





Review Article

Recruiting and retaining young adults: what can we learn from behavioural interventions targeting nutrition, physical activity and/or obesity? A systematic review of the literature

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Abstract

Objective: To describe strategies used to recruit and retain young adults in nutrition, physical activity and/or obesity intervention studies, and quantify the success and efficiency of these strategies.

Design: A systematic review was conducted. The search included six electronic databases to identify randomised controlled trials (RCT) published up to 6 December 2019 that evaluated nutrition, physical activity and/or obesity interventions in young adults (17–35 years). Recruitment was considered successful if the pre-determined sample size goal was met. Retention was considered acceptable if $\geq 80\%$ retained for ≤ 6 -month follow-up or $\geq 70\%$ for > 6 -month follow-up.

Results: From 21 582 manuscripts identified, 107 RCT were included. Universities were the most common recruitment setting used in eighty-four studies (79%). Less than half (46%) of the studies provided sufficient information to evaluate whether individual recruitment strategies met sample size goals, with 77% successfully achieving recruitment targets. Reporting for retention was slightly better with 69% of studies providing sufficient information to determine whether individual retention strategies achieved adequate retention rates. Of these, 65% had adequate retention.

Conclusions: This review highlights poor reporting of recruitment and retention information across trials. Findings may not be applicable outside a university setting. Guidance on how to improve reporting practices to optimise recruitment and retention strategies within young adults could assist researchers in improving outcomes.

Keywords
Young adults
Nutrition
Physical activity
Obesity
Systematic review
Recruitment
Retention

Young adults (aged 17–35 years) commonly develop poor lifestyle behaviours that track into later adulthood and increase the risk of chronic disease across the life course^(1,2). Rates of overweight and obesity have increased from 38% to 46% among those aged 18–24 years in the time periods from 2011–2012 to 2017–2018 in Australia^(3,4), while this has increased from 42% to 60% in 20–34-year-olds from

1994 to 2015 in the USA⁽⁵⁾. The increase in overweight and obesity rates coincides with worsening dietary patterns and physical inactivity during this life stage. A systematic evaluation of dietary patterns in adults from 187 countries found that the unhealthiest dietary scores were in 20–29-year-olds compared with all other age ranges⁽⁶⁾. Furthermore, a meta-analysis of physical activity change

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from adolescence to young adulthood demonstrated a 13–17 % (or 5.2–7.4 min/d) decline in moderate–vigorous physical activity from age 13 to 30 years⁽⁷⁾. Therefore, this represents a critical stage to establish healthy lifestyle behaviours.

Several reviews have provided insights into effective intervention approaches for improving health behaviour among young adults^(8–14); however, a more focused enquiry on recruitment and retention strategies is required. Recruitment refers to the process of selection of participants, from becoming aware of the health programme to enrolment of participants⁽¹⁵⁾, while retention refers to keeping participants enrolled for the duration of the health programme⁽¹⁵⁾. Effective recruitment and retention of young adults in health behaviour programmes are critical, yet present ongoing challenges. Both recruitment and retention may be impacted by transient living arrangements which are common during this life stage, while competing time demands may be prioritised over participation (e.g. study, work, socialising, relationships, family obligations and/or parenthood)^(16,17). Furthermore, the perceptions around the imminence of health problems for someone in their life stage may affect overall recruitment of young adults to a health programme^(17,18).

Issues with recruitment or retention can have serious consequences for any research study. Failure to recruit the desired sample size can lead to underpowered studies, leading to a type II error (false-negative findings), while under recruiting can impact representativeness of population samples and therefore the external validity of results⁽¹⁹⁾. Furthermore, prolonged recruitment can affect overall research expenditure⁽²⁰⁾ and adversely affect the commitment of those already enrolled in the study⁽²¹⁾. Failure to retain sufficient numbers may implicate the study power by affecting the composition between treatment and control groups⁽²¹⁾. In addition, differential dropout may occur, whereby particular sub-groups of individuals may be more likely to dropout than others⁽²¹⁾. These issues pose a threat to a study's internal and external validity⁽¹⁹⁾. Consequently, successful and timely recruitment and retention of participants are vital to the success of the overall health programme.

There is a lack of evidence to guide successful recruitment and retention strategies for young adults in health behaviour change interventions^(22,23). The few studies that have explored this have documented serious challenges. For instance, a systematic review of weight gain prevention interventions in young adults identified recruitment rates to be low (between 7.5 % and 48 % of their intended targeted population)⁽²⁴⁾, while another review of health behaviour interventions in young adult men⁽²⁵⁾ identified only 30 % of studies had achieved appropriate retention in line with the CONSORT requirements (≥ 80 % retained for ≤ 6 -month follow-up or ≥ 70 % for >6 -month follow-up) to prevent bias. Neither review looked at recruitment or retention rates by the various strategies used, while both confirmed that

insufficient reporting limited the ability to determine which strategies were most successful.

Furthermore, these reviews searched for studies up until 2015⁽²⁴⁾ and 2014⁽²⁵⁾. However, health behaviour interventions among young adults have increased significantly in recent years, with the number of published interventions doubling between 2015 and 2019 for studies targeting adiposity (n 26)⁽⁸⁾ and between 2014 and 2018 for studies aiming to improve dietary intake among young adults (n 29)⁽⁹⁾. This presents an opportunity to conduct a more focused enquiry into recruitment and retention strategies among this group.

To inform strategies to reach and retain young adults for effective implementation of interventions, evidence-based guidance is needed. Therefore, the current review aims to describe the strategies used to recruit and retain young adults in interventions targeting nutrition, physical activity or overweight/obesity in young adults (aged 17–35 years), and the success and efficiency of these strategies. The following research questions are answered in this review:

1. What are the most common recruitment strategies for young adults?
2. What are the most successful recruitment strategies for young adults?
3. Is recruitment success affected by number of strategies used?
4. What are the most efficient recruitment strategies for young adults?
5. What are the costs per participant recruited?
6. What are the most common retention strategies for young adults?
7. Do studies adequately retain young adults?
8. What are the most successful retention strategies for young adults?
9. What are the costs per participant retained?
10. What reporting is needed to assess the success of recruitment strategies?
11. What reporting is needed to assess the success of retention strategies?

Methods

This is a secondary analysis of included studies in a systematic review exploring the effectiveness of nutrition, physical activity or overweight/obesity interventions in young adults. The review protocol was registered with PROSPERO (CRD42017075795), and the methods are consistent with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. Results for the effectiveness of interventions have been published previously^(8,9,26). The current paper presents results for recruitment and retention data.

