

Participant recruitment strategies to population cohort studies: the lessons learned from Generation Scotland

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Abstract

Background: Generation Scotland (GS) is a genetic family health cohort study established in 2006 (N~24,000). A new wave of recruitment was initiated in 2022 aimed at adding a further 20,000 new participants to the cohort using online data collection and remote saliva sampling (for genotyping and DNA methylation profiling). Eligible individuals included anyone living in Scotland aged over 12 years. New participants give consent for linkage to their medical and administrative records, and to provide a saliva sample for DNA. The current study evaluates the different strategies employed to recruit new participants to the GS cohort for those aged 16+ (recruitment of ages 12-15 will be presented separately due to additional strategies).

Objective: This study aimed to evaluate recruitment strategies employed to recruit new participants to the GS cohort. Recruitment strategies were compared in terms of overall numbers as well as sociodemographic characteristics of the recruits, sample return rates and cost-effectiveness.

Methods: From May 2022 to the end of December 2023 recruitment was undertaken by the following methods: snowball recruitment (through friends and family of existing volunteers), invitations to those who participated in a previous survey during the pandemic (CovidLife: the GS COVID-19 impact survey) and Scotland-wide recruitment through social media (including sponsored Meta advertisements), news media and TV advertisement. Method of recruitment was self-reported by participants in the baseline questionnaire.

Results: Over the above period, 7,889 new participants were recruited to the cohort. According to the different strategies, this included, in order: social media (N=2,436, 30.9%), CovidLife survey responder invitations (N=2,049, 26.0%), TV advertising (N=1,367, 17.3%), snowball (N=891, 11.3%), news media (N=747, 9.5%) and other methods/unknown (N=399, 5.0%). More females signed up than males (70.5% female participants). To date, 83.5% of participants have returned their postal saliva sample. Sample return varied between demographic factors (>60 years 90.5% vs 16-34 years 71.1%). The average cost per participant across all recruitment strategies was £13.52. Past survey invitations (CovidLife) were most cost-effective at £0.37 per recruit, social media cost £14.78 per recruit, whilst TV advertisement recruitment was the most expensive at £33.67.

Conclusions: We present the challenges and successes of recruitment of new participants to a large ongoing cohort using remote assessment. Besides targeting existing survey responders, social media advertising has been the most cost-effective and easily sustained strategy for recruitment. We note different strategies resulted in successful recruitment over varying timescales (e.g.

consistent sustained recruitment for social media, and large spikes for news media and TV advertising) which may be informative for future studies with different requirements of recruitment periods. Limitations include self-reported methods of recruitment, and difficulties in capturing multi-layered recruitment. Overall, these data demonstrate the potential cost requirements and effectiveness of different strategies that could be applied to future research studies. Future work will report success and challenges of recruitment activities aimed at younger individuals, under 16 years.

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Original Paper

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Keywords

Recruitment methods; Facebook recruitment; social media; cost-effectiveness; advertisement; web-based study; cohort studies



Abstract

Background: Generation Scotland (GS) is a genetic family health cohort study established in 2006 (N~24,000). A new wave of recruitment was initiated in 2022 aimed at adding a further 20,000 new participants to the cohort using online data collection and remote saliva sampling (for genotyping and DNA methylation profiling). Eligible individuals included anyone living in Scotland aged over 12 years. New participants give consent for linkage to their medical and administrative records, and to provide a saliva sample for DNA. The current study evaluates the different strategies employed to recruit new participants to the GS cohort for those aged 16+ (recruitment of ages 12-15 will be presented separately due to additional strategies).

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Introduction

Recruitment of participants to population-based health research studies is a major challenge. Web-based recruitment strategies, including social media, are increasingly used for their reported low cost, time effectiveness and potential wide reach [1–3]. Social media adverts have the potential to reach large and targeted populations using algorithms, a complex set of rules and calculations, to prioritise the content seen by users [4]. Web-based strategies are often combined with traditional advertising media such as newspapers, radio, TV, and email [5–10]. However, few population-based studies have published comparisons of different recruitment methods, for example in terms of cost-effectiveness and sociodemographic features engaged by these different methods. In particular, success of remote bio-sampling return rates using such methods of recruitment remains relatively underexplored. In the context of a longitudinal population-based cohort, Generation Scotland (GS), we therefore describe different recruitment strategies and compare in terms of these above parameters.

GS is a large Scottish family health cohort, established as a resource to support research on the genetic and environmental determinants of mental and physical health and well-being. The original cohort was established between 2006-2011, and was made up of around N=24,000 individuals across Scotland, aged 18+ [11]. The mean age at recruitment was 47 years (SD 15), and the cohort comprises 59% females. Participants in the original cohort were recruited using a GP-based recruitment strategy by postal and telephone contact, with in-person clinic attendance (89%) and postal sample/questionnaire collection (11%) at considerable amount of staff time and postal charges [11].

In 2019, funding was obtained to expand the cohort and recruit an additional N=20,000 individuals [12]. In the new phase of recruitment, all data, questionnaires and bio-samples (saliva) are collected remotely. This format allows individuals to sign-up at a convenient time and from any location without having to travel to a clinic, minimising the cost and effort required to participate. As a population-based study across Scotland we considered it important to remove barriers of participation for under-represented groups, for example individuals from rural communities and those who find travel difficult. We also lowered the age of eligibility to join to 12+ years in order to support health research in the younger generation of individuals living in Scotland. Note, the current article focusses on recruitment of individuals aged 16+, with 12-15 year old recruitment being the subject of another article. Teen-specific recruitment strategies were applied to this age group with these strategies still being assessed. Postal saliva collection was selected as the bio-sampling measure as it performs well in DNA extraction and genetic analysis [13] and was considered appropriate for remote sampling and more acceptable than alternatives such as blood sampling which was required in the original cohort.

