A Survey Exploring Public Knowledge of Cardiovascular Disease Prevention in Cheshire, UK

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ABSTRACT

Background: Cardiovascular disease (CVD) is considered one of the leading causes of death in the UK, and annual statistical reports show that some areas in the north of England has one of the highest death rates due to CVD in the country.

Methods: A cross-sectional study was conducted in Cheshire to evaluate public knowledge and determine the most popular methods to receive updated information regarding CVD risk factors.

Results: 269 participants were eventually eligible for the analysis. The overall knowledge score was relatively high (median score = 12/12, IQR = 1); patients with a history of CVD or diabetes mellitus showed a lower level of knowledge compared with healthy individuals (P = 0.007). On the other hand, the internet was the most popular method to receive updated cardiovascular disease information (70% of the sample). Participants showed a tendency to visit official and governmental websites to obtain the needed information, and Google was the most selected platform in all age groups.

Conclusions: There might be a need to invest more time in providing CVD patients with sufficient instructions to ensure their adherence to secondary prevention measures. Also, more time and resources should be invested in developing official and governmental public health websites.

Keywords: Awareness, cardiovascular disease, knowledge, public health, social media.

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I. INTRODUCTION

In 2021, the British Heart Foundation (BHF) stated that approximately 8 million people are living with cardiovascular diseases (CVD) in the UK, with a death rate of 160,000 cases per year and an overall healthcare cost of 9 billion pounds annually [1]. Hence, several initiatives have been launched in the British community to encourage people to understand and control CVD risk factors and limit unhealthy behaviours, such as the 10-year CVD ambitions for England by the public health England organisation [2], and the national health service (NHS) long-term plan targeting the prevention of 150,000 cases of heart attack, strokes, and dementia in the next 10 years [3]. The impact of such policies would be tremendous; however, it is vital to assess the efficacy and effectiveness of these prevention policies by screening the public knowledge, specifically for subjects who might be exposed to the risks of CVD in the future, as in healthy adults and teenagers. Yet, this strategies would not be applicable unless several factors were taken into consideration, as it is important to adjust these policies according to each recipient's age, level of education, and many other factors that could severely influence the knowledge level of the public.

According to cumulative data in 2014, it was found that the north of England has one of the highest death rates due to CVD in the UK, specifically in Hyndburn, Tameside, and Blackburn in the north west [4]; these alarming numbers were also reported in the 2021 BHF report, where it was discovered that Manchester and Blackpool were among the top five UK areas with the highest premature CVD death rate between 2017 and 2019 [1]. One proposed explanation for these high rates is the fact that the north-west area is a massive industrial cluster for chemical and manufacturing businesses in the UK, as it was evident that exposure to certain chemical components might increase the risk of CVD [5], [6]. Another factor that could influence this high mortality rate is the fact that Liverpool, Knowsley, and Manchester are ranked among the top five most-deprived districts in England [7], which might also influence the level of CVD knowledge. Yet, all the previous factors would not provide an obvious explanation for the high CVD death rate in the north of England, and it would suggest an urgent need to screen the population's level of awareness regarding other CVD risk factors, such as stress, diabetes mellitus (DM), hypertension, and dyslipidemia.

This study aims to evaluate the public's CVD risk factors

knowledge and behaviour and assess the most preferred method to receive updated CVD information among the residents of Cheshire, in the north-west of England.

II. METHODS

A. Study Design and Participants

This was a cross-sectional study, where an online questionnaire was generated using Microsoft forms©. The inclusion criteria consisted of English-speaking adults who are currently living in Cheshire and able to use social media accounts; while the exclusion criteria were participants below 18, overseas respondents and UK residents living outside Cheshire area.

B. Protocol

The first stage of this questionnaire was participant's consent, where respondents were asked to read the participant's information and agree to the terms and conditions in order to take part in this study. This questionnaire was circulated on social media platforms using the largest public groups of each town in Cheshire by the lead researcher's personal account. Ethical approval was obtained by the University of Chester in 25-June 2021 (FREC reference number: 1803/21/AH/CMS); the recruitment period was between June 2021 and July 2021.

C. Questionnaire Design

This questionnaire was structured into four sections. The first section was designed to screen for participant eligibility; the second section was to define respondents' characteristics. The third part of the questionnaire included a 12-question quiz to evaluate each respondent's level of knowledge in CVD prevention, and it was developed using two pre-validated surveys which handled the same topic [8], [9]. The final part was established to determine the most preferred methods to receive updated CVD information.