The eligibility criteria, literature search, study selection and risk of bias of individual studies in the systematic review have been previously described in detail^(8,9). Table 1 outlines the full eligibility criteria. In brief, included studies were randomised controlled trials (RCT) of behavioural interventions with the primary objective of improving nutrition or physical activity, or treating or preventing obesity. Participants were required to be healthy young adults (aged 17–35 years), and any comparator or control was considered for inclusion. The definition of young adults used in studies varies based on human development and sociological perspectives. For the current review, a broad age range was included to ensure a range of studies in healthy young adults across the age range of 17–35 years. Both the National Institute of Health⁽²⁷⁾ and the European commission of Men's health⁽²⁸⁾ have used 18–35 years to define young adults. The inclusion criteria for participants were shaped around this definition, and the rationale for including those aged 17 years was due to some countries enrolling those aged 17 years in tertiary education^(29,30). Articles were located by searching six databases (Medline, Embase, PsycINFO, Science Citation Index, Cinahl and Cochrane Library) for articles published in English from date of inception to 6 December 2019 (see online supplementary material, Supplementary Table 1), as well as searching reference lists of retrieved papers and key systematic reviews. In addition, citation searches of the final included papers were conducted in Scopus. Papers linked to relevant RCT, including published study protocol, recruitment or process evaluation papers, or those publishing outcomes at differing follow-up time points, were also considered. Two independent reviewers screened the title, abstract and keywords of articles, followed by assessment of full-text articles that appeared to meet the inclusion criteria and then selected studies for inclusion. A third reviewer was consulted if disagreement existed between the two reviewers. Reasons for exclusion were recorded for ineligible papers.

Data extraction

Data relating to recruitment strategies (i.e. setting, method and duration), recruitment rates (i.e. number: invited, expressed interest/screened for eligibility, eligible, enrolled/randomised and commenced intervention), study characteristics (i.e. year of publication, country, intervention details and sample characteristics), retention strategies (i.e. any strategy used to keep participants enrolled for the study duration)⁽¹⁵⁾, retention rates (i.e. number completing post-intervention and longest follow-up assessment) and cost of recruitment and retention strategies (total cost, cost per participant randomised and/or retained and breakdown of costs by each strategy) were extracted by one reviewer and checked by a second reviewer.

Synthesis of results and analytic strategy

Results are presented narratively to address all research questions. To evaluate the success of recruitment and retention strategies, the following metrics were used:

- Recruitment rate (%) = total number of individuals randomised/total number who showed interest in the study
- Participation rate (%) = total number of eligible participants randomised/total number eligible at baseline
- Retention rate (%) = total number of participants who completed follow-up/total number who entered the study

Recruitment was considered successful if the pre-determined goal sample size was met⁽³¹⁾. Recruitment efficiency was calculated as the number of participants randomised/recruitment duration in days. Retention was considered adequate if retention was $\geq 80\%$ for ≤ 6 -month follow-up or $\geq 70\%$ for >6 -month follow-up, as defined in several previous systematic reviews^(25,32–34). Retention efficiency could not be calculated due to insufficient reporting of duration for follow-up data collection. The success of individual recruitment and retention strategies was calculated the same way, that is the number of studies which used a given strategy and had successful recruitment or retention divided by the number of studies which used that strategy. Efficiency of individual recruitment strategies was calculated as the mean and standard deviation across studies which used each strategy. Differences in recruitment and retention characteristics by intervention focus were assessed using Fisher's exact test for categorical variables and ANOVA for continuous variables. An overall test of significance was carried out using a contingency table between numbers of recruitment strategies using Monte-Carlo exact χ^2 test (SPSS version 25). Costs relating to recruitment and retention strategies were reported in USD. To standardise, studies reporting cost information in a currency other than USD (n 10 studies) were converted to USD using xe.com (<https://www.xe.com/currencytables/>) from the year and month that the study was conducted. Cost per participant randomised and cost per participant retained at post-intervention and at longest follow-up were then calculated. Finally, any gaps in reporting of recruitment and retention information were collated, and a summary was provided for key information required when reporting recruitment and retention in trials.

Results

Description of included studies

A total of 21 582 manuscripts were identified and screened, and of these, 107 individual RCT were included^(35–140) (Fig. 1). A summary of study characteristics is included in Table 2, with detailed characteristics presented in

Table 1 Eligibility criteria for participants, interventions, comparisons, outcomes and study design (PICOS)

	Inclusion	Exclusion
Participants	Healthy young adults across the age range of 17–35 years. All participants in the trial were required to be within this age range.	Participants with diagnosed obesity-related medical conditions such as type 2 diabetes or from specific population sub-groups, including those with severe mental illness, eating disorders, elite athletes or pregnancy.
Interventions	Behavioural interventions focusing on diet, physical activity and/or treating or preventing obesity. All modalities (e.g. face-to-face, print, eHealth and mHealth) were considered for inclusion.	<ul style="list-style-type: none"> Interventions involving bariatric surgery or anti-obesity medications. Studies which primarily investigated the acute impact of weight loss on other clinical biomarkers (e.g. insulin).
Comparators	Comparison groups with no intervention (e.g. waitlist control) and/or active treatments were considered for inclusion.	Single-arm studies with no comparison group.
Outcomes	Any measures (both objective and self-reported) to assess outcome effectiveness of interventions on either nutrition, physical activity and/or obesity as the primary outcome at baseline and a minimum of one post-intervention time point.	Did not measure nutrition, physical activity and/or obesity as the primary outcome.
Study designs	Randomised controlled trials (RCT) including pilot and feasibility RCT. Papers linked to relevant RCT, including published study protocol, recruitment or process evaluation papers, or those publishing outcomes at differing follow-up time points, were also considered.	Study design was not an RCT or associated 'linked paper' of RCT.

Supplemental Table 2. Fifty percentage of studies were published since 2015 (n 53), and around half were conducted in the USA (n 58, 54%) and recruited participants from a University/College setting (n 84 studies, 79%). There was a mean of 276 participants per study, and participants were mainly aged 17–25 years (n 60 studies, 56%) and were of white/Caucasian ethnicity (n 62 studies, 58%). Intervention focus was most commonly physical activity (n 31, 29%) followed by nutrition (n 28, 26%). The most common mode of intervention delivery was eHealth (e.g. email, mobile phone applications, websites and social media) (n 61 intervention arms, 35%). The mean duration of interventions was 15.5 weeks, ranging from single session interventions to 3 years duration.

Recruitment

All recruitment details are summarised by intervention focus in Table 3. Responses to recruitment research questions are provided below.

Research question #1: What are the most common recruitment strategies for young adults?

The most common recruitment strategies were flyers (n 40, 37%) and using an existing cohort or participant database (n 29, 27%). Recruitment strategies are summarised in Table 4.

