data collection

Individual semistructured interviews were conducted by the researcher (LP, female research associate) in a private and adequately quiet room in a leisure centre that was convenient for the participants. Interviews were completed by 15 participants and lasted between 45 min and 1 h.[10] We developed the topic guide based on relevant qualitative research within the European Diabetes Prevention Study.[19 20] As in our previous work, we allowed flexibility within the topic guide for participants to follow their own train of thought, employed active listening to prompt a revisit of areas that might provide further insight and encouraged them to tell their own stories. To ensure consideration of behavioural strategies that might be familiar to participants from their experience of the programme, we referred to specific elements of the CALO-RE taxonomy of behavioural change techniques.[21] In the interviews we provided general, followed by more specific, prompts. For example, a participant might be asked about the behavioural change strategies they used, but if this was misunderstood, they would be asked specifically about goal setting. Prompts that elicited detailed responses were revisited within each interview and later added to the topic guide, ensuring that the schedule developed as the interviews progressed. All interviews were audio recorded and transcribed verbatim.

### Analysis

We used the framework approach for data analysis.[22] An initial framework was developed using the topic guide and emergent themes used to extend the framework. Transcripts were read, checked and coded. To facilitate the data coding and collation into hierarchical themes, all transcripts were imported into NVivo V.9.[23] In an early conceptual model, we allocated 'barrier and facilitator' codes to two broad categories: category 1: 'motivation and strategies for behavioural change' that encompassed those situations where participants were talking about themselves, independent of the NLNY intervention; and category 2: 'influential intervention features' where participants were describing aspects of the intervention that had impacted on their behavioural changes. Each of these two broad categories was then subdivided to reflect the different phases of the behavioural change process. Category 1 comprised subsets about personal perceptions of initiating, enacting and maintaining behavioural change. Category 2 comprised subsets with perceptions about influential intervention features that encouraged people to join the programme, become involved with the activities and then were supported after leaving the programme and helped towards independently maintaining beneficial lifestyle changes.

In discussion, the research team drew on TDF of behavioural change to derive further coding themes.[15] Thematic charts were constructed as a matrix, with categories and phases as described above (horizontal) against theoretical domains of behavioural change (vertical). Use of NVivo software facilitated constant comparison across participant data within each matrix cell. Researcher LP read, checked, coded and organised the content during the data analysis. Coding was checked by SD. Subsequently, thematic coding allocations were discussed, compared and agreed by LP and SD. In cases where the conceptual differences between theoretical domains of behavioural change were indistinct in the context of the data of this interview study (eg, when the difference between intentions and goals was difficult to apply), we amalgamated the theoretical domains.

## RESULTS

Characteristics of the 15 participants in this interview study are detailed in table 1. The mean IMD score of all NLNY participants, based on post code data, was slightly higher (more deprived) than the mean across the whole local authority area and those who participated in the interview study had a range of scores. At the time of the interviews, eight participants had completed the 12 month follow-up. There was a good balance of gender, age and employment status among interviewees. After analysis of 15 interview transcripts, there were no new themes relevant to the research question (ie, relating to participants' perspectives of their behavioural change or of engaging features of the programme) emerging from the data.

The theoretical domains of behavioural change in the final analysis framework comprised: intentions and goals; reinforcement (including positive consequences); knowledge; social role and identity; social influences; beliefs about capabilities and skills; behavioural regulation; attention and decision processes; memory and emotion; and environmental context and resources. Exemplar quotes for participant perspectives in theme

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**Table 1** Participant characteristics

| Participant identifier | Gender | Age (mean*= 54 years) | Employment status | IMD score (mean*=40) | BMI category (mean*= 34 kg/m$^2$) | PA baseline (mean*=49 MET-h/day) | PA 6 months (mean*=53 MET-h/day) | PA 12 months (mean*=56 MET-h/day) |
|---|---|---|---|---|---|---|---|---|
| A | F | 59 | Working | 33 | 40–49 | 44 | 49 | 62 |
| B | F | 45 | Not working | 11 | 30–39 | 50 | 55 | 60 |
| C | F | 58 | Working | 11 | 30–39 | 42 | 57 | 62† |
| D | F | 53 | Not working | 44 | 50+ | 51 | 58 | 51 |
| E | M | 50 | Retired | 52 | 30–39 | 49 | 55 | 64 |
| F | M | 50 | Working | 5 | 30–39 | 39 | 45 | 54 |
| G | F | 57 | Working | 11 | 50+ | 50 | 66 | 69 |
| H | F | 54 | Working | 18 | 30–39 | 71 | 63 | 72 |
| I | F | 60 | Retired | 14 | 30–39 | 45 | 51 | 53 |
| J | M | 59 | Retired | 16 | 40–49 | 46 | 63 | – |
| K | M | 63 | Retired | 19 | 40–49 | 47 | 60 | 53 |
| L | M | 52 | Not working | 51 | 30–39 | 49 | 57 | 71 |
| M | M | 48 | Working | 67 | 30–39 | 42 | 67 | 63 |
| N | M | 53 | Working | 21 | 30–39 | 46 | 55 | 61 |
| O | F | 47 | Working | 51 | 25–29 | 40 | 56 | 72 |