D. Sample Size Calculation

According to the latest national statistical reports, the population of Cheshire was estimated to be 931,347 in 2019 [10]. By applying this population size with a confidence level of 80% and a margin of error of 7%, the minimum needed sample size is 84 participants [11].

E. Outcomes Measured

Firstly, the association of the quiz score (the proposed awareness level) with participants' characteristics. Secondly, the most selected method to receive updated CVD prevention information was measured.

F. Statistical Analysis

Data were extracted using Microsoft excel© and incomplete responses were excluded. Then data were standardised and checked for normality using the Kolmogorov-Smirnov test (K.S test). Statistical analysis was launched by the interpretation of descriptive statistics, where numerical variables were expressed in median and interquartile range, while nominal data were expressed in frequency and percentage. Afterwards, data were divided into subgroups according to the age and the BMI. IBM

SPSS version 26 was used to test for correlation, where Spearman test was used for nonnormally distributed numerical variables; at the same time, the Mann-Whitney-U test was used to test for difference among variables with two independent samples in nonnormally distributed data, while the Kruskal-Wallis test was used for variables with more than two independent samples; finally, the association among nominal variables was tested using the Chi-squared test. IBM SPSS© version 26 was used for data analysis, whereas Microsoft Excel© and GraphPad© were used to generate the relevant graphs. P-value < 0.05 was considered statistically significant.

III. RESULTS

A. Screening and Recruitment

The number of the screened participants who submitted their applications was 302. However, 19 respondents failed to fulfil the inclusion criteria, whereas 14 responses had incomplete data and were sequentially excluded (Fig. 1). The overall number of participants who were eligible for data analysis was 269.

B. Distribution of the Data

Numerical variables were checked for normality using the K.S test, and it was found that age, height, weight, and BMI were not normally distributed (K.S p-value < 0.05); hence, they were expressed using the median and interquartile range; whereas nominal variables were expressed with frequency and percentage, and the collected data were analyzed using nonparametric tests.

C. Participants' Characteristics

The median age of respondents was 48-years old (range 20-81) and age groups were divided according to the World Health Organization (WHO) glioma classification, where 49.8% of the sample was considered as "youth", 39.8% was considered as "middle age", and 10.4% was considered as "elderly". On the other hand, 84.4% of the sample were females and 15.2% were males; additionally, 66.2% of the sample were nonsmokers, compared to 33.8% who were smokers or previous smokers; 10.4% of the sample had a history of CVD or DM, and according to the WHO BMI classification, 33.1% of the sample had normal weight, 31.6% were pre-obese, and 33.4% were obese. Finally, 23.4% of the sample had a school degree compared to 46.5% who completed a higher education level (Bachelor, Master's, or PhD), as shown in (Table I). The median quiz score was 12/12 (the questions and the percentage of the answered questions are shown in the appendix).

D. Factors Influencing Participants' Awareness

After applying the Spearman test, no significant correlation was found between the quiz score and the age of the participants (Fig. 2A). Also, no significant difference was found between the quiz score and the different age groups using Mann-Whitney U. Simultaneously, the quiz score and the BMI failed to show a statistically significant correlation (Fig. 2B), and no significant difference was found among the different BMI groups. Three BMI values (10.5, 51, and 55 kg/m2) were considered outliers, however,

the outcomes were not altered before or after their exclusion, and they were included in the analysis. Finally, the Kruskal-Wallis test was used to study the difference of the quiz score according to gender, educational level, work field, and smoking habits, yet, no significant difference was found among these groups (p-value > 0.05).

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On the other hand, the Mann-Whitney U test was used to investigate the difference of the quiz score according to participants background as healthcare workers and no significant difference was found, as shown in (Table II).

