

Research: Educational and Psychological Aspects

Influence of sociodemographic characteristics on the preferred format of health education delivery in individuals with type 2 diabetes mellitus and or cardiovascular disease: a questionnaire study

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Abstract

Aim To examine the influence of sociodemographic factors of interest on preference for a particular health education format among people with type 2 diabetes and/or cardiovascular disease.

Methods A questionnaire was used to collect information on the influence of six sociodemographic factors of interest on the preference for health education formats in people with type 2 diabetes and/or cardiovascular disease. Chi-squared tests were used to examine the distribution of preferences between groups. The characteristics of the population preferring the online format were then examined in more detail using logistic regression.

Results Responses were received from 1559 participants. Overall the preferred health education format was one-to-one learning from a doctor or nurse (67%). Age, gender, diagnosis and educational level all affected the preferences expressed. The characteristics showing most consistent and significant influence were age and educational level. Overall, 29% ranked the online format highly (scores 1 or 2). This group were more likely to be aged < 65 years ($P < 0.001$) and to have a higher level of educational attainment (upper secondary education or higher; $P < 0.001$).

Conclusions Significant differences between sociodemographic groups exist in preferences for health education formats among people with type 2 diabetes and/or cardiovascular disease. Preferences should be considered when designing educational interventions to ensure they are accessible to the target group and to avoid increases in health inequality.

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Introduction

Type 2 diabetes and cardiovascular disease are two of the largest causes of ill health and mortality worldwide. Diabetes affects 415 million people worldwide, of whom 90% have type 2 diabetes [1]. Cardiovascular disease is the number one cause of death globally [2]. The two conditions frequently co-occur, with cardiovascular disease affecting 32% of people with type 2 diabetes and being responsible for over half of deaths in this group [3]. The diseases also share many risk factors, including obesity, dysglycaemia and hyperinsulinaemia [4]. Whilst

effective medical treatment is a key component of managing these diseases, the person's lifestyle significantly impacts the trajectory of each disease [2,5].

Making the necessary lifestyle adjustments requires the individual to be informed about and to understand the importance of these factors with regard to their disease [6]. Self-management education is an important method to help people with diabetes or cardiovascular disease develop this understanding, and there is a growing body of evidence to support this [7]. Recent systematic reviews have shown that self-management education improves HbA_{1c}, self-efficacy and diabetes knowledge [8], and reduces all-cause mortality in type 2 diabetes [9]. In cardiovascular disease, educational interventions have been found to improve biological variables, such as blood pressure and cholesterol, as well as to reduce cardiac recurrence risk and overall mortality [10].

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What's new?

- Health education in a variety of formats is an essential foundation for treatment of type 2 diabetes and cardiovascular disease.
- This study identified distinct format preferences for different sociodemographic groups, particularly related to age and education level.
- This knowledge highlights the importance of ensuring access to educational interventions for vulnerable people with type 2 diabetes and/or cardiovascular disease.

Helping the person better understand their disease can improve their coping strategies and help them live well with the disease in addition to reducing disease-related anxiety [5,11]. Furthermore, people with diabetes who have knowledge of their own HbA_{1c} have been found to have better disease control [12]. The required lifestyle changes, such as maintaining a healthy weight, managing dietary cholesterol and incorporating regular exercise are also similar between the two conditions. The described commonalities in epidemiology, risk factors and management have led us to consider self-management education for type 2 diabetes and cardiovascular disease together in this study.