Recruitment for the expansion of the cohort began in May 2022 and has since used a range of approaches, traditional and web-based, with overlaps. Here, we report strategies used in the recruitment of new participants to the GS cohort up to the end of December 2023, comparing the sociodemographic characteristics of participants, saliva sample return rates and cost-effectiveness of each strategy, defined as the cost per participant. We present novel research on recruitment methods including reports of demographic and geographic reach which can be used to inform recruitment strategies, timelines, and costs required for future studies.

Methods

Study Design

The GS study aims to expand the original cohort (N=24,000) by recruiting an additional 20,000 new participants across Scotland. Although, to date, recruitment is ongoing, in the current description we compare recruitment methods during our initial main phase of recruitment of the general population from May 2022 – Dec 2023 aged 16 years and over. Participants interested in the study sign-up online on the GS web portal. This online platform takes volunteers through participant information, cohort consents and provides access to baseline and follow-on questionnaires, as well as prompting a request for an address to post the saliva testing kit. Since we have lowered our recruitment eligibility age to anyone living in Scotland aged 12 years and over, we have implemented additional levels of confirmation of their capacity for consent for those aged 12-15 by their parent or guardian. This report however focusses on participants aged 16 years or older since different recruitment methods are being used for participants under 16 years old and will be reported separately.

In order to assess recruitment routes, the current report uses responses to one of the baseline survey questions: “How did you hear about GS?”. Participants select one option from a pre-defined list of answers itemised in Table 1. There is also a free text option to describe how an individual heard about GS if “Other” was selected. The response to these questions, sign-up date and email records were used to assign a single recruitment method to each participant (full definitions for assigning recruitment method are detailed in Multimedia Appendix 1, Table S1-1).

In general, we consider that a person is formally a full member of the GS cohort if they have completed the study consent, baseline survey, and returned their saliva sample for genetic analysis. However, in order to be able to report on the saliva sample return rate a successful recruitment, and therefore the inclusion criteria for this study, was defined as an individual who had completed the study consent and baseline survey only. In total, N=840 individuals were excluded for not completing the baseline survey.

Table 1. Baseline questionnaire response options for the question “How did you hear about GS?” (only one option allowed).

How did you hear about Generation Scotland?
1. Through a family member
2. Through a friend
3. Employer or organisation
4. Social media
5. Radio
6. TV
7. Newspaper/online news source
8. Other organisation eg. Charity/other study
9. Clinician/GP
10. Contacted by Generation Scotland after taking part in a previous study e.g., CovidLife
11. Generation Scotland website
12. Web search ^a
13. The Scottish Health Research register SHARE ^b Newsletter ^c
14. Public engagement event ^c
15. College/University ^c
16. School ^c
17. Poster/billboard/flyer ^c
18. Other (add free text)

^a Option removed in December 2023.

^b NHS Research Scotland initiative SHARE [14].

^c Options added in December 2023.

Recruitment Methods

Recruitment began in May 2022 and this study reports activities to the end of December 2023. A “soft launch” of the cohort was conducted between May and December 2022 to trial the performance of the GS portal with limited numbers and to use our existing network of volunteers to recruit new participants. From January 2023 we pursued additional, Scotland-wide recruitment methods, including a news media launch, social media advertising and a TV advertisement. This took inspiration from the multi-layered approach of the GLAD study [5]. Figure 1 shows a timeline of recruitment activities and corresponding sign-up numbers.

Snowball recruitment (May-October 2022, January and June 2023)

Snowball recruitment, where research volunteers were asked to recommend joining GS to relatives, friends and other contacts, was the first strategy adopted. From May to October of 2022 members of the original GS cohort with an available email address were invited to join the online portal themselves and at the same time encouraged to invite additional friends and family members to join (N= 9,531).

In late-January 2023, a newsletter was sent to all GS participants providing a further update on the expansion of the cohort and again encouraging existing participants to invite friends and family members to join. The newsletter was sent to N=7,916 individuals by email including original GS participants and new sign-ups. Paper newsletters were sent to original GS cohort participants with a postal address but no email information available (N=11,642). Another email newsletter was sent in

June 2023 to 6,056 participants who had so far joined the online portal.

Invitation to previous survey responders: CovidLife (May-December 2022 and June 2023)

CovidLife was an observational study run by GS to investigate the impact of the COVID-19 pandemic on mental health and well-being of people living in the UK [15]. Approximately 18,000 members of the UK population took part (92.2% resided in Scotland). Recruitment to the CovidLife study took place from March 2020 and was mostly achieved through emails to participants of the NHS Research Scotland initiative, SHARE [14]. Individuals living in Scotland who took part in CovidLife and consented to being re-contacted were invited to join GS by email from May to December 2022 (N=13,262). In June 2023 a further 11,355 reminder emails were sent to individuals who had not responded to the first invitation.

News media (25th January 2023)

On the 25th January 2023, following success of the soft launch, wider recruitment was launched with a media campaign composed of traditional media (TV news, radio, and newspaper) and social media (Twitter, Facebook, Instagram) strategies. A variety of media coverage, including online news articles (Multimedia Appendix S1-2) and TV and radio news slots were arranged for the launch date. This included a front-page BBC (British Broadcasting Corporation) Scotland web article and live question and answer interview on BBC Scotland. There were also news features on the Universities of Edinburgh and Aberdeen websites.