Interestingly, a gap was recognised according to the presence of a previous history of CVD or DM. These participants had a lower median score compared to healthy participants (p-value = 0.007), as shown in (Fig. 3).
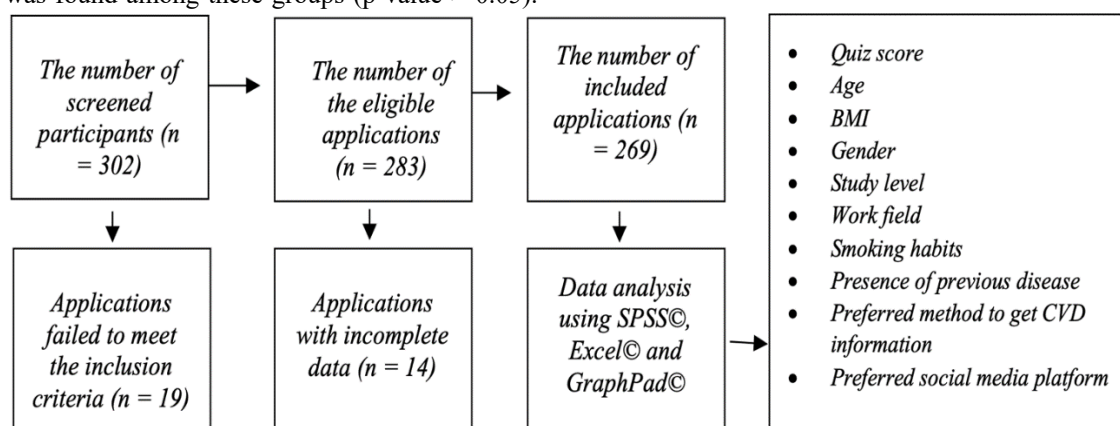

Fig. 1. Summary of the study protocol (BMI: Body mass index, CVD: cardiovascular disease).

TABLE I: BASELINE CHARACTERISTICS

| Variable	N (%)	Median	Interquartile range
Age (Years)	269 (100%)	48	21
Youth (15-47)	134 (49.8%)	36	14
Middle-age (48-63)	107 (39.8%)	55	7
Elderly (>64)	28 (10.4%)	67	6
Gender	269 (100%)	-	-
Female	227 (84.4%)	-	-
Male	41 (15.2%)	-	-
Prefer not to say	1 (0.4%)	-	-
Weight (kg)	269(100%)	74	24
Height (meter)	269(100%)	1.65	0.125
BMI (kg/m2)	269(100%)	27.26	8.93
Underweight (BMI<18.5)	5 (1.9%)	16.36	2.43
Normal (18.5<BMI<24.9)	89 (33.1%)	22.53	2.45
Pre-obese (25<BMI<29.9)	85 (31.6%)	27.41	2.73
Obesity I (30<BMI<34.9)	46 (17.1%)	32.28	2.71
Obesity II (35<BMI<39.9)	25 (9.2%)	36.21	1.99
Obesity (BMI>40)	19 (7.1%)	42.38	2.14
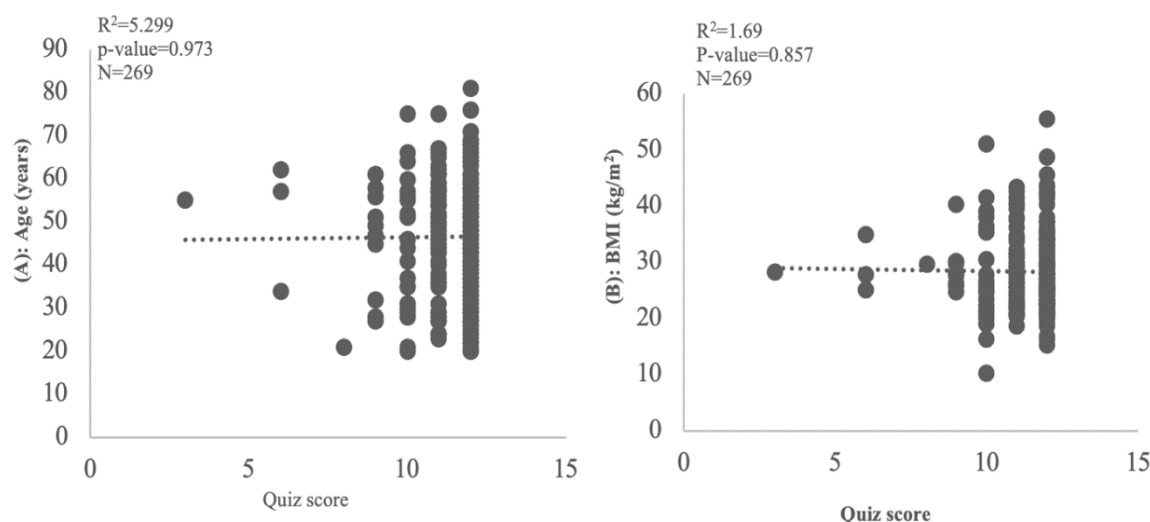
Fig. 2. A: Scatter plot of the quiz score with the age showing no correlation among the variables using Spearman test (p-value = 0.973, ρ=+0.2). B: Scatter plot of the quiz score with the BMI showing no correlation among the variables using Spearman test (p-value = 0.857, ρ=-0.11).