Educational information is available for people with type 2 diabetes and/or cardiovascular disease in a wide variety of formats, including one-to-one advice, printed information, group-based structured education, and telephone helplines. Offering a variety of formats is intended to widen access to self-management education for people with cardiometabolic disease [13]. The internet is a method of delivering/receiving information that has grown in the past 15 years, and several authors have proposed that it may be a useful way to reach geographically or socio-economically isolated groups [14]. Others have suggested that the necessity for computer literacy or the economic means to own a computer might limit its utility [11]. The results of the recent Health Living for people with Diabetes (HELP) study testing a web-based self-management education programme in the UK was mixed, showing moderate impact on HbA_{1c} but no impact on diabetes-related distress, in the main trial [15]; however, the intervention did previously show a positive effect on diabetes-related distress in a mixed-methods study of a sample of 19 people [16], in which improvements in self-efficacy and support, management of low mood, and diabetes awareness were also observed. Cardiac rehabilitation has also been translated to an online format, an example of which is the Activate Your Heart web-based cardiac rehabilitation programme. This was demonstrated to improve exercise capacity, quality of life and dietary habits in people with coronary heart disease [13].

In the past 15 years many studies have evaluated internet-based educational interventions for people with type 2 diabetes and cardiovascular disease [11]; however,

systematic reviews have identified a need for more information to determine for which particular group of people, with respect to sociodemographics, this format is useful [17]. Respecting individuals' preferences in terms of educational methods is probably key to encouraging target group engagement with health education, which is currently underutilized [18]. Understanding individuals' preferences will help ensure that future educational materials are designed in the most effective way possible.

The aim of the present questionnaire study was to address this knowledge gap and identify whether preference for a particular method of health education may be associated with particular sociodemographic factors of the target groups. Tailoring of self-management education interventions to certain demographic groups, for example, certain ethnic minorities or age groups, has been recommended in order to increase efficacy, in both diabetes and cardiovascular disease [19,20]. Despite its importance, the question of what factors influence preference for a particular health education format remains largely unanswered in the literature to date. Additionally, with respect to internet-based education, it is likely that attitudes will have evolved with time; therefore, there is a need to re-evaluate the topic continually.

Methods

Study design

No suitable validated tool was available for data collection, therefore, a self-completion questionnaire was developed. Firstly, the literature was searched regarding the structure of questionnaires used for similar studies. The UK data service, a database of validated questions regarding demographic information was then consulted for suitable questions. The six most commonly occurring demographics were selected. The decision to focus on only six characteristics was made to ensure the questionnaire was as short as possible to reduce respondent burden and increase the response rate. In addition to demographics, eligibility questions and ranking questions about preferences for methods of learning about their condition were also included. The questionnaire was then reviewed by a panel of experts in questionnaire design. Finally, the questionnaire was shown to a small focus group of potential respondents to consider acceptability and ease of understanding. The test data were not included in the final dataset because adjustments were made according to the suggestions made.

The study was concerned with associations between sociodemographics and preferences for education in cardiometabolic health; therefore, the questionnaire study was undertaken in a population with either cardiovascular disease or established type 2 diabetes, or both. The study used convenience sampling with a multi-pronged recruitment strategy to facilitate recruitment of a wide range of people with the conditions of interest. The questionnaire is available in full in Appendix S1.

Ethics

Ethical approval was obtained after proportionate review by a National Health Service research ethics committee (ref. 17/NW/0037). The sponsor had no role in the design, undertaking or reporting of the study. Participants verbally consented to take part in the study. A formal consent form was not signed to avoid collection of personally identifying data. The participants were aware that they could refuse to participate without any implications for their care. Acceptance, completion and return of the questionnaire was a further indicator of agreement to participate.

Study participants

Potential participants for the study were identified through diabetes eye clinics and general practices. Participants were approached directly by their health provider, therefore, no information was shared with the research team prior to their agreement to participate. Participants were given the option to return the questionnaire either online or via paper copy. There was a single time point of completion for each participant.

Eligibility criteria were: age ≥ 18 years; diagnosis of cardiovascular disease (defined as heart disease, peripheral vascular disease or stroke) and/or established type 2 diabetes; not having already completed the questionnaire; and being able and willing to complete the questionnaire.

Sociodemographic factors

The population characteristics analysed included diagnosis, age, gender, ethnicity, highest completed level of education and socio-economic status. Socio-economic status was inferred at the level of the general practice from Public Health England data on Index of Multiple Deprivation (IMD). The IMD combines information from seven domain indices which measure different types or dimensions of deprivation, to produce an overall relative measure of deprivation, on a small neighbourhood level. This method of practice-level IMD coding was chosen in order to maximize the number of responses. Large numbers of personal or personally identifying questions would have been required to calculate socio-economic status on an individual level, which was deemed to be off-putting to the participant.