Research question #2: What are the most successful recruitment strategies for young adults?

The mean participation rate (% eligible who were randomised) could be calculated for ninety-six studies. The overall mean was 83%. The mean recruitment rate (% interested who were randomised) was calculated for seventy-eight studies, with an overall mean of 55%. The median

recruitment rate (participants recruited per day) in the forty-eight studies which reported it was 1.9 participants per day.

Forty-six studies reported a power estimation (43%), and seven pilot studies reported a goal sample size (7%). Of these, forty-one studies (77%) reported that participant recruitment reached the pre-determined sample size. Success of individual recruitment strategies was determined for forty-nine studies. To provide a meaningful representation of success, only recruitment strategies that were reported in at least three studies were considered, this included thirteen strategies. The top four strategies with the highest success rates were face-to-face (e.g. university/college fairs at start of semester open days) (n 13, 100%), email (n 14, 88%), newspaper advertisements (n 7, 88%) and online advertisements (e.g. Google ads) (n 7, 88%) (Fig. 2).

Research question #3: Is recruitment success affected by number of strategies used?

The median number of recruitment strategies used across the forty-nine studies was 2 (range 1–9 strategies per study). Figure 3 presents the percentage ratio of recruitment success by number of recruitment strategies, highlighting that no relationship exists based on whether fewer or more strategies are utilised. The overall test of significance using a contingency table indicates that there was no significant relationship (Monte-Carlo exact χ^2 test, $\chi^2(7) = 4.8$, $P = 0.73$).

Research question #4: What are the most efficient recruitment strategies for young adults?

Efficiency of individual recruitment strategies was determined for forty-eight studies. As with recruitment success, to provide a meaningful representation of efficiency, only

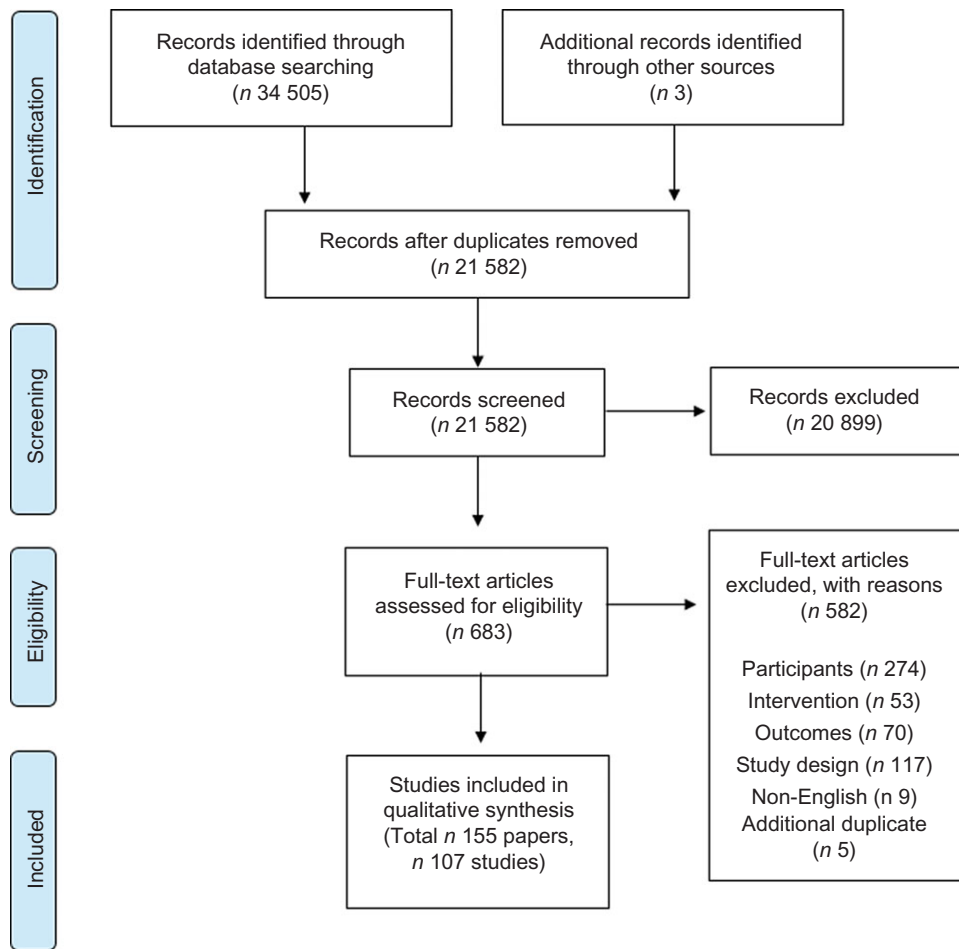


Fig. 1 (colour online) Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram of included studies

recruitment strategies that were reported in at least three studies were considered ($n\ 13$). The mean and standard deviation of recruitment efficiency was calculated for each recruitment strategy. The top four strategies which had the highest efficiency were advertising through letters (mean \pm SD of 8.7 ± 14.1 participants recruited per day), using existing cohorts or participant databases (7.3 ± 10.8 participants recruited per day), face-to-face (6.4 ± 10.3 participants recruited per day) and advertising within university classrooms (6.1 ± 10.8 participants recruited per day) (Table 5).

Research question #5: What are the costs per participant recruited?

Total cost of recruitment was documented in three studies (Project Grad, TXT2BFIT and SNAP study)^(35,46,139,141,142). Costs in ascendency were: Project Grad which spent US \$20 729 for recruiting participants from a University setting and implemented two recruitment strategies (mailed literature and telephone calls to students)⁽⁴⁶⁾. Next, TXT2BFIT spent US\$32 861.98 for recruiting participants from a community and University setting and implemented fourteen recruitment strategies (GP letter, Facebook

advertisement, Google advertisement, Gumtree advertisement, Social media page, University e-newsletter, University web home page, University research volunteer page, poster, brochures, commuter newspaper advertisement, local newspaper advertisement, students' magazine and word of mouth)^(35,141). Last, SNAP study spent US\$139 543 to recruit participants from a community setting and implemented nine strategies (television, print media, radio, mass mailing, website recruitment, email, flyers and community events, study referral and word of mouth)^(139,142). Two of these studies provided a breakdown of costs by strategy. Specifically, the SNAP study reported mass mailings (US\$76 466.34) and television (\$24 074.00) to be most expensive, while the cheapest paid strategies were flyers and community events (costed together at US\$2713.27) and website recruitment (US\$5222.23). There were no costs associated with some strategies including word of mouth and study referral. The most expensive strategies in the TXT2BFIT programme were brochures (US\$12 922.20) and letters sent from general practitioners (US\$9316.20), while the cheapest paid strategies were Gumtree advertisement (US\$34.08) and University student