Social media (January 2023- 31st December 2023)

Social media adverts were run on Meta (Facebook and Instagram) by the GS team from January 2023. Examples of paid adverts are shown in Multimedia Appendix S1-3. Spirit Media [16], a media marketing and advertising agency spun-out from the University of Edinburgh, has assisted with developing a social media strategy using sophisticated audience targeting since June 2023. Approximately 4,840,503 impressions (number of views) been received for Meta from June to the end of December 2023. In addition to advertising, the GS Twitter, Facebook, LinkedIn and Instagram accounts have been actively posting information about GS and lay summaries to highlight research facilitated by the GS cohort. Approximately three posts per week have been produced since May 2023 (Multimedia Appendix S1-4).

TV advertising (5-30th June 2023)

A TV advertisement was run in June 2023 on STV (Scottish Television commercial channel) [17]. The 30-second advertisement featured three current GS volunteers sharing their experiences of taking part in GS. The advert was designed to show the ease and potential impact of joining the cohort. It ran for 25 days (5th-30th June), for an average of 6 slots per day, at 70% daytime and 30% peak times with an estimated 11,866,880 impressions.

Assorted methods

Emails and letters were sent to members of other research studies including parents and children of the Growing Up in Scotland (GUS) study [18], and GS was featured in various newsletters, including the NHS Research Scotland initiative SHARE [14], Aberdeen Children of the 1950s [19], and

Dyslexia Scotland. Members of the GS team have attended events, including the Edinburgh Science Festival, Glasgow Science Festival and the Royal Highland Show. Flyers were distributed at these events with QR codes directing individuals to the GS portal. From October 2023, GP practices that were part of the Primary Care Research Network (PCRN) began contacting eligible registered individuals by text, inviting them to join GS. These recruitment methods are not included in detail in the summaries below as the overall recruitment numbers were relatively low (Total assorted methods, N=391), were not active during the full study period for this analysis, and relevant options for some of these assorted methods were only added to the baseline survey question 'How did you hear about GS?' in December 2023. However, we consider these activities important for awareness-raising and communicating the importance of health research to the public.

Recruitment effectiveness metrics

Sociodemographic characteristics of recruited participants are presented for each recruitment method compared to the general Scottish population to assess representativeness of recruits from each strategy. This included comparisons of age, sex, ethnicity, local authority regions, Scottish Index of Multiple Deprivation (SIMD) quintiles and urban-rural classifications. The response rate is presented for the CovidLife survey responders, TV and social media methods. This was calculated for each method by dividing the total sign-ups per method by the estimated number of impressions (TV and social media) or the total number of emails sent (CovidLife responder invitations). For snowball recruitment and news media it was not possible to determine a denominator.

We also evaluated the saliva sample return rate using chi-squared tests to test the association between recruitment method and demographic factors. Post hoc pairwise tests using Bonferroni adjustment were applied for multiple comparisons. The overall cost and cost per participant of each method are presented. Supplies and service costs and human resource costs were estimated to determine the time required to carry out and sustain each strategy.

Results

Recruitment method effectiveness

In total, 7,889 new participants who had completed study consents and the baseline questionnaire were recruited to GS in the study period. Figure 1 shows the timeline of recruitment activities and corresponding sign-up numbers. For 399 (5.0%) individuals, the recruitment method was assigned as either unknown or one of the assorted recruitment methods described above.

Snowball recruitment: From May-December 2022, emails were sent to original GS participants encouraging snowball recruitment. Overall, 891 individuals were recruited through invitation from a friend or family member with upticks coinciding with the January and June 2023 newsletters (Figure 1).

Invitation to previous survey responders: CovidLife: Email invitations to 13,262 CovidLife participants, sent from May to December 2022, resulted in recruitment of 1,306 individuals (9.8% response rate, 16.6% of total recruits). Reminder emails were sent in June to 11,355 individuals, resulting in a further 743 sign-ups (6.5% response rate to reminders, 9.4% of total recruits).

News media: Recruitment across Scotland via a variety of media coverage, resulted in 526 sign-ups (6.7% of total recruits) on launch day (25/01/23) and 747 (9.5%) sign-ups from news media in total.

Social media: Social media adverts generated the most sign-ups, 2,436 individuals (30.9%) to the end of December 2023. This equates to an average of 312.5 sign-ups per month since Spirit Media started coordinating social media recruitment in June 2023 to the end of December 2023. Given a total impressions of 4,840,503 across Meta, response rate to social media advertising is an estimated 0.05%.

TV advertising: The June TV advert led to the recruitment of 1,367 participants, 17.3% of the recruitment total. This was achieved within a single month of the advert running. The TV advert received an estimated 11,866,880 impressions resulting in a response rate of 0.012%.

Sociodemographic Characteristics

Sociodemographic characteristics of the 7,889 new participants are presented by recruitment strategy in Table 2. Overall, there was a high sex imbalance with more females recruited to the cohort (70.6% female). Study participants were older, with 49.1% of participants over 60 years old compared to 30.8% of the Scottish population. Among newly recruited participants, 1.2% were of non-white ethnicity compared to 7.1% of the Scottish population. Generally, new sign-ups were living in less deprived regions compared with the general population, however, new recruits were relatively well matched for regional representation (defined according to local authority regions) and for urban/rural classifications.

Comparing recruitment methods, social media had the greatest sex imbalance with 80.0% of recruits identifying as female. Snowball recruitment and news media methods were the most successful at recruiting younger adults with 21.2% and 13.3% of recruits aged 16-34 years, respectively. Previous survey respondents (CovidLife) had the highest proportion of older recruits, (61.9% aged >60) followed by social media (49.5% aged >60). TV advertisement demonstrated the best match of Scottish population distribution across SIMD quintiles with 16.5% of TV recruits in the most

deprived SIMD quintile. Those recruited via social media also had a relatively even population spread within SIMD quintiles (24.7%-11.9%).