For the primary analysis, age was divided into four categories (≥ 50 , 51–65, 66–79 and ≥ 80 years). Ethnicity was grouped as white British, South Asian and all other ethnicities, based on the most prevalent ethnicities described. IMD deciles were re-coded into tertiles based on the population, and grouped as low (most deprived), middle and high (least deprived).

Statistical analysis

Statistical analysis was performed using SPSS version 25. A significance level of 5% was used, with no allowance for multiplicity. Sociodemographic characteristics of respondents

correctly completing and incorrectly completing the questionnaire were compared using a chi-squared test, or Fisher's exact test when cell numbers were < 5 .

Primary analysis

In the primary analysis, for each sociodemographic factor of interest, chi-squared analyses were used to assess associations with preferred educational method.

Subgroup analyses

As a large number of participants ranked one-to-one education with a doctor or nurse as the most preferred learning method, there was a fairly small number of respondents ranking other methods as their overall first choice. Therefore, in order to perform meaningful analysis about other methods also, we carried out subgroup analyses for the highest ranked method when one-to-one education was excluded, in the whole population. This allowed us to look at preferences regarding non-face-to-face methods (particularly online) across a large number of respondents.

In accordance with the study aims of investigating the demographics of respondents preferring the online format of education, we then examined in more detail the characteristics of those who preferred online education (i.e. as first or second choice). Further chi-squared tests were used to ascertain whether the sociodemographic characteristics of this group differed from those of the population as a whole.

After ruling out collinearity, logistic regression was performed to assess the relative impact of each of the sociodemographic factors of interest on preference (or otherwise) for online health education. One problem was that some participants had failed to rank the online method entirely. From assessing the affected questionnaires in context, including answers to white space questions, it was inferred that the majority of these participants were using 'non-ranking' to express a preference against the method; therefore, the decision was made to count these questionnaires as 'online not highly ranked'. A sensitivity analysis was conducted to assess whether this materially changed the conclusions in comparison to coding these responses as missing data.

Results

A total of 1559 eligible responses were received and analysed. Thirty-one respondents (2%) had not completed the ranking section of the questionnaire appropriately and, unfortunately, it was necessary to exclude these respondents from the preference analyses.

Participant characteristics

Overall, the sample consisted of 58% men, and had a mean (SD; range) age of 66 (12.3; 21–95) years. The most common

diagnosis was type 2 diabetes [1273 participants (82%)], while 527 participants (34%) had cardiovascular disease. A total of 251 participants (16%) had both type 2 diabetes and cardiovascular disease.

Sociodemographic data on the respondents, and a comparison between the complete and incomplete ranking groups, are presented in Table 1. To ascertain representativeness, sample demographics were compared with published Public Health England data for the Central Midlands region [21]. The sample was representative of published data regarding ethnicity and sex. The sample had a higher proportion of people aged > 65 years and individuals with the greatest levels of deprivation than the region in general, in keeping with the known higher prevalence of cardiometabolic disease in these populations. Participants with incomplete responses did not differ significantly from those with complete responses except regarding ethnicity.

Primary analysis

In the overall sample, the most preferred method across all groups was learning one to one from a doctor or nurse (67%, $n = 1358$). The sociodemographic factors which introduced a statistically significant difference in preference distribution were gender ($P = 0.015$) and age ($P < 0.001$). The full results of the analysis of first choice method variation for all sociodemographic factors is presented in Table 2. The

preference for one-to-one learning was much more widely held (75%) in those aged ≥ 80 years in comparison to the youngest age group, those aged ≤ 50 years (56%). Additionally, a substantial minority of the younger population preferred the online method (17%), whereas this was unpopular with older groups (2.9%). For gender, the differences were less pronounced, therefore, although statistically significant, they may not be clinically important. However, a higher proportion of men than women preferred the one to one (69% vs 66%), online (11% vs 8.9%) and telephone (4.1% vs 3.4%) methods, and more women than men preferred group (7.4% vs 4.4%) and leaflet (14% vs 12%) methods.