*Means of study participants, based on available data at relevant time points.
†Grey font indicates participants interviewed before 12 month follow-up.
BMI, body mass index; F, female; IMD, index of multiple deprivation; M, male; MET, metabolic equivalent of task; PA, physical activity.

one, 'motivation and strategies for behavioural change' categorised according to the analysis framework described, are shown in table 2 and exemplar quotes for participant perspectives in theme two, 'influential intervention features', similarly categorised according to the analysis framework described, are shown in table 3.

Further explanation, organised by theoretical domains, is given below and includes some direct quotes (in italics) referenced to the individual participant characteristics, with the participant identifier, as detailed in table 1, in brackets following each quote. Where people talked about barriers to participation in the intervention or to making behavioural change, the focus in this participant group, which was purposively selected for outcome success, was on how they had overcome these barriers.

## Intentions and goals

Many participants talked about their appreciation of a 'need to change' (participant A, female, age 59) and their concern for future health, while some talked about planning for retirement. Previous efforts to lose weight, as well as a reluctance to set goals that might not be achieved and an acknowledgement that they *needed some encouragements* (participant A), were frequently mentioned as barriers to making change, whereas ease of access, with no waiting, and recommendations from friends encouraged people to act on intention and join the NLNY programme. The individual assessment for risk of developing T2D in the future[5] was generally seen by participants as promoting their engagement in action planning.

A preference for intervention delivery to single-sex groups had been expressed by potential participants during earlier intervention planning consultations. In the interview analysis described here, this feature of the programme was appreciated by some, although others preferred a mixed-sex group, particularly where spouses joined the programme together. The delivery model was able to accommodate both variations.

The clear programme structure promoted involvement for some. More detailed individual goal setting was described with different degrees of specificity from: *I want to lose weight, that's my goal* (participant C, female, age 58), to: *I could get another stone off by Christmas it's just a pound (weight) a week that's all it is, a pound a week* (participant B, female, age 45). Some participants appreciated the individually defined PA routines that were facilitated through use of the Technogym Wellness System key.[16 17] The Wellness System provided software that was used to set individual gym routines that could be monitored both by the participant involved and remotely by the trainers.

Maintenance goals ranged from continuing to turn up regularly to PA sessions (following completion of the programme), to writing their own individual gym routines or other ingrained activity. Aspects of maintenance intentions ranged from disappointment that they had not achieved their original target weight together with an intention to, *just keep doing it, and, you know, hopefully one day it will kick in* (participant K, male, age 63); through pleasure in what they had achieved mixed with the desire to achieve yet more, to a determined pride and satisfaction with their success, *There is no way I am going to let go of what I have done because I worked too hard* (participant H,



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**Table 2** Participants' perspectives: motivation and strategies for behavioural change