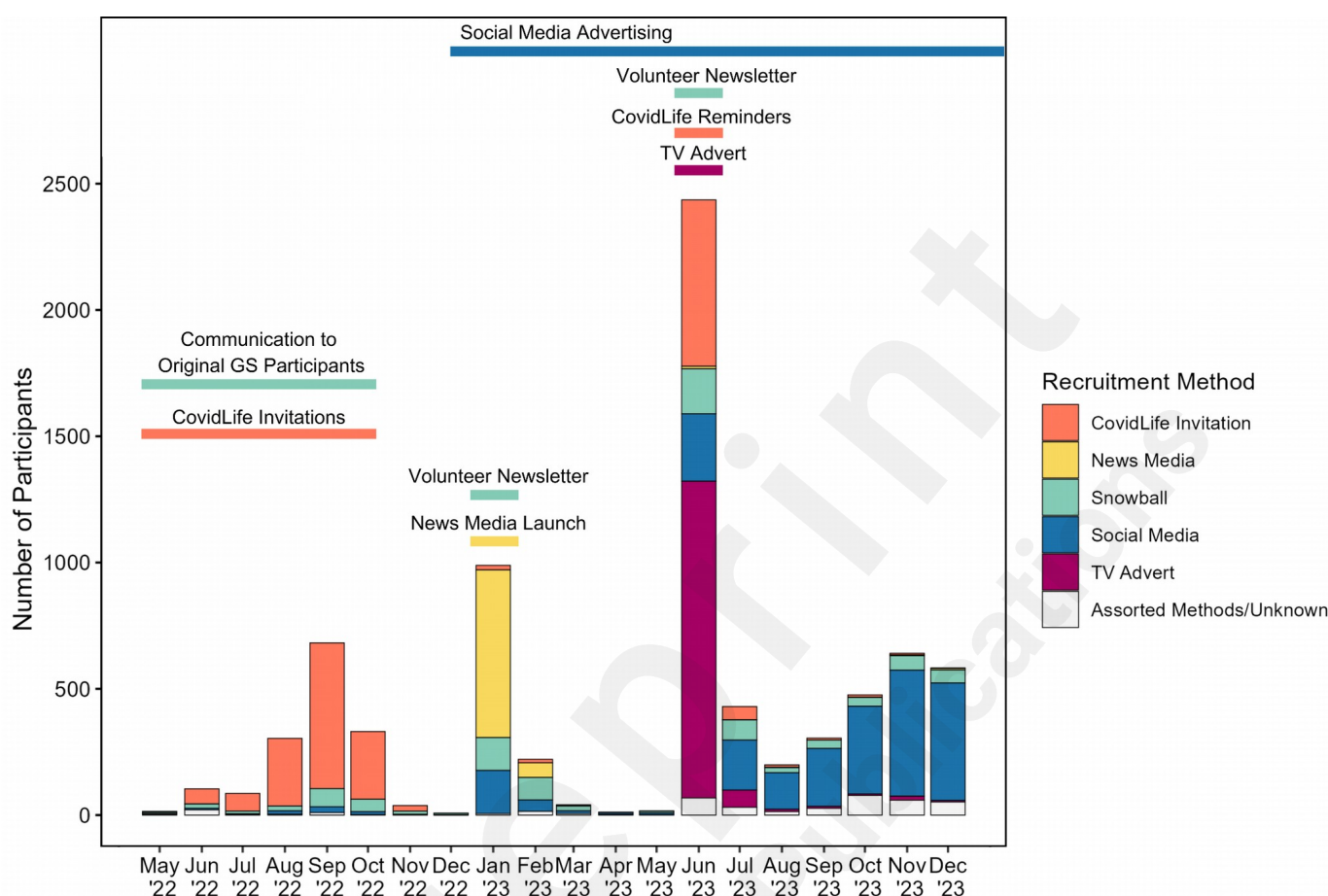


Figure 1. Timeline of new participant recruitment to the GS cohort from May 2022 to December 2023 including the periods of coverage for each recruitment method activity.

Table 2. Summary of demographic characteristics by recruitment method with comparison to the Scottish population.