**Table 2** Summary of study characteristics in 107 studies of nutrition, physical activity and obesity interventions in young adults

	<i>n</i>	%
Publication year		
Before 2005	6	6
2005–2009	11	10
2010–2014	37	35
2015–6 December 2019	53	50
Country		
USA	58	54
Australia	11	10
Canada	8	7
UK	5	5
Thailand	3	3
Finland	3	3
New Zealand	2	2
Italy	2	2
Other	15	14
Number of participants		
Mean	276.3	
Median	124	
Range	20–3336	
Recruitment setting		
University/College	84	79
Community	10	9
Military	4	4
University/College + Community	3	3
Clinical	2	2
Workplace	1	1
University/College + Clinical	1	1
University/College + Community + Workplace	1	1
Not reported	1	1
Age		
Mean years (sd)	21.1	3
17–≤25 years	60	56
17–≤30 years	23	21
17–≤35 years	24	22
Ethnicity		
Predominantly white	62	58
Predominantly non-white	7	7
Not reported	38	36
Intervention focus		
Physical activity	31	29
Nutrition	28	26
Weight gain prevention	18	17
Weight loss	16	15
Nutrition and Physical Activity	14	13
Mode of intervention delivery*		
Face-to-face only	38	22
eHealth only	61	35
Print materials only	4	2
Wearable device only	2	1
Face-to-face + print materials	22	13
Face-to-face + eHealth	21	12
Face-to-face + eHealth + wearable device	2	1
Face-to-face + eHealth + print materials	8	5
Face-to-face + wearable device	2	1
eHealth + wearable device	7	4
eHealth + print materials	4	2
Wearable device + print materials	2	1
Intervention duration (weeks)		
Mean	15.5	
Median	8.0	
Range	< 1–156	

*Reported by active intervention arms (*n* 173).

magazines (US\$701.52). There were several free strategies provided by University resources (i.e. University e-newsletter, University volunteer page, University web home page).

Cost per participant randomised was established in three studies. In the PROJECT GRAD study, this was US \$45 for the passive recruitment method and \$79 for the active recruitment method⁽⁴⁶⁾. The TXT2BFIT and SNAP

Table 3 Summary of recruitment details of 107 studies of nutrition, physical activity and obesity interventions in young adults, by intervention focus

		Total (n 107)		Physical activity (n 31)		Nutrition (n 28)		Weight gain prevention (n 18)		Weight loss (n 16)		Nutrition and physical activity (n 14)	
		n	%	n	%	n	%	n	%	n	%	n	%
Recruitment setting	University/College	84	78.5	27	87.1	23	82.1	13	72.2	11	68.8	10	71.4
	Community	10	9.3	1	3.2	3	10.7	3	16.7	2	12.5	1	7.1
	University and other	5	4.7	0	0.0	0	0.0	2	11.1	2	12.5	1	7.1
	Military	4	3.7	2	6.5	2	7.1	0	0.0	0	0.0	0	0.0
	Health service	2	1.9	0	0.0	0	0.0	0	0.0	1	6.3	1	7.1
	Workplace	1	0.9	0	0.0	0	0.0	0	0.0	0	0.0	1	7.1
	Not reported	1	0.9	1	3.2	0	0.0	0	0.0	0	0.0	0	0.0
Recruitment strategies	Flyers	40	37.4	8	25.8	5	17.9	14	77.8	8	50.0	5	35.7
	Existing cohort/database	29	27.1	9	29.0	9	32.1	4	22.2	3	18.8	4	28.6
	Email	28	26.2	6	19.4	4	14.3	8	44.4	7	43.8	3	21.4
	Face-to-face	26	24.3	8	25.8	4	14.3	5	27.8	3	18.8	6	42.9
	University classroom	23	21.5	7	22.6	7	25.0	6	33.3	1	6.3	2	14.3
	Poster	19	17.8	4	12.9	5	17.9	3	16.7	5	31.3	2	14.3
	Newspaper/newsletter	18	16.8	4	12.9	3	10.7	5	27.8	6	37.5	0	0.0
	Social media	15	14.0	3	9.7	3	10.7	3	16.7	5	31.3	1	7.1
	Online ads	13	12.1	1	3.2	3	10.7	4	22.2	4	25.0	1	7.1
	Word of mouth	13	12.1	3	9.7	3	10.7	3	16.7	4	25.0	0	0.0
	Media release	10	9.3	1	3.2	0	0.0	2	11.1	6	37.5	1	7.1
	Letters	10	9.3	1	3.2	1	3.6	6	33.3	2	12.5	0	0.0
	University website	6	5.6	2	6.5	1	3.6	0	0.0	3	18.8	0	0.0
	Digital bulletin boards	2	1.9	0	0.0	2	7.1	0	0.0	0	0.0	0	0.0
	Phone	1	0.9	1	3.2	0	0.0	0	0.0	0	0.0	0	0.0
	Unclear/not reported	7	6.5	3	9.7	2	7.1	0	0.0	0	0.0	2	14.3
	Duration of recruitment	≤1 month	12	11.2	6	19.4	2	7.1	1	5.6	2	12.5	1
>1 to <4 months		19	17.8	3	9.7	5	17.9	3	16.7	3	18.8	5	35.7
4 to 6 months		7	6.5	3	9.7	2	7.1	1	5.6	0	0.0	1	7.1
>6 months to <1 year		3	2.8	2	6.5	0	0.0	0	0.0	1	6.3	0	0.0
≥1 year		7	6.5	0	0.0	0	0.0	4	22.2	2	12.5	1	7.1
Mean		172		110		82		375		183		140	
Median		90		75		90		150		60		87	
Range (d)	7–1095		7–365		16–180		30–1095		14–600		30–480		
Not reported	59	55.1	17	54.8	19	67.9	9	50.0	8	50.0	6	42.9	
Recruitment efficiency (participants/d)*	Mean	5.0		6.9		3.9		4.7		5.1		3.0	
	Median	1.9		1.2		2.7		1.5		1.0		2.1	
	Range	0.04–33.6		0.1–31.2		0.9–11.2		0.04–29.3		0.2–33.6		0.2–7.0	
Number invited to participate†	Mean	2127		748		2815		–		–		3181	
	Median	880		880		732		–		–		1500	
	Range	163–15 000		163–1265		233–15 000		–		–		244–10 370	
Number interested/screened‡	Mean	782		348		441		1999		858		506	
	Median	239		217		247		437		318		220	
	Range	61–8903		61–1526		75–2240		105–8903		79–4164		62–3059	
Number eligible§	Mean	435		220		315		1044		290		613	
	Median	180		158		208		306		97		164	
	Range	21–3983		21–1017		45–2024		66–3983		53–1743		40–3336	