Subgroup analysis: methods other than face to face

When the one-to-one method was removed, preferences were more evenly spread. Leaflet was the most popular, preferred by 610 participants (40%). This was followed by online, preferred by 427 participants (28%). Factors that showed a significant influence on the distribution of preferred method were diagnosis ($P = 0.046$), gender ($P = 0.02$), age category ($P < 0.001$) and highest level of education ($P < 0.001$). Table 3 shows analyses by individual sociodemographic factors. Similar patterns in learning method preferences were observed as described in the primary analysis.

Table 1 Sociodemographic characteristics of the study population of those with complete and incomplete questionnaires

		All participants n (% of total population)	Complete n (% by covariate)	Incomplete n (% by covariate)	P
Diagnosis	Type 2 diabetes only	1020 (66)	1003 (98)	17 (1.7)	0.63
	Cardiovascular disease only	192 (12)	187 (97)	5 (2.6)	
	Stroke only	63 (4.1)	62 (98)	1 (1.6)	
	Multiple cardio-metabolic comorbidities	275 (18)	272 (99)	3 (1.1)	
Gender	Women	646 (42)	634 (98)	12 (1.9)	0.66
	Men	896 (58)	882 (98)	14 (1.6)	
Age	≤ 50 years	171 (11)	168 (98)	3 (1.8)	0.95
	51–65 years	516 (34)	507 (98)	9 (1.7)	
	66–79 years	619 (41)	609 (98)	10 (1.6)	
	≥ 80 years	197 (13)	195 (99)	2 (1.0)	
Ethnicity	White	1408 (92)	1390 (99)	18 (1.3)	0.001
	South Asian	77 (5.0)	72 (94)	5 (6.5)	
	Other	47 (3.1)	44 (94)	3 (6.4)	
Socio-economic status	Low (IMD 1–4)	527 (35)	516 (98)	11 (2.1)	0.37
	Middle (IMD 5–7)	480 (32)	475 (99)	5 (1.0)	
	High (IMD 8–10)	491 (33)	481 (98)	10 (2.0)	
Highest level of education	No formal	117 (8.2)	116 (99)	1 (0.9)	0.68
	Primary	229 (16)	224 (98)	5 (2.2)	
	Lower secondary	457 (32)	450 (99)	7 (1.5)	
	Upper secondary	295 (21)	293 (99)	2 (0.7)	
	Degree or equivalent	326 (23)	321 (98)	5 (1.5)	
Total		1559 (100)	1528 (98)	31 (2.0)	

IMD, Index of Multiple Deprivation.

P values test for the difference between completers and non-completers, estimated using chi-squared test.

IMD 2015 decile score range: 1–10, where 1 is the most deprived and 10 the least deprived.

Bold indicates statistically significant result.

Table 2 First choice method for health education variation by sociodemographic factor