	TV	News Media	Social Media	CovidLife Invitation	Snowball recruitment	Total	Scotland Population (%)
n (% of total participants)	1,367 (17.3%)	747 (9.5%)	2,436 (30.9%)	2,049 (26.0%)	891 (11.3%)	7,889 ^a	
Sex (%)							
Female	937 (68.5%)	453 (60.6%)	1,950 (80.0%)	1,386 (67.6%)	555 (62.3%)	5,570 (70.6%)	51.9% ^b
Male	428 (31.3%)	293 (39.2%)	483 (19.8%)	662 (32.3%)	334 (37.5%)	2,309 (29.3%)	48.1% ^b
Missing/Prefer not to say	<10	<10	<10	<10	<10	10 (0.1%)	
Age (%)							
16-34	86 (6.3%)	99 (13.3%)	174 (7.1%)	64 (3.1%)	189 (21.2%)	669 (8.5%)	28.1% ^b
35-60	652 (47.7%)	363 (48.6%)	1,055 (43.3%)	716 (34.9%)	358 (40.2%)	3,346 (42.4%)	41.1% ^b
>60	629 (46.0%)	285 (38.2%)	1,207 (49.5%)	1,269 (61.9%)	344 (38.6%)	3,874 (49.1%)	30.8% ^b
Ethnicity (%)							
White	1,358 (99.3%)	731 (97.9%)	2,412 (99.0%)	2,016 (98.4%)	881 (98.9%)	7,783 (98.7%)	92.9% ^c
Other	<10	16 (2.1%)	21 (0.9%)	27 (1.3%)	<15	92 (1.2%)	7.1% ^c
Missing	<10	<10	<10	<10	<10	14 (0.2%)	
Scotland Region (%)							
Aberdeen and North East	177 (12.9%)	81 (10.8%)	299 (12.3%)	415 (20.3%)	110 (12.3%)	1,122 (14.2%)	10.7% ^b
Edinburgh and Lothians	212 (15.5%)	202 (27.0%)	420 (17.2%)	693 (33.8%)	233 (26.2%)	1,886 (23.9%)	16.7% ^b
Glasgow and Strathclyde	527 (38.6%)	211 (28.2%)	694 (28.5%)	382 (18.6%)	208 (23.3%)	2,124 (26.9%)	40.7% ^b
Highland and Islands	127 (9.3%)	71 (9.5%)	280 (11.5%)	144 (7.0%)	79 (8.9%)	731 (9.3%)	7.2% ^b
Scotland South	<10	<30	165 (6.8%)	99 (4.8%)	40 (4.5%)	355 (4.5%)	4.8% ^b
Tayside, Central and Fife	310 (22.6%)	155 (20.7%)	557 (22.9%)	304 (14.8%)	191 (21.4%)	1,594 (20.2%)	19.9% ^b
Missing	<15	<10	18 (0.7%)	12 (0.6%)	31 (3.5%)	79 (1.0%)	
SIMD (%)							
1 - Most Deprived	226 (16.5%)	58 (7.8%)	291 (11.9%)	83 (4.1%)	57 (6.4%)	757 (9.6%)	20.6% ^d
2	256 (18.7%)	104 (13.9%)	393 (16.1%)	237 (11.6%)	113 (12.7%)	1,161 (14.7%)	21.1% ^d
3	291 (21.3%)	143 (19.1%)	528 (21.7%)	347 (16.9%)	167 (18.7%)	1,550 (19.6%)	19.8% ^d
4	306 (22.4%)	184 (24.6%)	608 (25.0%)	584 (28.5%)	219 (24.6%)	2,004 (25.4%)	19.3% ^d
5 - Least Deprived	278 (20.3%)	257 (34.4%)	598 (24.5%)	786 (38.4%)	304 (34.1%)	2,338 (29.6%)	19.2% ^d
Missing	<15	<10	18 (0.7%)	12 (0.6%)	31 (3.5%)	79 (1.0%)	
Urban-Rural (%)							
1 - Large Urban Areas	420 (30.7%)	287 (38.4%)	651 (26.7%)	786 (38.4%)	336 (37.7%)	2,644 (33.5%)	37.8% ^e
2	541 (39.6%)	189 (25.3%)	788 (32.3%)	412 (20.1%)	225 (25.3%)	2,253 (28.6%)	33.9% ^e
3	105 (7.7%)	60 (8.0%)	236 (9.7%)	179 (8.7%)	63 (7.1%)	675 (8.6%)	8.6% ^e
4	35 (2.6%)	18 (2.4%)	116 (4.8%)	63 (3.1%)	15 (1.7%)	259 (3.3%)	2.6% ^e
5	182 (13.3%)	115 (15.4%)	392 (16.1%)	438 (21.4%)	131 (14.7%)	1,319 (16.7%)	11.6% ^e
6 - Remote Rural Areas	74 (5.4%)	77 (10.3%)	235 (9.6%)	159 (7.8%)	90 (10.1%)	660 (8.4%)	5.5% ^e
Missing	<15	<10	18 (0.7%)	12 (0.6%)	31 (3.5%)	79 (1.0%)	

^a Total includes 399 individuals where recruitment method was assigned as an "assorted recruitment method/unknown".

^b Based on National Records of Scotland (NRS) Mid-2023 Population Estimates [20]. Restricted to ages 16+.

^c Based on NRS 2022 Scottish Census [21].

^d Based on 2021 NRS Population Estimates by Scottish Index of Multiple Deprivation (SIMD)[22]. Restricted to ages 16+ and estimated from SIMD deciles.

^e Based on 2021 NRS Scottish Government Urban Rural Classification [23]. Restricted to ages 16+.

Saliva sample return rate

After completing the study consents and baseline questionnaire participants were sent a postal saliva sample kit. Reminders were sent to individuals to return their saliva sample kit at three, six and ten weeks. Median time to return a saliva sample was 13 days (IQR 8-21 days). Overall, 83.5% of participants have returned their postal saliva sample (Table 3). The sample return rate was compared between recruitment method and demographic factors, full chi-squared results and pairwise tests are presented in Multimedia Appendix 2. Males had a significantly higher sample return rate at 88.8% compared to females at 81.3% (X^2 (df 1, N=7,826) = 65.03, $p < .001$). Individuals >60 years old were significantly likely to return their saliva sample than those aged 16-34 years old (90.5% vs 71.1%) (X^2 (df 2, N=7,836) = 287.06, $p < .001$). The sample return rate was significantly lower in quintiles mapping to areas with higher deprivation (least deprived: 88.7% vs most deprived: 71.5%) (X^2 (df 4, N=7,798) = 151.96, $p < .001$). Comparing recruitment methods there were significantly different sample return rates between methods (X^2 (df 5, N=7,836) = 148.83, $p < .001$). CovidLife survey responders had the highest sample return rate (90.4%) whilst TV recruitment had the lowest (78.5%).

Table 3. Summary of saliva sample return rate following sign-up, by recruitment method and demographic factors. Only individuals who were sent a specimen kit (excludes those with no address information, N=53) were included in denominator (N=7,836).