Table 3 Continued

	Total (n 107)		Physical activity (n 31)		Nutrition (n 28)		Weight gain prevention (n 18)		Weight loss (n 16)		Nutrition and physical activity (n 14)	
	n	%	n	%	n	%	n	%	n	%	n	%
Number enrolled/randomised	276		147		281		369		135		595	
	124		95		168		163		69		164	
Range	20–3336		20–935		32–2024		40–1689		40–470		39–3336	
Mean	38.1		38.0		39.7		–		–		48.4	
Median	31.7		39.2		25.5		–		–		72.1	
Range	1.4–92.8		2.3–79.1		1.6–92.8		–		–		1.4–87.0	
Mean	54.8		55.6		70.2		47.6		29.3		68.8	
Median	57.4		59.9		75.3		43.6		22.1		71.8	
Range	5.9–100.0		6.4–100.0		26.3–100.0		10.5–98.3		5.9–71.3		21.4–100.0	
Mean	82.6		82.7		90.0		72.4		71.7		91.3	
Median	99.2		100.0		100.0		75.7		79.6		100.0	
Range	4.0–100.0		4.0–100.0		45.9–100.0		15.3–100.0		20.9–100.0		73.3–100.0	

Results in bold were statistically significantly different between groups of studies with different intervention focus ($P < 0.05$).

*n 48 studies (14 physical activity, 9 nutrition, 9 weight gain prevention, 8 weight loss, 8 nutrition and physical activity).

†n 21 studies (7 physical activity, 8 nutrition, 1 weight loss, 5 nutrition and physical activity).

‡n 78 studies (20 physical activity, 18 nutrition, 14 weight gain prevention, 14 weight loss, 12 nutrition and physical activity).

§n 96 studies (26 physical activity, 26 nutrition, 14 weight gain prevention, 16 weight loss, 14 nutrition and physical activity).

||Results available for only one weight loss study and are not reported.

Table 4 Summary of recruitment strategies of 107 studies of nutrition, physical activity and obesity interventions in young adults

Recruitment strategy	Total (n 107)*	
	n	%
Flyers	40	37.4
Existing cohort/database	29	27.1
Email	28	26.2
Face-to-face	26	24.3
University classroom	23	21.5
Poster	19	17.8
Newspaper/newsletter	18	16.8
Social media	15	14.0
Online ads	13	12.1
Word of mouth	13	12.1
Media release	10	9.3
Letters	10	9.3
University website	6	5.6
Digital bulletin boards	2	1.9
Phone	1	0.9
Unclear/not reported	7	6.5
Number of strategies used (mean ± sd)	2.5 ± 1.9	

*n 1 study did not report the recruitment setting; therefore, the total includes all 107 studies, but the breakdown by recruitment setting includes 106 studies.

studies were more expensive with a total cost per participant randomised of US\$131.77 and US\$232.96, respectively^(35,139,141,142).

Retention

Retention details are summarised by intervention focus in Table 6. Responses to retention research questions are provided below.

Research question #6: What are the most common retention strategies for young adults?

Of the included studies, seventy-six studies (71%) reported strategies to retain participants. Almost half of these studies (n 44, 41%) used financial incentives such as gift cards, twenty-two studies (21%) used reminders and increased contact with participants and eighteen studies (17%) gave participants credit for university/college courses in return for participation (Table 6).

Research question #7: Do studies adequately retain young adults?

In the seventy-six studies which reported retention rates at post-intervention (range 1 week to 3 years, median: 12 weeks), there was a mean ± sd retention rate of 83 ± 14%. Forty-nine studies measured retention rates at the longest follow-up and found that a mean ± sd of 76 ± 23% of participants was retained. Longest follow-up ranged from 1 week to 2 years from baseline (mean 25.9 weeks, median 17.5 weeks) and ranged from 1 week to 1 year and 11 months from the end of the intervention (mean 17.3 weeks, median 11.5 weeks). Overall, seventy studies (65%) had adequate retention (≥80% retained for ≤6-month follow-up or ≥70% for >6-month follow-up).

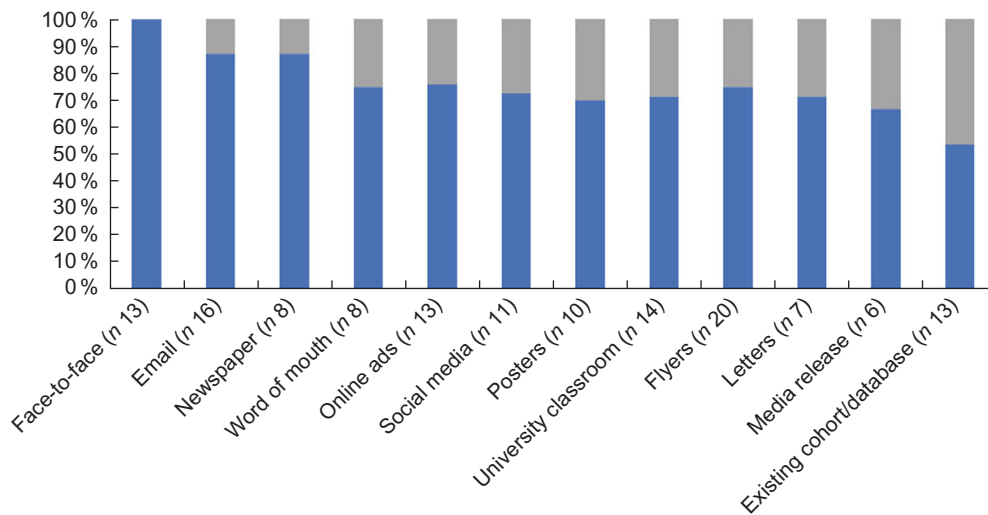


Fig. 2 (colour online) Success* of recruitment strategies used across forty-nine studies of nutrition, physical activity and/or obesity interventions in young adults. *Recruitment was considered successful if the pre-determined goal sample size was met

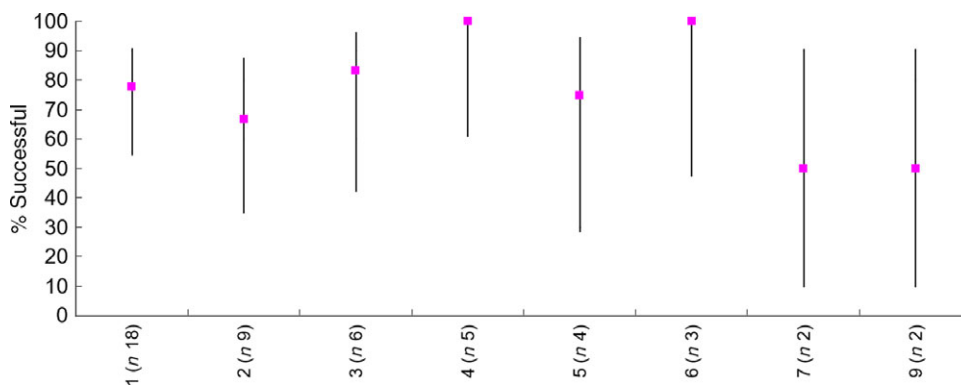


Fig. 3 Recruitment success* (%) by number of recruitment strategies used. *Recruitment was considered successful if the pre-determined goal sample size was met

Research question #8: What are the most successful retention strategies for young adults?