TABLE II: COMPARISON OF FACTORS COULD INFLUENCE CVD KNOWLEDGE (QUIZ SCORE)

| Sample size (269)		N (%)	Median quiz score	Interquartile range	P-value
Gender	Female	227 (84.4%)	12	1	
	Male	41 (15.2%)	12	1	0.276
	Prefer not to say	1 (0.4%)	-	-	
Healthcare worker	Yes	42 (15.6%)	12	1	0.235
	No	227 (84.4%)	12	1	
Educational level	School degree	63 (23.4%)	12	1	
	Bachelor's degree	80 (29.7%)	12	1	
	Master's degree	40 (14.9%)	12	1	0.373
	PhD degree	5 (1.9%)	12	2	
	Other	62 (23%)	11.5	1	
	Not applicable	19 (7.15)	12	1	
Work field	Business, finance, and insurance	40 (14.9%)	12	1	
	Hospitality, catering, and leisure services	12 (4.5%)	12	1	
	Manufacturing, construction, and agriculture	21 (7.8%)	11	2	0.314
	Public sector and education	72 (26.8%)	12	1	
	Social care	31 (11.5%)	12	1	
	Transport, retail and wholesale	16 (5.9%)	11.5	3	
	Other	77 (28.6%)	12	1	
Smoking habits	Smoker	25 (9.3%)	11	1	
	Previous smoker	66 (24.5%)	12	1	0.309
	Not a smoker	178 (66.2%)	12	1	
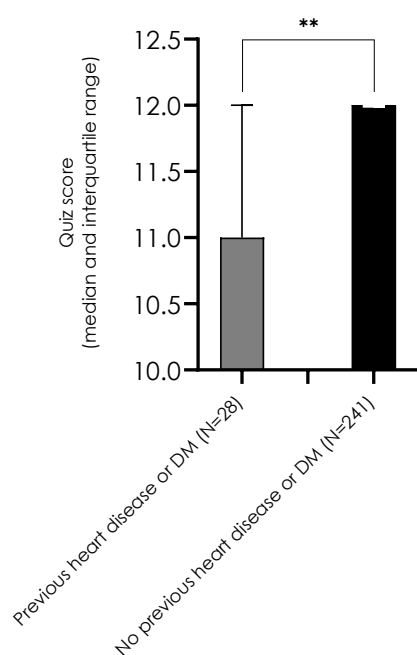
Fig. 3. Comparison of CVD knowledge according to the presence of previous heart disease.

E. The Preference of Participants to Receive Updated CVD Information

The current study findings propose that the internet was the most popular method, where it was the choice of 70.3% of the studied sample, whereas telephone calls and SMS were the least preferred ones, with only 0.4% (Fig. 4A). On the other hand, more than half of the sample (56.9%) chose to visit official and governmental websites like the NHS and the BHF, compared to 30.9% who preferred to search for CVD updated information using Google themselves (Fig. 4B). Finally, regarding the favorite social media platform to receive CVD information, Google+ was the most popular one with 41.6%, which is believed to be misinterpreted as the Google search engine instead of the Google+ platform, while the second most preferred social media platform was Facebook with 23.8%, as shown in (Fig. 4C). Moreover, the Kruskal-Wallis test was also used to assess the association of the participants' most preferred methods to receive CVD information (Internet, TV, radio, magazines, street advertisements, face-to-face discussion, telephone calls, and SMS) according to their age groups, however, no significant difference was found. Yet, a significant association was recognized regarding the preferred social media platform according to respondents' age, with a p-value of 0.001.
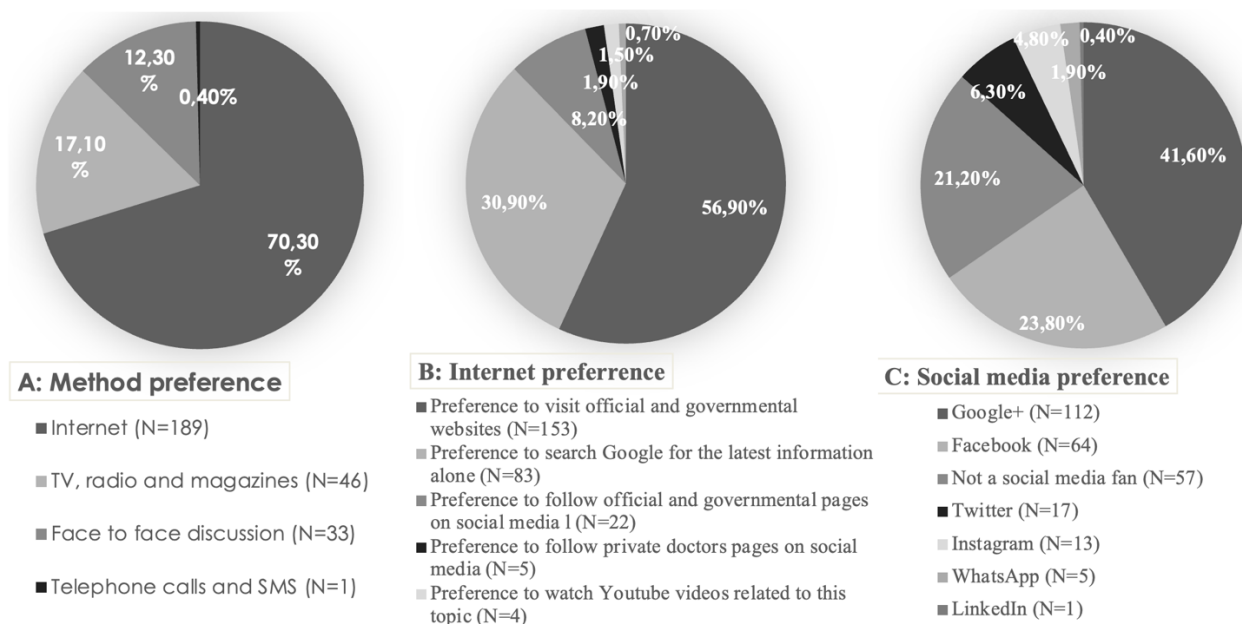
Fig. 4. A: The preferred method to receive updated CVD information. B: The internet preference of the participants. C: The most popular social media platform.