| Theory domains of behavioural change | Phases of behavioural change | | |
|---|---|---|---|
| | **Initiating** | **Enacting** | **Maintaining** |
| Intentions and goals | I think it's how much you want to have a healthy life (B, female, 45) | So then I couldn't do that (injury) so I wrote myself another routine (E, male, 50) | I am going to do this and keep it up (H, female, 54) I am staying within a couple of pound (C, female, 58) |
| Reinforcement (including positive consequences) | | I (used to) eat all those things (fatty food) in abundance and the minute you stop you feel better –you don't feel so sluggish (H, female, 54) | I feel better, and I feel mentally better (C, female 58) 'You think, 'I could do without going,' but you go and then you think, 'I am n'arf (very) glad I have gone''(G, female, 57) |
| Knowledge | I mean to be truthful it's not that you don't know what to do, because there's enough literature out there, there's enough education out there (B, female, 45) | For me the main things that have stuck out have been nutrition. Also raising awareness of how to be healthy, like drinking more water (A, female, 59) | It's getting yourself educated, 'do I need chips? Can I do with a jacket potato instead?' (N, male, 53) |
| Social role and identity | I was spoilt as a child, and sort of always fat, I was always a fat kid (K, male, 63) | I think as a mother you give everything to everybody else don't you? And it's like 'take it yourself' sometime isn't it? (D, female, 44) | Yeah, it's not for a woman in her forties to be doing stupid things like that (run) and I surprised myself by doing it. I thought 'that's something to be proud of' (O, female, 47) |
| Social influences (including influence of trainer) | She said (wife),'Oh well, maybe you want to have a go' and I'd been looking for an excuse maybe to try and lose some weight (I, female, 60) | I don't think he would have gone if I hadn't been pushing him, and some nights that I didn't want to go he was—so we encouraged each other (0, female, 47) | My daughter tags along to make sure… she watches me because I'm frightened of the water (G, female, 57) |
| Beliefs about capabilities and skills | Every time you loose weight and then come off the diet it (weight) goes on and more goes on … so it was about getting more active (A, female, 59) | Like everything the more you get familiar with it, the more confident you get and the more rewarding it became (J, male, 59) | I could quite easily walk into another (mainstream) session…. Because I knew what was coming and I knew the equipment (L, male, 52) |
| Behavioural regulation, attention and decision processes, memory and emotion | My biggest pitfall, with my height and my size, I felt embarrassed coming (M, male, 48) | I monitor what I'm having, eating a lot of fruits, a lot more salads, so the eating science has totally changed (D, female, 44) | If I do slide I tend to go to the baths, and then I get positive while I'm swimming (E, male, 50) |
| Environmental context and resources | I was in the waiting room (Doctors) and there was a leaflet on the wall and I phoned them (B, female, 45) | It's being given something (free gym access)for me to get a year when I can change something (C, female, 58) | Thank God the leisure centre opens early so I go swimming before I go to work (H, female, 54) |

Darker shading reflects a perceived greater degree of emphasis on the selected themes, evidenced from the interviews.



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**Table 3** Participants' perspectives: influential intervention features

| Theory domains of behavioural change | Phases of behavioural change | | |
|---|---|---|---|
| | **Encouragement** | **Involvement** | **Support** |
| Intentions and goals | Being an all men's session that's what drew me in (E, male, 50)<br>It *[the risk assessment]* sort of gives you a wakeup call (L, male, 52) | The key thing* is great, it is really good to set yourself little targets (J, male, 59)<br>To me it means 'goal' as in keep coming to Aqua-aerobics (D, female, 53) | The most recent one was 50 miles in 50 days. It wasn't forced on anyone just, "Who wants to sign up for this?' and then part way through, 'Do you need any help? (A, female, 59) |
| Reinforcement (including positive consequences) | *[The trainers said]* "What we are looking for is not necessarily a huge amount of weight loss; we are looking for you to feel healthier and to shape up' (H, female, 54) | I've not felt under any pressure to sort of meet these targets,* but they're obviously good motivating features of the programme (K, male, 63) | It is good to get rewarded and recognised for it as well (N, male, 53) *[talking about being mentioned in the programme newsletter]* |
| Knowledge | When we first started they gave us the healthy eating chart and this showed you what you should try and avoid (H, female, 54) | They were telling you exactly what was going on and also telling you what time it was and where it was (I, female, 60) | The programme has newsletters, so once the programme is finished, you're still getting the newsletters. We get stuff on text, we get stuff on e-mail (A, female, 59) |
| Social role and identity | | One of them *[activities]* was going to be aqua-aerobics and I'm thinking, 'that's for girls, that, I'm not going' *[but]* Once you got in the water I felt totally relaxed (M, male, 48) | You sit them down and say, well they'll say to me, "How much were you weighing?" like I was 20 stone, "No way and how long did it take you to lose it?" they focus on what you've said (E, male, 50) |
| Social influences (including influence of trainer) | On the very first day I suppose it was how friendly everybody was. (F, male, 50)We were all in the same boat so I found it easy (G, female, 57) | It's an encouragement, I suppose it can be a pressure sometimes because you think to yourself, 'I don't really want to go out tonight,' but then you think, 'they've *[others in the group]* made the effort so yeah I'll go' (F, male,50) | There was a guy there, you would have thought he had been an athlete all his life and he was *[had been]* massive. He just looked so fit and healthy and just being among people like that makes you want to achieve something (H, female, 54) |
| Beliefs about capabilities and skills | We were in classes *[group]* working together and that builds up your confidence. I wouldn't have had the confidence to go straight into a mainstream class (0, female, 47) | I mean you name it, there was things I'd never even heard of, erm boxercise, we did tennis, we did walking, we did gym and we did cooking—I mean cooking to me was the takeaway! (L, male, 52) | If we are doing something wrong, they *[trainers]* will tell us and they will help us out (M, male, 48) |
| Behavioural regulation, attention and decision processes, memory and emotion | It *[the risk assessment]* makes you think about it and it gives you the information, and then it's up to you really, whether you want to do something or not. It's one of those things where you can't, nobody can make you do it, but they can give you the information and say, 'right this is the bottom line, now the decision is up to you' (L, male,52) | | It's sort of 'head down, keep going 'and I think the routine is important, because there are days you don't feel like doing anything, but 'I'm going to miss aqua-fit—get out and go (A, female, 59) |
| Environmental context and resources | I got involved in this and it was free, which made a massive, massive difference (F, male,50) | You were able to do lots and lots of different activities and you found the ones that suited you (O, female, 47) | It is being given something *[gym access card]* for a year so I can change something (D, female, 53)I think if I do less than 3 *[sessions]* it's not paying for my *[ gym access]* card (C, female, 58) |