Success of individual retention strategies was determined for seventy-four studies (69%). To provide a meaningful representation of each strategy’s ability to meet the criteria for acceptable retention, only retention strategies that were reported in at least three studies were considered (n 6). The most successful retention strategies were providing participants with course credit for university/college courses (n 15, 88%), prize/prize draw (n 9, 75%) and financial incentives (n 31, 72%). (Fig. 4).

Research question #9: What are the costs per participant retained?

Total cost of retention was documented in forty studies^(35,38,42–46,49,55,58–63,69–71,74,76,77,86,88–91,101–103,109,114,115,119,120,126,134,136,137,139,143) ranging from US\$50 (n 1 strategy was used) to US\$202 700 (n 1 strategy used), with a median cost of US\$1935. The costs per participant retained at post-intervention were established in thirty-eight studies,

ranging from US\$0.50⁽⁸⁶⁾ to US\$553.83⁽⁹⁰⁾, with a median cost of US\$22.55. Costs per participant retained at longest follow-up were established in eighteen studies, ranging from US\$1.15⁽¹⁴³⁾ to US\$97.20⁽⁶³⁾, with a median cost of US\$20.

Discussion

The current study provides a comprehensive review of the recruitment and retention data of 107 RCT targeting nutrition, physical activity or overweight/obesity in young adults. Notably, the review highlights the poor reporting of details related to recruitment information across the trials (i.e. only 46% of studies provided sufficient information to determine the ability of individual recruitment strategies to meet pre-determined sample sizes), although reporting for retention was better (69% of studies provided sufficient information to determine whether individual retention strategies achieved adequate retention rates). Guidance

**Table 5** Efficiency of recruitment strategies used across forty-eight studies of nutrition, physical activity and/or obesity interventions in young adults

Recruitment strategy	Recruitment efficiency (number of participants recruited per day)*	
	Mean	SD
Letters (<i>n</i> 8)	8.7	14.1
Existing cohort/database (<i>n</i> 14)	7.3	10.8
Face-to-face (<i>n</i> 14)	6.4	10.3
University classroom (<i>n</i> 13)	6.1	10.8
Media release (<i>n</i> 8)	4.9	11.6
Email (<i>n</i> 13)	3.6	7.8
Flyers (<i>n</i> 19)	3.2	6.8
Word of mouth (<i>n</i> 8)	2.6	3.7
University website (<i>n</i> 3)	2.1	1.5
Posters (<i>n</i> 11)	1.9	1.9
Social media (<i>n</i> 9)	1.3	1.0
Online ads (<i>n</i> 9)	0.9	0.6
Newspaper (<i>n</i> 8)	0.7	0.3

*Recruitment efficiency = the number of participants randomised/recruitment duration in days. The (*n*) refers to the number of studies which used each strategy.

is required for researchers on how to improve reporting practices to help improve recruitment and retention strategies for use with young adult population samples.

Recruitment findings

In terms of recruitment, 77% of studies had participant recruitment that met pre-determined sample sizes, with face-to-face recruitment most likely to achieve recruitment goals. This is higher when compared with another review (*n* 151 RCT) of recruitment data from trials that had no restrictions for age and found 56% of studies achieved their target sample size⁽¹⁴⁴⁾. The most efficient strategy was advertising through letters. However, results from the current review should be interpreted with caution. Given that 79% of studies used a university setting to recruit potential participants, findings may not be applicable to other settings.

When planning health behaviour interventions with young adults, researchers need to consider the efficiency of recruitment approaches in order to make the most of available resources and time. Despite the limitations relating to poor reporting of recruitment rates, the review provides some guidance for researchers working with young adults in regard to the number of participants required to respond to recruitment strategies to ensure a sufficient sample size is recruited. Our findings suggest just under one-third of young adults who express interest and/or are screened for eligibility then provide consent and participate in the study. Of those individuals who meet study inclusion criterion, almost two-thirds go on to participate in a study. Practically speaking if a sample of ~100 young adults is required, this means that ~300 young adults must be engaged by the recruitment strategies and screened for eligibility, of which ~200 would meet inclusion criteria, and ~100 would go on to participate in the study. Furthermore, studies focusing on weight gain prevention or weight loss

took longer to recruit the target sample (mean of 375 d and 183 d) compared with studies focusing on nutrition and/or physical activity. They also screened more people and reported a much lower proportion of those expressing interest being randomised (47.6% and 29.3%). This is likely due to stricter inclusion criteria, but is an important consideration for studies focusing on weight with a need to allocate extra time and resources for recruitment.

Few studies reported the cost information related to recruitment (*n* 3 studies). In these studies, recruitment costs in ascendency were US\$20 729 to enrol 338 participants, US\$32 861.98 to enrol 250 participants and US\$139 543 to enrol 609 participants. However, in-kind support from the University (i.e. University e-newsletter) was common; therefore, costs will likely be higher if recruiting outside of a University setting. The costs associated with recruiting young adults may be higher than other population groups due to extra challenges of recruiting this population group⁽²⁴⁾. When compared with another systematic review of physical activity interventions among all adults (19 years of age and above), costs per participant recruited were approximately US\$27.62 (reported as £20.32 but converted to USD for comparison)⁽¹⁴⁵⁾. Although this was only reported in one study in the review, this appears lower than costs per participant recruited in this current review which ranged from US\$45 to US\$232.96.

The recruitment strategies predominantly used were more traditional, such as flyers and email, as opposed to 'newer' strategies, such as online advertising and social media. This is consistent with other reviews which have reported this information^(24,146). There is potential to further explore the success of 'newer' strategies, given the high use and engagement with electronic and social media among young adults⁽¹⁴⁷⁾. The use of online platforms for intervention delivery (e.g. e-Health and mHealth) has advanced substantially in recent years among young adults and was the most common mode of intervention delivery identified in this review. However, there has not been the same rise in use of online platforms as a means of recruitment.