Furthermore, the Mann-Whitney U test was used to compare each platform according to the age, and statistically significant associations were found, as the youth population preferred Instagram, Twitter and Facebook, compared to the elderly population, who preferred Google search and WhatsApp, with a p-value < 0.05 (shown in asterisks in Fig. 5), while LinkedIn did not reflect a significant association due to the small number of participants who chose this platform in the first place (one participant).
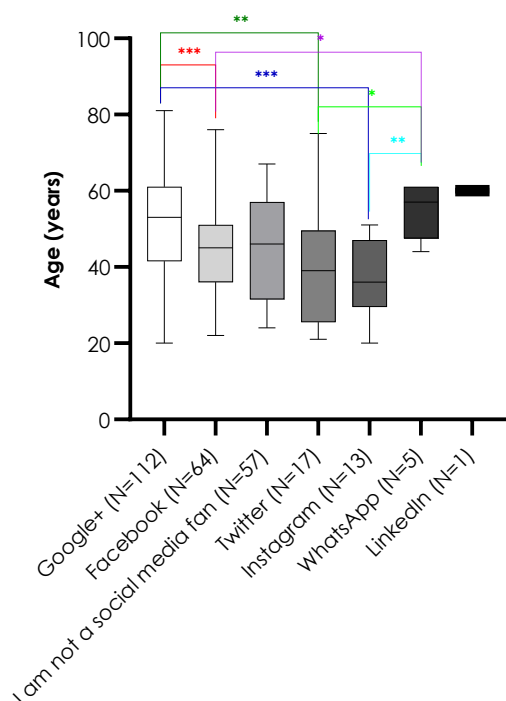

Fig. 5. The distribution of social media platform preference (X-axis) according to age (Y-axis), Mann-Whitney U test was applied between every two platforms and statistically significant associations were lined (*: P-value < 0.05, **: P-value < 0.01, ***: P-value < 0.001).

On the other hand, the Kruskal-Wallis test was also used to evaluate the potential association between the participants' quiz scores and both the most preferred method to receive CVD information and the most preferred social media platform. However, no significant difference was found.

Finally, the Chi-square test was applied to evaluate any potential association between gender, educational level, and work field with the preferred method to receive CVD information and the preferred social media platform. Nevertheless, no statistically significant association was found among the proposed variables (p-value > 0.05).

IV. DISCUSSION

To the best of our knowledge, this is the first study to be conducted in Cheshire to evaluate public knowledge regarding CVD risk factors and investigating the most popular method for receiving updated CVD prevention information.