Darker shading reflects a perceived greater degree of emphasis on the selected themes, evidenced from the interviews.
*References to the Technogym Wellness system individually programmable key.



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female, age 54).The maintenance focused intention to *not let go of the achievement* (participant F, male, age 50) was particularly evident in this participant group.[16]

### Reinforcement (including positive consequences)

When talking about PA, many interviewees mentioned the *feel-good factor afterwards* (participant B), and this perceived positive feedback featured in both the enacting and maintaining phases. The emphasis in the programme was on praise for success. One participant described being disappointed because they had not lost much weight, but then being pleased when the NLNY trainers emphasised how many inches the participant had lost from their waist measurement. Generally, the supportive ethos of the programme, engendered by the trainers, was perceived as promoting positive reinforcement.

Some participants talked about specific health benefits that they attributed to the changes they had made. One described how their blood pressure had been *through the roof* (participant F) but was now much lower; another described how the PA meant they could sleep at night, and yet another explained how they no longer suffered from sleep apnoea. All these health benefits were seen as reinforcing efforts to maintain the behavioural changes they had made.

### Knowledge

Many participants accepted that they already knew, before joining the programme, that they were *eating too much* or *the wrong sort of stuff* (participant J, male, age 59). However, details and, in particular, clear explanations around why specific advice was important, such as discussions around *fat content and things like saturated fats* (participant H), were additional knowledge for some. Others detailed how their misconceptions, for example, around the causes of T2D were resolved by asking the trainers. The programme information pack and healthy eating chart provided at the beginning encouraged people to *look at packages when you were buying things* (participant H) and were considered to be clear and helpful.

The regular newsletters, emails and texts, with new recipes and updated timetables, were much appreciated as information provision features of the programme. The newsletters were sent, mostly via email, during the intervention and continued after the follow-up at 12 months had been completed by each participant, thus spanning all phases of the behavioural change process. Generally, people were keen to keep in touch and read about the programme even after they had completed it. The continued access to regular newsletters was appreciated as helping to maintain behavioural change in the longer term.

### Social role and identity

When reflecting on their social role and identity, people mentioned: the impact of retirement with, *no structure to life* (participant A); the despair of redundancy, *I was thinking 'I will look for a job tomorrow –no I will look... and before I knew the weeks were going past and the months'* (participant M, male, age 48); and their new role when the children had grown up and they were no longer, *running round after them* (participant O, female, age 47). In relation to the programme, people described how they had encouraged others to join, given people lifts to activities, encouraged other participants to keep going, made sure newcomers were welcomed in any post programme 'drop-in' sessions, and generally described themselves in an empathetic and supporting role: *You'd have to coax some of the lads into the water, you did honestly just because of their size, I mean they're good swimmers, but it's just because of their size* (participant E, male, age 50). We labelled the social role of encouraging others to join as 'awareness champions' and the social role of empathetic encouragement within the programme as 'peer supporters'. In both cases, the opportunity and ability to influence others appeared to help the person in maintaining their own behavioural change.