Comparably, other reviews of recruitment data among physical activity interventions^(145,146), mental health trials⁽¹⁴⁸⁾ and those using digital tools⁽¹⁴⁹⁾ to recruit have all highlighted inadequate reporting and evaluation, while accentuating the need for better guidance in reporting⁽¹⁵⁰⁾. Recently, the ORRCA project (Online Resource for Recruitment research in Clinical trials, www.orrca.org.uk) has created a database of all RCT on recruitment to help improve recruitment of participants into trials.

Research question #10: What reporting is needed to assess the success of recruitment strategies?

Gaps in reporting of key recruitment information mean that the success of recruitment strategies could not be evaluated sufficiently. Similarly, issues with reporting recruitment information were emphasised in the 2016 review on weight gain prevention interventions by Lam *et al.*⁽²⁴⁾. It was hoped

Table 6 Summary of retention details of 107 studies of nutrition, physical activity and obesity interventions in young adults, by intervention focus

		Total (n 107)		Physical activity (n 31)		Nutrition (n 28)		Weight gain prevention (n 18)		Weight loss (n 16)		Nutrition and physical activity (n 14)	
		n	%	n	%	n	%	n	%	n	%	n	%
Strategies to retain	Payment/gift voucher	44	41.1	9	29.0	10	35.7	7	38.9	11	68.8	7	50.0
	Reminders/increased contact	22	20.6	5	16.1	3	10.7	4	22.2	6	37.5	4	28.6
	Course credit	18	16.8	5	16.1	6	21.4	4	22.2	1	6.3	2	14.3
	Prize/Prize draw	12	11.2	3	9.7	5	17.9	2	11.1	0	0.0	2	14.3
	Feedback	5	4.7	2	6.5	0	0.0	3	16.7	0	0.0	0	0.0
	Flexible scheduling	4	3.7	0	0.0	0	0.0	1	5.6	3	18.8	0	0.0
	Completion certificate	1	0.9	0	0.0	0	0.0	0	0.0	0	0.0	1	7.1
No incentive /not reported	31	29.0	10	32.3	11	39.3	5	27.8	3	18.8	2	14.3	
Retention rate: % randomised retained	At post-intervention*												
	Mean	83.3		84.2		80.3		80.8		85.4		87.6	
	Median	85.5		90.0		87.5		80.5		85.5		94.0	
	Range	22.0–100.0				23.0–100.0		65.4–98.0		22.0–100.0			
	At longest follow-up†												
	Mean	75.9		83.8		85.4		59.9		62.9		72.0	
Median	84.0		86.0		89.5		64.0		67.0		73.5		
Range	8.0–100.0				21.6–100.0		8.0–94.0		53.9–100.0				

*n 76 studies (21 physical activity, 16 nutrition, 16 weight gain prevention, 14 weight loss, 9 Nutrition and physical activity); 25 studies did not collect data at post-intervention, and 6 studies collected data but did not report retention.

†n 49 studies (11 physical activity, 16 nutrition, 9 weight gain prevention, 5 weight loss, 8 nutrition and physical activity); 57 studies did not collect data beyond the end of the intervention.

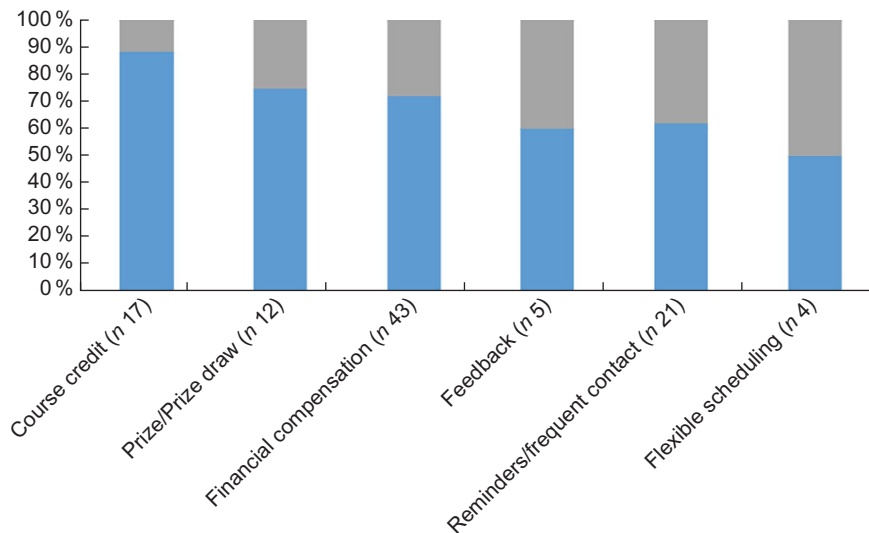


Fig. 4 (colour online) Adequacy* of retention strategies used across seventy-four studies of nutrition, physical activity and/or obesity interventions in young adults. *Retention was considered adequate if retention was $\geq 80\%$ for ≤ 6 -month follow-up or $\geq 70\%$ for > 6 -month follow-up

that the review by Lam *et al.* would illicit better reporting, but gaps still remain. As such, we have outlined the key recruitment information that should be reported in trials and the benefits of reporting this information (Table 7).

Retention findings

In terms of retention, 65 % of studies had adequate retention and the most successful retention strategy was course

credit. The mean \pm SD retention rate of $83 \pm 14\%$ is slightly lower when compared with another review by Walters *et al.* (n 151 RCT) that had no restrictions for age and reported an average retention rate of 89 %⁽¹⁴⁴⁾. Of note, this current review included fewer longer-term trials with only 38 % having follow-up > 6 months from baseline, compared with 64 % in the Walters review⁽¹⁴⁴⁾. Thus, young adults are likely to be harder to retain in the long term. Although



reporting of retention was better than recruitment (69% of studies provided sufficient information about retention strategies), results should be interpreted with caution. As was the case for the recruitment results, findings for retention (i.e. use of course credit) will unlikely be applicable outside of University or College settings.

Research question #11: What reporting is needed to assess the success of retention strategies?

Gaps in reporting retention information prevented detailed insights to inform successful retention strategies for use in this age group. Comparatively, a systematic review of smoking, nutrition, alcohol, physical activity and obesity RCT ($n = 10$) also highlighted reporting issues about retention⁽²⁵⁾. Therefore, we have outlined in Table 8 the key retention information to be reported in trials and the benefits of reporting this information.