		First choice method n (% within category)						P
Overall		one to one 1358 (67)	Group 116 (5.8)	Online 200 (9.9)	Phone 77 (3.8)	Leaflet 260 (13)	Other 1 (0.0)	
Diagnosis	Type 2 diabetes	882 (67)	74 (5.6)	143 (11)	47 (3.6)	171 (13)	0 (0.0)	0.12
	Cardiovascular disease	170 (72)	9 (3.8)	17 (7.2)	10 (4.2)	30 (13)	0 (0.0)	
	Stroke	57 (70)	6 (7.4)	6 (7.4)	7 (8.6)	5 (6.2)	0 (0.0)	
Gender	Multiple	246 (66)	27 (7.2)	33 (8.8)	13 (3.5)	53 (14.2)	1 (0.3)	0.02
	Women	560 (66)	65 (7.4)	75 (8.9)	29 (3.4)	117 (14)	0 (0.0)	
	Men	788 (69)	51 (4.4)	123 (11)	47 (4.1)	140 (12)	1 (0.1)	
Age	≤50 years	140 (56)	13 (5.2)	43 (25)	20 (8.0)	35 (14)	0 (0.0)	<0.001
	51–65 years	437 (65)	41 (6.1)	88 (13)	27 (4.0)	78 (12)	0 (0.0)	
	66–79 years	553 (71)	49 (6.3)	59 (7.5)	18 (2.3)	102 (13)	1 (0.1)	
	≥80 years	184 (75)	8 (3.3)	7 (2.9)	7 (2.9)	39 (16)	0 (0.0)	
Ethnicity	White	1239 (68)	104 (5.7)	179 (9.8)	63 (3.5)	234 (13)	1 (0.1)	0.09
	South Asian	61 (65)	6 (6.4)	8 (8.5)	5 (5.3)	14 (15)	0 (0.0)	
	Other	38 (53)	6 (8.3)	12 (17)	7 (9.7)	9 (13)	0 (0.0)	
Socio-economic status	Low (IMD 1–4)	463 (66)	51 (7.2)	68 (9.7)	31 (4.4)	90 (13)	1 (0.1)	0.353
	Middle (IMD 5–7)	409 (68)	31 (5.1)	65 (11)	25 (4.2)	72 (12)	0 (0.0)	
	High (IMD 8–10)	437 (70)	30 (4.8)	50 (8.0)	21 (3.4)	86 (14)	0 (0.0)	
Highest level of education	No formal	103 (64)	12 (7.5)	11 (6.9)	9 (5.6)	25 (16)	0 (0.0)	0.20
	Primary	192 (68)	12 (4.2)	31 (11)	15 (5.3)	33 (12)	0 (0.0)	
	Lower secondary	409 (69)	37 (6.2)	56 (9.4)	19 (3.2)	76 (13)	0 (0.0)	
	Upper secondary	254 (66)	25 (6.5)	46 (12)	10 (2.6)	52 (13)	0 (0.0)	
	Degree or equivalent	293 (71)	14 (3.4)	46 (11)	15 (3.6)	43 (10)	1 (0.2)	

IMD, Index of Multiple Deprivation.

Data are numbers (%) of people with factor X preferring method Y.

P values test for the difference between groups, estimated using the chi-squared test.

IMD 2015 decile score range: 1–10, where 1 is the most deprived and 10 the least deprived.

Bold indicates statistically significant result.

Subgroup analysis: population ranking online education highly

Overall, 457 participants (29%) ranked the online method of health education highly (i.e. as first or second choice). The chi-squared analysis showed that factors significantly influencing how a participant ranked the online method were gender ($P = 0.010$), age ($P < 0.001$), and education level ($P < 0.001$). Participants ranking the online method highly were more likely to be younger, to be male and to have higher levels of education. Table 4 shows the full results of the chi-squared test to compare the sociodemographic characteristics of this group who preferred the online method with the study population as a whole. Ethnicity and socio-economic status did not appear to significantly influence the ranking.

Finally, direct logistic regression was performed to assess the impact of a number of sociodemographic factors on the likelihood of ranking the online learning method highly relative to not. The model contained five independent variables (gender, age, ethnicity, socio-economic status and highest level of education). The fully adjusted model containing all the predictors was statistically significant, chi-square (6, $n = 1559$) = 157.419 ($P < 0.001$), indicating that the model was able to distinguish between respondents who did and did not rank the online method highly. The model as a whole explained between 11% and 16% of the

variance in preference, and correctly classified 72% of cases. The sensitivity analysis regarding participants who had not ranked the online mode found that conclusions were not significantly changed by coding the responses as missing, but the quality of the logistic regression model (measured by goodness of fit) was reduced.

Only three of the independent variables made a unique statistically significant contribution to the model (gender, age and educational level). The strongest predictor of preference was higher education, odds ratio of 2.14 (95% CI 1.58 to 2.90). The full results are presented in Table 5. Figure 1 shows this information in a forest plot.