### Social influences

Many were encouraged to join by others who were already involved in the programme, and some joined initially in order to help other people. People described their previous experiences of PA, which they had often found difficult and embarrassing, as a huge barrier to participation in PA programmes. The social support inherent in the design of the NLNY programme, with *all new together* (participant G, female, age 57) like-minded participant groups, helped people to overcome their embarrassments. A friendly ethos, which was actively promoted by the trainers, encouraged engagement in the programme. Once people were involved in the programme, social comparison became an important feature, and seeing what other people of similar age and with similar issues had achieved was cited as highly motivating. Also, social obligation, either to the trainers or to other people in the group, was described as helping to maintain involvement. Similarly, making regular arrangements with others, whom they had met through the programme, helped to sustain PA postprogramme: 'if somebody says, *Will you be here on Wednesday? ' … I can't let them down, I will be here on Wednesday* (participant I, female, age 60).

### Beliefs about capabilities and skills

The gradual introduction to PA, described by one person as *bit by little bit; it builds, and builds, and builds* (participant I), was central to the structure of the programme. Members of this participant group were often unsure of their capability at the start, but gradual progression and introduction to a variety of different activities through the intervention structured programme promoted skills development and enhanced belief in capabilities: *I go to the gym now and I stay on the cross-trainer for an hour, that's on level nine, where [before] I couldn't even do level one* (participant B). There was an appreciation

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that learning how to use different equipment through the programme helped them to know their capabilities so they could exercise on their own postprogramme. Some described how they had 'moved on' with confidence and even how they could: *do something more strenuous or lengthier than the sessions* (participant F).

### Behavioural regulation, attention and decision processes, memory and emotion

There were many references to embarrassment as a barrier affecting a decision to participate in PA before this programme: *I was too like paranoid of the size I was* (participant E). There were also references to complex emotional issues with food intake. Application of successful strategies for behavioural regulation and decision processes was most evident in the maintenance phase. Regulation of food intake included strategies for advance planning, such as reducing intake for some time before a social meal, or making up for excess intake by being *super frugal over the rest of the week* or *burning the calories off* (participant B) by spending a couple of hours in the gym afterwards. Monitoring during weight maintenance was often related to the fit of clothes, such as *If I feel that something is getting tight or I am uncomfortable in it* (participant H), although others described getting weighed regularly.

With similar emphasis on the maintenance phase, people talked about their established PA routines and planning other commitments around their habitual gym sessions or classes so that these were not disrupted. One described how they *used to go to the club with the lads and I could drink 10 pints easy, on a Friday night* (participant N, male, age 53), but they no longer did this because they had established a routine of running on a Saturday morning.

### Environmental context and resources

As participants were mostly living in socioeconomically deprived circumstances, cost of gym access, which was provided as part of the intervention, was an incentive to stay involved and was also cited as an obligation to make the most of the opportunity. After the free access finished, the cost of continuing to access the gym was a major issue for some and was perceived as a barrier to maintaining PA. The issue of cost was especially problematic for those who were not working outside the home. For people who were employed, early morning and evening gym access was appreciated, whereas others appreciated classes at quiet times of the day, when the facilities were less busy. The cheaper option of walking was sometimes viewed as unsafe (on your own) in the immediate locality, although the group walks organised by the trainers in the park or countryside were popular. For some, the leisure centre base was appreciated as an informal social meeting point, which meant people did not have to make detailed arrangements to meet. A few were more independent and had progressed to a stage where they could most easily maintain their PA by swimming or running, usually before work, on a regular basis.

## DISCUSSION

### Main findings

In this qualitative study, nested within the NLNY intervention pilot evaluation, we aimed to develop an appreciation of participant perspectives across different phases (initiating, enacting and maintaining) of the behavioural change process. Analysis according to the TDF[13] highlighted the importance of social influences, as well as the social role and identity both outwith and within the programme. Intentions and goals were also dominant themes across all phases, whereas reinforcement, regulation and decision processes were most evident in the maintenance phase. Participants described complex strategies for maintaining PA and regulating dietary intake over time. Environmental context and resources (especially monetary costs where people had financial constraints) were important and were linked to the social aspects of engaging in PA.