	Saliva Sample Return (N=7,836)	
Total	6,543	83.5%
Recruitment Method		
CovidLife Invitation	1,840	90.4%
News Media	668	89.7%
Snowball Recruitment	738	83.0%
Social Media	1,923	79.6%
TV	1,068	78.5%
Other	306	78.5%
Sex		
Female	4,495	81.3%
Male	2,040	88.8%
Age Group		
16 - 34 years	471	71.1%
35 - 60 years	2,587	77.9%
>60 years	3,485	90.5%
Ethnicity		
White	6,460	83.6%
Other	73	79.3%
SIMD		
1 - Most Deprived	540	71.5%
2	909	78.4%
3	1,279	82.8%
4	1,711	85.5%
5 - Least Deprived	2,071	88.7%

Cost-effectiveness of recruitment strategies

Excluding individuals recruited from assorted methods/unknown (N=7,490), the overall cost per participant recruited was £13.52 across the five highlighted methods, with a total spend of £101,261. Detailed cost breakdowns are presented in Multimedia Appendix S1-5. TV was the most expensive (albeit rapid) strategy in both absolute terms and by cost per participant (£33.67). The production cost of the high-quality TV-ready advert was £6,316 whilst the STV advertising campaign cost £34,650. We note that the advert has been re-used repeatedly on social media platforms representing value for money on the production of the initial advert. Snowball recruitment had the second highest cost per recruit at £17.89. The bulk of the expenditure for this was attributed to posting paper newsletters to original GS volunteers in January 2023 where an email address was not available (£13,794). The total spend on social media recruitment was £36,003, which equated to £14.78 per participant recruited. Social media costs included advertisement costs, Spirit Media marketing services and staff time to create regular social media posts and respond to comments and messages.

The least expensive method was invitations to CovidLife survey responders (£0.37 per recruitment) which required minimal staff hours to prepare communications and email CovidLife participants. The news media strategy was also low-cost (£3.39 per recruitment), which took advantage of the University of Edinburgh's central media and press office services, but otherwise using unpaid media sources.

Table 4. Cost-effectiveness of recruitment methods. Detailed cost breakdowns in Multimedia Appendix S1-5.

Recruitment Method	n	Cost	Cost per Recruitment
TV	1,367	£46,025.20	£33.67
Social Media	2,436	£36,003.35	£14.78
Snowball recruitment	891	£15,944.33	£17.89
News Media	747	£2,529.80	£3.39
CovidLife Invitation	2,049	£758.94	£0.37
Total	7,490 ^a	£101,261.62	£13.52

^a Total excludes the 399 individuals where recruitment method was from an "assorted recruitment method/unknown".

Discussion

This study reports the effectiveness of a variety of strategies utilised in the recruitment of individuals to the GS longitudinal cohort. A multi-layered approach was taken, using a combination of recruitment methods, leading to the recruitment of 7,889 new participants. We report data to the end of December 2023 however, recruitment is currently ongoing, with the aim to conclude in June 2025.

Recruitment effectiveness

Table 5 provides an overall assessment of the recruitment strategies employed. The initial recruitment plan was to exclusively use existing GS volunteers to drive snowball recruitment. This was intended to build upon the existing family aspect of the cohort. Overall, snowball recruitment cost £17.89 per new volunteer, driven by postage expenses for the annual newsletter. However, snowball recruitment through this channel was a secondary aim as the main purpose of the annual newsletter was to provide the latest cohort information and recent findings to original GS for whom we only have address information.

In contrast, invitation to previous survey responders (CovidLife) by email was a relatively inexpensive strategy and required minimal staff time. This method yielded a high response rate (10%), likely because it targeted a population recently engaged in health research, via the CovidLife surveys. Although this was an effective strategy, there were concerns that repeated messaging to potential volunteers might have limited repeated returns or even incurred a net negative impact.

Because of its nationwide reach, the media launch was successful in gaining a substantial number of recruits within a few days but sign-ups dropped sharply thereafter. This is likely due to the short-lived nature of media coverage. Similarly, the TV advert received over 11 million impressions and reached a wide audience across Scotland. These strategies demonstrated the value of a multi-layered approach as social media-derived recruitment was also increased in January (concurrent with the news coverage), compared to February/March, and during the June TV advert campaign compared to July/August.

The TV advert recruited individuals from a broader sociodemographic range than is often achieved in research studies. This has also been observed by the NutriNet-Santé study which also used TV recruitment [24]. Although highly successful in driving many recruits in a short time period this strategy was expensive and not affordable over a longer period (Table 5). However, the TV advert was also repurposed for use as a social media advert beyond the TV advertising and therefore fed into other methods of recruitment.

Social media engagement and advertising has been active since February 2023 and has generated steady sign-ups overall bringing in the highest number of recruitments. Our observations are consistent with other studies which have demonstrated the benefits of social media recruitment [25–28]. Social media has the advantage of immediacy in directing individuals to sign-up with a single click whilst already using an online device. Algorithm-driven advertising directs the adverts to those most likely to sign-up and has the ability to target a desired audience, including age range and location. This method also offers greater control of advertising expenditure than other media. However, there is a lack of transparency around how platform algorithms work [29] and targeting may reinforce demographic trends. We report social media to be the most female-biased method and have so far recruited only small numbers of young participants through this method. This finding contrasts with other studies that have reported social media as being effective at reaching younger

populations [25, 30, 31]. This may be due to advertising materials (ie. the more traditional TV advert) appealing more to an older demographic. Demographic patterns may also be reinforced by the Meta algorithm pushing adverts to those with similar characteristics to those who have previously clicked on an advert. Social media platform use by young people can shift significantly, evidenced by the rapid rise of TikTok use [32] and reported decline in Facebook use among young people in the UK [33]. Our results demonstrate the need for researchers to adapt to the fast-moving field of social media using materials that appeal to younger individuals, utilise algorithms to broaden demographic reach and adapt to new platforms used by younger audiences [34].