Discussion

Overall preference for all groups for self-management education programmes in people with cardiovascular disease or type 2 diabetes was one-to-one learning from a doctor or nurse. Groups varied in their preferences for other methods. Sociodemographic factors significantly impacting on the preferences were gender, age and level of educational attainment. With respect to online education the population that ranked this method highly were notably different from the population as a whole, they were more likely to be younger (aged ≤50 years), more likely to be men and more likely to have higher levels of completed education.

Table 3 Analysis of highest ranked choice other than one to one by different sociodemographic groups

		First choice if not one to one n (% within group)					P
		Group 297 (19)	Online 427 (28)	Phone 198 (13)	Leaflet 610 (40)	Other 8 (0.5)	
Overall							
Diagnosis	Type 2 diabetes	202 (20)	304 (30)	121 (12)	392 (38)	5 (0.5)	0.046
	Cardiovascular disease	27 (15)	43 (25)	26 (15)	77 (44)	2 (1.1)	
	Stroke	10 (17)	14 (24)	16 (27)	19 (32)	0 (0.0)	
	Multiple*	58 (21)	64 (23)	34 (12)	121 (44)	1 (0.4)	
Gender	Women	145 (23)	155 (24)	81 (13)	257 (40)	6 (0.9)	0.02
	Men	150 (17)	268 (30)	115 (13)	349 (39)	5 (0.6)	
Age	≤50 years	36 (17)	91 (43)	27 (13)	58 (27)	1 (0.5)	<0.001
	51–65 years	106 (20)	180 (33)	62 (11)	192 (35)	3 (0.6)	
	66–79 years	120 (21)	135 (23)	75 (13)	242 (42)	4 (0.7)	
	≥80 years	26 (16)	13 (8.0)	27 (17)	97 (60)	0 (0.0)	
Ethnicity	White	268 (19)	385 (27)	169 (12)	565 (41)	7 (0.5)	0.076
	South Asian	15 (22)	15 (22)	13 (19)	24 (35)	1 (1.5)	
	Other	12 (20)	22 (36)	12 (20)	15 (25)	0 (0.0)	
Socio-economic status	Low (IMD 1–4)	117 (22)	145 (27)	74 (14)	203 (378)	3 (0.6)	0.27
	Middle (IMD 5–7)	83 (18)	139 (30)	65 (14)	177 (38)	1 (0.2)	
	High (IMD 8–10)	87 (19)	114 (24)	58 (12)	205 (44)	4 (0.9)	
Highest level of Education	No formal	18 (18)	18 (18)	19 (19)	44 (44)	0 (0.0)	<0.001
	Primary	37 (16)	58 (26)	40 (18)	91 (40)	0 (0.0)	
	Lower secondary	86 (20)	104 (24)	54 (12)	189 (44)	1 (0.2)	
	Upper Secondary	71 (22)	101 (32)	23 (7.2)	126 (39)	0 (0.0)	
	Degree or equivalent	62 (18)	128 (37)	41 (12)	110 (32)	5 (1.4)	

IMD, Index of Multiple Deprivation.

Data are numbers (%) of people with factor X preferring method Y.

P values test for the difference between groups, estimated using chi-squared test.

IMD 2015 decile score range: 1–10, where 1 is the most deprived and 10 the least deprived.

*Multiple cardio-metabolic comorbidities.

Bold indicates statistically significant result.