Once more studies are available with detailed information on recruitment and retention, as outlined in Table 7 and Table 8, it will be worthwhile to update the current review. Providing greater detail on these aspects will assist with truly determining successful, cost-effective and efficient strategies to recruit and retain young adults. Furthermore, this information will help ensure statistical power is achieved and retained, leading to fewer false-negative findings. Finally, project co-ordinators will be better informed on ways to improve budgeting, planning and time management.

Strengths and limitations of the review

This review is the largest and most comprehensive review to evaluate recruitment and retention information from behavioural interventions targeting nutrition, physical activity or overweight/obesity in young adults. Furthermore, the quantification of recruitment and retention success, efficiency and cost is useful to inform future study planning. There are a number of limitations to acknowledge. Primarily, to be included, all participants were required to be within the age range of 17–35 years. As such, this risks excluding studies that included mainly young adults but also had some outside the age range. In addition, the calculations to determine the success of individual recruitment and retention strategies were basic (i.e. number of times the strategy was used in a study with recruitment or retention meeting criteria/the total number of times the strategy was used in a study). In implementing this approach, we were unable to determine if certain strategies had more ‘weighting’ with regard to recruitment or retention success. However, this approach was considered most appropriate as few studies provided recruitment and retention numbers by each strategy. Exploration of the combinations of recruitment and retention strategies was not feasible due to the large number of combinations with very few studies using the exact same combination of strategies and thus may result in false-positive or false-negative findings. For the recruitment rate calculation, a denominator of all those

reached was not used because of the difficulty of measuring reach when passive/reactive recruitment strategies are used that require the potential participants to contact the research team. The definition of adequate retention is limited in that the cut-off of 6-months for follow-up does not consider additional cut-offs for studies with longer-term follow-up (e.g. >12 months). However, in this review, only 15% of studies included follow-up >12 months from baseline. In addition, studies were limited to those published in English, which may have excluded relevant studies and could limit the generalisability of the findings.

Recommendations from this research

- Future studies should report complete details of recruitment and retention as outlined in Table 7 and Table 8 within the main paper or in protocol papers or Supplementary information. Alternatively, journals and researchers should publish papers specifically focusing on recruitment and retention.
- Greater focus on recruiting diverse samples of young adults and determining successful strategies to do so. In particular, different ethnicities and samples from a variety of socio-economic backgrounds.
- Researchers should consider the number of young adults that need to be reached to recruit the predetermined sample size. Based on the current review, if a sample recruitment target is 100 young adults, then at least 300 participants need to be engaged by recruitment strategies.
- Researchers should consider sufficient costs when budgeting for recruitment and retention. Recruitment costs per participant randomised in the university setting ranged from US\$45 to US\$232.96. Furthermore, median retention costs were US\$22.55 per participant retained (range: US\$0.50 to US\$553.83).

Conclusions

Overall, the current review emphasises poor reporting of recruitment, retention and related costs within behavioural interventions that include young adults. Due to the large proportion of studies that have used a university setting to recruit potential participants, findings may not be applicable to other settings. Guidance is required for researchers on how to improve reporting practices to help better establish recruitment and retention strategies for use with young adult populations. Essential recruitment and retention data are required in established checklists of reporting for trials (e.g. CONSORT) or as an extension. An update of this review will be required once a sufficient number of new studies publish essential recruitment and retention data.

**Table 7** Key reporting information for recruitment in trials

Recruitment information required	Benefits of providing this information
Required/goal sample size	Will help to determine if recruitment strategies reached the numbers required to maintain statistical power.
Duration of recruitment period	Will assist with determining the efficiency of recruitment strategies.
Detailed eligibility criteria and geographical location of the study/population	Provide reasoning for delays in recruitment (i.e. strict criteria likely to take longer) and enable stratification analysis based on different population groups and criteria.
Numbers invited to participate, interested/screened, eligible and enrolled/randomised by recruitment method.	This will indicate the numbers required at each stage and the success of each specific recruitment method.
Recruitment setting	Will help to determine which recruitment methods are the most effective across the different settings.
All recruitment methods utilised with sufficient detail	Insufficient detail is often provided. For example, by reporting "Social media", it is unclear if paid advertising was used or if it was simply shared by the research team on social media. Also, providing more detail on the specifics of each recruitment method (e.g. messaging, content) will be vital to determine which aspects are effective.
Frequency of contact (where applicable)	In most cases, it is unclear how often potential participants were contacted. For example, if social media advertisements were used, how many and how often were advertisements displayed to potential participants? This will be useful in determining the level of contact or exposure required to recruit participants.
Cost/expenditure of recruitment methods	Providing the cost and currency will help to determine the cost per participant recruited.
Recruitment incentives (i.e. incentive to complete baseline survey) and associated cost	This information will help to determine which incentives may enhance recruitment.
Participant burden: length of time and requirements (i.e. online survey, blood tests, in-person measurements) to complete baseline assessment and overall commitment requirements of programme.	Baseline measures that take a considerable amount of time and obligation (i.e. blood test) may prevent potential participants from taking part. Therefore, this information is vital to determine the level of participant burden and will help in understanding any difficulties with achieving required sample size or if changes are required to the number of measures collected at baseline.
Representativeness of participants recruited	Will help to determine if particular recruitment strategies are more likely to recruit population sub-groups.

Table 8 Key reporting information for retention in trials

Retention information required	Benefits of providing this information
Duration of programme/intervention and duration of each follow-up time point from end of intervention	Will help to contextualise the numbers retained and help determine retention.
Information on completers and non-completers	This information will help to determine any equity issues.
Number of participants retained at the end of the intervention and at each follow-up time point	This information will help to determine what strategies maximise retention.
Participant burden: length of time and requirements (i.e. online survey, blood tests, in-person measurements) to complete assessments at end of intervention and all follow-up time points	Assessment measures that take a considerable amount of time and obligations (i.e. blood test) may prevent participants from returning for end of intervention or follow-up assessments. Therefore, this information may help to provide context to low retention rates.
All retention methods utilised with sufficient detail	Insufficient detail is often provided for retention. For example, instead of reporting "emails were sent," provide information on the number of emails sent and the tone, format and messaging in the emails to help determine the success of specific strategies.
Frequency of contact (where applicable)	In most cases, it is unclear how often potential participants were contacted to aid in retention. For example, if participants were contacted via email to invite them to attend follow-up assessments, it would be useful to provide the number and frequency of these emails.
Cost/expenditure of retention methods	This will help in determining the level of contact or exposure required to retain participants.
	Providing the cost and currency will help to determine the cost per participant retained.



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Supplementary material

For supplementary material accompanying this paper visit <https://doi.org/10.1017/S1368980021001129>

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