Saliva sample return rate

Although overall postal saliva sample return is good, at over 83%, our study highlights the requirement to oversample by 20% to obtain the desired biosample target. Those recruited via TV advertising (78.5%) and social media (79.6%) had the lowest saliva sample return rates. This was expected given these strategies had the broadest recruitment target, reaching harder to recruit demographics and individuals less connected to the project than CovidLife previous survey responders (90.4%). Sample return was also lower in some demographic groups, including younger people (16-34 years old, 71.1%) though still overall at relatively high levels. This highlights the need for additional recruitment efforts in these groups, with specific recruitment strategies, to reach sample target numbers across a diverse demographic.

Ongoing Development

We aimed to address barriers to recruitment with ongoing development of the sign-up process. We provided email and phone assistance to all participants to answer any queries about the cohort or assist in the sign-up process. Adjustments have been made through the recruitment period based on volunteer feedback to improve our recruitment process. This included the creation of a landing page (the web page an individual “lands” on after following a link) (Multimedia Appendix S1-6). to improve user experience. The option to sign-up using a phone number and receive updates via SMS instead of an email address was also added with the aim of improving accessibility, particularly for young people, based on feedback from our Young Persons Advisory Group (YPAG) and parents. Since its introduction in June 2023, 15% of volunteers included in this study have signed up primarily using a mobile number.

Withdrawal from GS

Participants are able to withdraw from the study at any time to remove their data and have their sample destroyed. The average withdrawal rate for the cohort during the recruitment period was 0.44% in line with other similar studies [9, 14].

Study Strengths and Limitations

The strengths of the study are the reporting of novel approaches used in the remote recruitment of participants to a national cohort (Table 5). Whilst other studies such as the NutriNet-Santé study [24] and Genetic Links to Anxiety and Depression (GLAD) study [5] have reported use of TV recruitment through news reporting and media coverage, to our knowledge no other health study has used a paid TV advertisement to recruit participants. Additionally, we report important evidence on the effectiveness of social media. In the literature, social media is often reported to be most effective when targeting specific hard-to-reach populations [31, 35–37] or younger individuals [38, 39]. Here,

we report recruitment with broad inclusion criterion and a large recruitment target. Furthermore, other studies have reported the impact of demographic factors on remote saliva sample return [40, 41] but to our knowledge, no other studies have reported how online and traditional recruitment methods impact sample return rates.

In this study we have successfully assigned one of five key recruitment routes to 95% of new participants using self-reported questionnaire responses combined with sign-up date and records of emails sent to participants. However, a limitation of this study was that self-reported responses may not always be accurate. Individuals were only able to select one option for “how they heard about GS” when they may have heard about GS from several sources. We do not know if individuals selected the first source they heard from or the one that motivated the sign-up. For example, of previous survey responders who had received a CovidLife email invite from us, 7% selected social media and 4% selected ‘friend or family’ as how they heard about GS.

Another limitation of the study is the inability to statistically assess the impact of the multi-layered recruitment strategy. We can report observational benefits of running multiple recruitment methods at the same time but is difficult to disentangle and assess this impact fully.

The cost-effectiveness analysis estimated the hours of staff time required for each recruitment method in order to compare strategies. However, in practice, there have been 15 management and delivery team members with a direct and indirect focus on recruitment activities. Therefore, the true total cost of recruitment would also include salary costs for the team. Additionally, historical costs associated with recruitment methods were not taken into account in the present study. For example, we report invitations to CovidLife survey responders to be a low-cost strategy. However, we do not take into account the costs associated with recruitment to the CovidLife study in 2020, which required payment to NHS Research Scotland initiative SHARE to email their participants.

Conclusions

This paper presents some of the challenges and successes of recruitment of individuals to a nation-wide cohort. Using a multi-layered strategy of recruitment approaches has created a sustained pattern of recruitment, with additional spikes, and has allowed us to reach a broader demographic of participants than with more traditional recruitment methods. In particular, the TV advertising campaign proved highly effective in recruiting a large number of participants in a short amount of time and from a broad sociodemographic background, while social media resulted in the most overall sign-ups over a longer, sustained period. Further efforts are required to improve accessibility with ongoing developments to the sign-up process and appropriate demographic targeting, in particular to recruit younger individuals. These data demonstrate the potential cost requirements and effectiveness of different strategies that could be considered in the planning of future cohort research studies.

Table 5. Summary of strengths and weaknesses of each recruitment method utilised in the

Recruitment method	Strengths	Weaknesses
Snowball recruitment	• Cost-effective to use existing network of volunteers • We already communicate with volunteers regularly about cohort updates • Recruitment within families enhances genetic power of the cohort	• Do not want to overtask current volunteers • Sending paper letters is expensive compared to emailing volunteers
CovidLife Invitation	• High response rate • Reaches audience already interested in taking part in research • Inexpensive to email individuals	• Recruiting from participants already taking part in research may reinforce current sociodemographic trends • Finite number of individuals to contact
Social media	• Cost-effective to run for a long period of time • Takes individuals to the sign-up page in one click • Reaches wide audience • Potential to reach younger individuals	• Demographic selection bias towards women (algorithm feedback) • Requires considerable time investment to maintain online presence • Lack of control over platform algorithms
News media	• Reaches wide audience • Utilises potentially trust-worthy news sources	• Very short term (e.g., a news article will only be front page for one day) • Requires contacts to reach news outlets • Limited control over materials produced
TV advertising	• Reaches wide audience • Rapid recruitment • Broad SIMD recruitment • Reusability of TV advert for social media	• Expensive to produce TV-ready advert • Expensive to run advert campaign

recruitment of participants to the GS cohort.