The design of the intervention was intended to engender social support within the programme. The qualitative analysis has evidenced the importance of this social context. The analysis identified a social role where 'awareness champions' had used their own experience to recruit others to the programme and a social role where 'peer supporters' had encouraged others to enact and maintain PA. It was clear that the cost of gym access was prohibitive for some postprogramme. Intervention cost is an issue and improving long-term maintenance strategies to address this is important for sustainability of the programme in mainstream service provision.

### Strengths and limitations

The strengths of this novel analysis included highlighting programme features that were perceived as beneficial for initiating, enacting and maintaining behavioural change and identifying opportunities (eg, formalising peer-support and monitoring the use of behavioural change techniques) that could promote further intervention development. The study was strengthened by using an interview topic guide that was prepared from our previous work in this area (see additional file 1);[19] also, the interviews were loosely structured so that people were encouraged to tell their story in their own way and emphasise what was important to them. The interviewer was not known to the participants, but was familiar with the programme and easily able to establish rapport.

The small study size and primary focus on successful participants were primarily resource-driven limitations. The most common reason provided for withdrawing from the intervention was around time constraints and we might have explored ways to ameliorate this with unsuccessful participants. The interview arrangements were made by the delivery staff and invitations to

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participate were influenced by convenience; however, this limitation was reduced by conducting interviews at different times, including evenings to facilitate participant access, and the participant characteristics covered a broad range. Also, the interviews took place in leisure centres, which were convenient for and familiar to the participants.

### Comparison with other studies and implications

A review regarding barriers and facilitators to intervention implementation was conducted to support recent NICE guidance.[1] The barriers and facilitators identified in this review were also reflected in our study, although we found that barriers (apart from cost) were often cited here to illustrate ways in which these had been overcome. Interestingly, two studies in the NICE review highlighted concerns about the appropriateness of primary care for preventive assessment and intervention.[21 24] The direct link between the risk assessment and intervention provision in the NLNY pilot promoted engagement, although sustaining the community recruitment strategy may be difficult and the option to 'signpost' people at risk, who have been identified through the National Health Service Health Checks, is an alternative.[25]

The social networks, which were formed during the active phase of the NLNY intervention, appeared to persist and to be valued beyond the 1-year duration of follow-up. There is evidence for the effectiveness of social support for behavioural change more generally,[26] and the allocation of 'like-minded' participants to activity groups was designed to promote social support. However, for some participants, the prohibitive cost of gym access, once the free access year had expired, was a barrier to behavioural change maintenance that may raise the risk of intervention-generated inequalities.[27] In the next phase of the pilot study, we will seek to encourage more low-cost activity options.

Maintaining change in PA and dietary behaviours requires an ongoing proactive effort and an intervention duration of more than 1 year may be needed.[12 19]

### Unanswered questions and future research

For sustainable service provision, an intervention programme needs to be as cost effective as possible. An economic evaluation of the NLNY intervention, modelled to health outcomes, is needed to assess cost-effectiveness. Options to reduce intervention costs include more formal use of 'peer support' and improved use of technologies for data collection and e-communication with participants during the follow-up and maintenance phase.

Although we did not exclude people from local ethnic minority communities from participating in NLNY, only a few were enrolled. Cultural adaptation of the programme with appropriate recruitment options and community support to improve uptake from ethnic minority groups is needed.[28]

This qualitative study has informed the development of the NLNY intervention and the associated pilot study results are encouraging; however, a formal evaluation will be needed to determine intervention effectiveness.

## CONCLUSIONS

Consideration of emergent themes in relation to progressive phases and theoretical domains of behavioural change provided a novel structure that added to the depth and utility of this analysis. This analysis will inform intervention optimisation, including features that promote engagement and progression through the programme.

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**Competing interests** The business case and outline plan for this pilot study was determined by a steering committee. This included representatives from members of the organisations that comprised the funding consortium as well as the Principal Investigator for the evaluation, coauthor MW. The detailed development of the intervention was then progressed by a small operational team including the evaluation researcher, coauthor LP. The operational team reported to the steering committee. The funders had no role in the collection, analysis and interpretation of data, the writing of the article and the decision to submit it for publication. Coauthors MW, FS, SD and LP received salaries from Newcastle University, Institute of Health and Society that provided open access funding for the publication. The authors declare that they have no other competing interests.

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