Table 4 Comparison of sociodemographic factors between population ranking the online method highly and the overall population

		Online highly ranked, n (% within group) 457 (29)	Online not highly ranked, n (% within group) 1102 (71)	P
Overall				
Gender	Women	167 (26)	479 (74)	0.010
	Men	286 (32)	610 (68)	
Age	≤50 years	100 (58)	71 (42)	<0.001
	51–65 years	188 (36)	328 (64)	
	66–79 years	144 (23)	475 (77)	
	≥80 years	16 (8.1)	181 (92)	
Ethnicity	White British	413 (29)	995 (71)	0.62
	All other ethnicities	39 (31)	85 (69)	
Socio-economic status	Low (IMD 1–4)	159 (30)	368 (70)	0.11
	Middle (IMD 5–7)	146 (30)	334 (70)	
	High (IMD 8–10)	123 (25)	368 (75)	
Highest level of education	No formal	19 (16)	98 (84)	<0.001
	Primary	57 (25)	172 (75)	
	Lower secondary	110 (24)	347 (76)	
	Upper secondary	116 (39)	179 (61)	
	Degree or equivalent	135 (41)	191 (59)	

IMD, Index of Multiple Deprivation.

P values test for the difference between groups, estimated using chi-squared test.

IMD 2015 decile score range: 1–10, where 1 is the most deprived and 10 the least deprived.

Bold indicates statistically significant result.

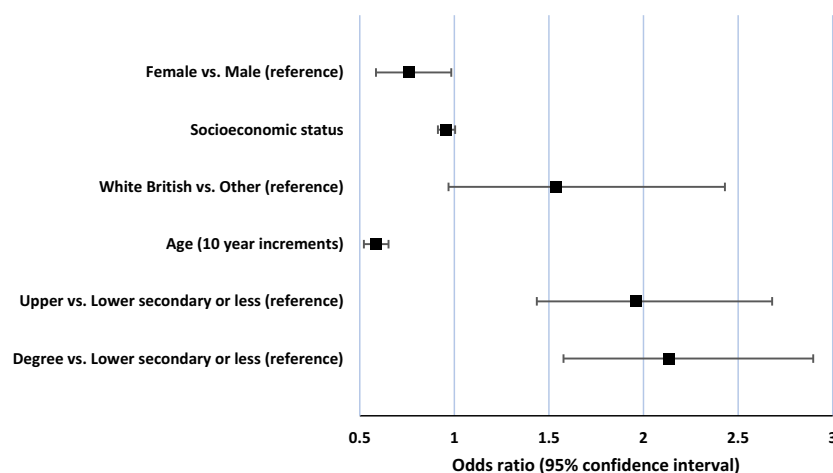
Our findings are consistent with those of Sarkar *et al.* [22], who also identified a significant difference in education format preferences between participants of differing ages and levels of

educational attainment. Similar to our study, they found that older people were less likely to accept the online method, as were those with less than high school level education.

Table 5 Odds of ranking the online learning method highly by socio-demographic factors

Factors	Odds ratio	95% CI (lower, upper)	P
Gender (women vs men)	0.76	0.59, 0.98	0.04
Socio-economic status (one-decile increment)	0.96	0.91, 1.00	0.07
Ethnicity	1.54	0.97, 2.43	0.07
Age (10-year increment)	0.58	0.52, 0.65	<0.001
Highest education (vs none–lower secondary)			
Upper secondary education	1.96	1.44, 2.68	<0.001
Degree	2.14	1.58, 2.90	<0.001
Constant	9.47		<0.001

Bold indicates statistically significant result.

**FIGURE 1** Forest plot of logistic regression results showing effect of sociodemographic factors on likelihood of ranking an online education format highly.

Gorter *et al.* [23] looked at a similar question in a comparable sample size, with a similar age, gender and ethnicity distribution, also finding an overall preference for education delivery by a doctor or nurse, during the regular check-up rather than as part of a separate course. However, their analysis of sociodemographic factors was more concerned with which self-management tasks respondents found more or less burdensome, and consequently their study was not directly comparable with the present study.

Our finding that educational preferences depend significantly on age is pertinent, in view of the aging population; however, it is important to note that the current young population will in time make up the older age group and may carry their current preferences with them.

The other factor that consistently emerged as influential in terms of health education format preference was the person's level of educational attainment. This finding is critical in light of the well documented disadvantages that the population with low educational attainment have with respect to cardiometabolic disease. This group has been demonstrated variously to be at higher risk of developing cardiometabolic disease [24–26], less likely to attain treatment targets

[29,30], and to have higher rates of complications and mortality [29,30]. Thus this represents a key target group for future educational interventions, for whom preferred format options should be made available. The finding that this group was less likely to prefer the online method raises concerns that a blanket roll-out of online health education might disadvantage this already vulnerable group and widen health inequalities.