Ethics approval

This study involves human participants. All components of Generation Scotland received ethical approval from the NHS Tayside Committee on Medical Research Ethics (REC Reference Number: 05/S1401/89). Generation Scotland has also been granted Research Tissue Bank status by the East of Scotland Research Ethics Service (REC Reference Number: 20-ES-0021), providing ethical approval for a wide range of uses within medical research. Written informed consent was obtained from all participants in GS:SFHS. NGS participants gave consent online. All participants aged 16 years or over provide their own informed consent whilst those aged 12–15 years require parental confirmation of their capacity to consent. Participants gave informed consent to participate in the study before taking part.

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Conflicts of Interest

Riccardo E Marioni is a scientific advisor to Optima Partners and the Epigenetic Clock Development Foundation. Daniel McCartney is an employee of Optima Partners Ltd.

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Abbreviations

BBC: British Broadcasting Corporation

GLAD: Genetic Links to Anxiety and Depression

GS: Generation Scotland

GUS: Growing up in Scotland

SIMD: Scottish Index of Multiple Deprivation

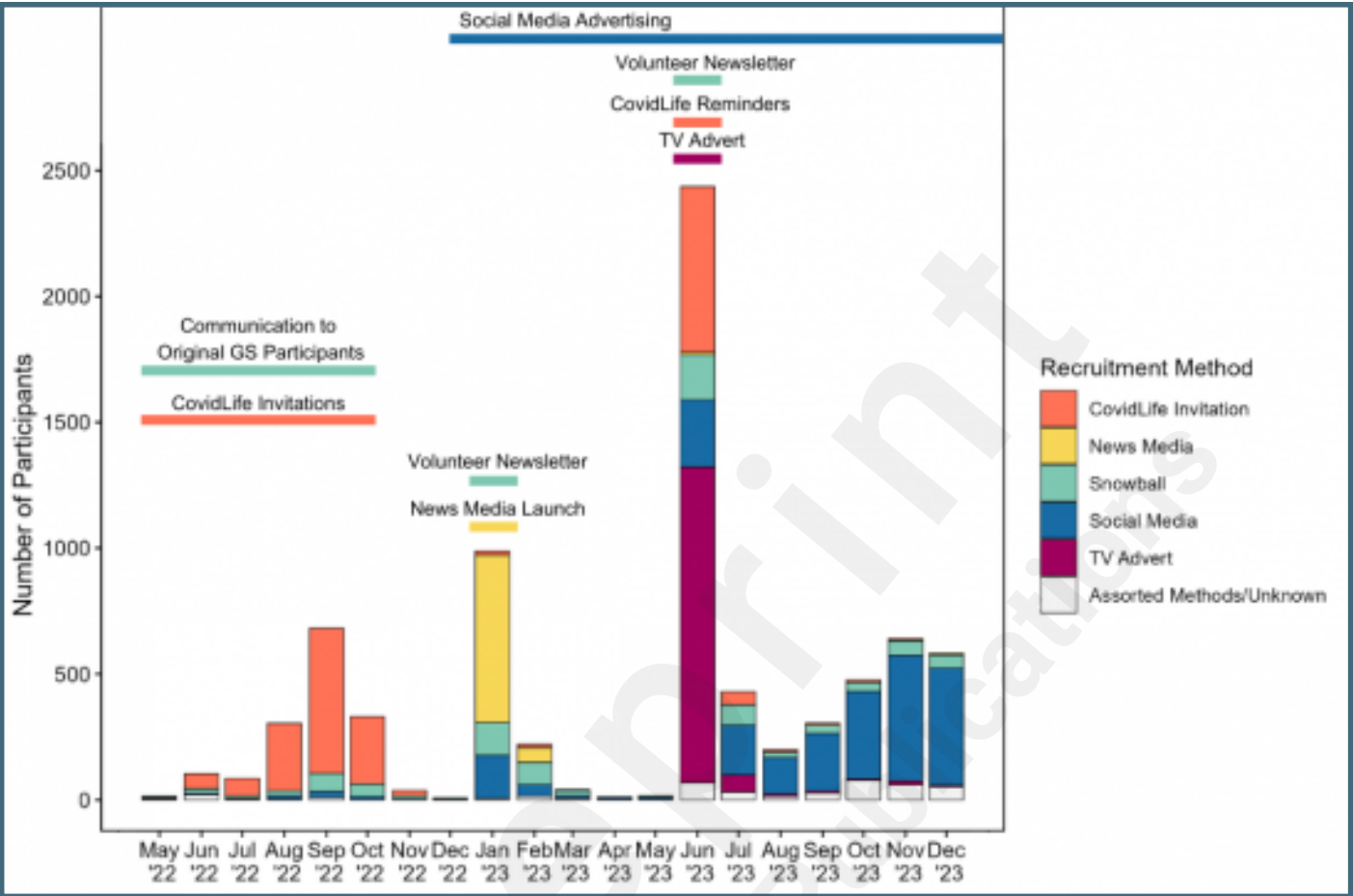
YPAG: Young Persons Advisory Group



Supplementary Files

Figures

Timeline of new participant recruitment to the GS cohort from May 2022 to December 2023 including the periods of coverage for each recruitment method activity.



Multimedia Appendixes

Supplementary figures and tables.

URL: <http://asset.jmir.pub/assets/a5fcf1383f6e6e215be5fc1dc92bff8b.docx>

Chi-squared and pairwise test results evaluating sample return rate between recruitment method and demographic factors.

URL: <http://asset.jmir.pub/assets/f3095f1a3409f2260346496d0ab205cf.docx>