This is the largest study to date looking at the influence of sociodemographic factors on health education preferences in type 2 diabetes and/or cardiovascular disease and the first in the UK population. The study covered a wide geographical area and used multiple channels of recruitment. The study had some weaknesses, particularly issues of selection bias due to the low proportion of responses from non-white British individuals, despite data gathering in ethnically heterogeneous locations, which is likely to be because the questionnaire was only available in English. Certain respondent groups within the diagnosis categories also received very few responses. The results reported regarding both of these factors should be interpreted with caution because of the small sample sizes. Furthermore, due to the methods of

distribution of the questionnaire, it was not possible to know the response rate (for example, it was impossible to know how many people had viewed the webpage but declined to complete it).

A diverse recruitment strategy was implemented in order to capture opinions of people with preferences for a range of formats; however, we cannot know what the preferences would have been for those who we did not reach, and who may also be the group who are hardest to target with health education. To encourage a large sample, the questionnaire was kept deliberately simple. This limited the number of factors about which we were able to collect data; for example, we did not collect data about duration or severity of disease or health literacy, which may also influence preferences. Additionally, socio-economic status was only measured at the general practice level. This improved questionnaire acceptability to participants and may have helped maximize response numbers, but it meant the data regarding socio-economic status are less accurate than if they were collected at an individual level.

In the case of some results, particularly the effect of diagnosis on first choice preference, the *P* value was very close to the significance level. Although classed as significant, conclusions drawn from results close to the significance level should be interpreted more tentatively.

In conclusion, significant differences exist in how different sociodemographic groups prefer to learn about their cardiometabolic health and it will be important to take these preferences into account in order to develop educational resources targeted to the most vulnerable groups, those with poor outcomes or who are otherwise under-served by current healthcare provision. Future work may focus on further understanding of the reasons for these preferences, differences between the primary and secondary care populations and development of group preference-specific educational resources.

Across all groups one-to-one learning with a doctor or nurse was preferred and should continue to be offered, which is an important finding in the context of the current shift towards digital healthcare. Other methods may be useful as supplementary to the consultation.

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Competing interests

A.K.W., Y.C. and C.G. have no conflict of interests to declare. S.I.S. has received honoraria for speaking at meetings and serving on Advisory Boards for Novartis, Sanofi-

Aventis, Novo Nordisk, Janssen, Merck Sharp & Dohme, AstraZeneca, Lilly and Boehringer Ingelheim.

M.J.D. does not hold any conflicts of interest, however, for transparency we provide the following statement of conflict: M.J.D. is the Principal Investigator on the DESMOND programme (Diabetes education and self-management for people with newly diagnosed type 2 diabetes). S.S. is employed by the University Hospitals of Leicester NHS Trust, which receives not-for-profit income for DESMOND. All authors are actively engaged in research and have previously received grants from the NIHR, the Medical Research Council and Diabetes UK to develop and test diabetes self-management education and support programmes like DESMOND. The University Hospitals of Leicester NHS Trust (with which S.S. has a contract) receives licensing fees to support implementation of the DESMOND programme in clinical commissioning groups in the UK, Ireland and Australia. K.K. has acted as a consultant and speaker for Novartis, Novo Nordisk, Sanofi-Aventis, Lilly, Servier and Merck Sharp & Dohme. He has received grants in support of investigator and investigator-initiated trials from Novartis, Novo Nordisk, Sanofi-Aventis, Lilly, Pfizer, Boehringer Ingelheim and Merck Sharp & Dohme. K.K. has also received funds for research, honoraria for speaking at meetings and has served on advisory boards for Lilly, Sanofi-Aventis, Merck Sharp & Dohme and Novo Nordisk.

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Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Appendix S1. Questionnaire used in the study.