A. Factors Influencing Participants' Awareness Levels

Our analysis showed that patients with previous history of CVD or DM had lower levels of CVD knowledge compared to healthy individuals. This finding was compatible with previous studies conducted in Australia and Canada, which showed that CVD patients had poorer knowledge of CVD risk factors [12], [13]. Also, one study conducted in China provided evidence that stroke patients had inadequate knowledge of CVD risk factors [14], whereas another study in the United States of America concluded that patients with peripheral artery diseases had insufficient knowledge of CVD risk factors [15]. These results could be attributed to the fact that a better knowledge of CVD risk factors would be reflected as a lower incidence of heart disease [16], which might have led these patients to develop their cardiac conditions in the first place; it might also be related to the inadequacy of patient verbal teaching by their supervising general practitioners (GP), especially that the standard GP consultation time in the UK is 10 minutes [17], which might

be considered an inadequate time to explain all the needed information to the patient.

Interestingly, no difference was found related to participants' educational level, whereas in the past several studies reported that higher educational levels were linked to higher awareness levels [18], [19]. One explanation for this finding is the improved knowledge level during the COVID-19 pandemic and the increased tendency of people to search for information regarding prevention methods to protect and maintain their health [20]. It is also noteworthy to mention that health education in the UK is included in key stage 3 and 4 curricula [21], which is for students between 11-16 years, leading to a healthier lifestyle during their adulthood. Simultaneously, no significant difference was found in CVD awareness according to age, although one study conducted in China provided evidence that the elderly had lower CVD knowledge levels compared to the younger generation [22]. However, in the UK, several factors could affect this finding, starting with the available access of public health services for the elderly over 65 years old [23], and the application of the national service framework strategy to ensure a healthier life for the elderly [24]. Finally, one study in the United Arab Emirates showed a lower level of CVD awareness among females compared to males [25]; such difference was not found in the current study, which could be related to the conservative social nature of the Gulf countries and relative community restrictions compared to the UK [26].

B. The Preference of Participants to Receive Updated CVD Information

As it was expected, the internet was the most preferred modality to receive CVD information and due to the rapid and continuous development of the online healthcare services, it became one of the most popular methods as the internet provides an easy access method to enormous amounts of information and allows people to answer specific questions about numerous topics and conditions [27]. Simultaneously, the lockdown also affected people's internet search and encouraged them to look for public health awareness information [28]. Yet, the question remains whether this personal health teaching approach would change people's behaviours regarding CVD risk factors or not.

According to our analysis, the most preferred social media platform in all age groups was Google+. However, the personal version of Google+ was hibernated in 2019 [29]. This information was not acknowledged by the lead investigator when this questionnaire was developed otherwise Google+ would had been excluded from the answers. Hence, it is believed that participants misinterpreted Google+ as the Google search engine. This presumption is supported by the fact that Google search engine is one of the most frequently used search engines and has a market share of 93% in the UK compared to all other internet search engines [30]. The second most selected platform was Facebook, which aligns with the fact that it is the most popular social media platform in the UK [31]. However, that would not be applicable to all age groups, as the current study found that Instagram, Twitter, and

Facebook were more preferred in the youth group (15-47 years).

Finally, the fact that more than half of the sample preferred visiting official and governmental websites (like the NHS and the BHF) to receive CVD information would reflect an adequate level of public trust in these institutes and indicates the professional nature of their services; this is compatible with the fact that people have a high level of trust in the NHS [32] and in the overall healthcare system in the UK [33].

C. Future Prospects

The current study could serve as a pilot study to evaluate its design and recognise possible limitations if it was applied to a larger population [34]. As this type of study is considered cost-effective, time-saving, and reproducible [35], an improved version of this questionnaire could be applied in the most affected CVD areas in the UK to evaluate the residents' awareness level.

D. Limitations

Caution must be addressed when drawing a conclusion from this study, as several limitations should be stressed. Firstly, the online nature of this questionnaire would not allow the researchers to reach people who might be happy to participate but do not use social media platforms, leading to selection bias. Also, the cross-sectional nature of this study would not reflect any change in CVD awareness level in the future.

V. CONCLUSION

Despite the continuous improvements in cardiovascular disease treatment strategies and the considerable efforts by researchers and healthcare professionals to reduce the burden and complications of cardiovascular disease, it is still considered as one of the leading causes of death in the UK; hence, it is important to focus on preventive measures alongside potential treatment strategies. This study was conducted to evaluate the public knowledge about CVD risk factors in Cheshire, as the north of England has one of the highest mortality rates due to CVD in the UK. The public knowledge was found to be satisfactory and no difference was found to be related to age, gender, educational level or work field; however, patients with previous cardiac conditions or diabetes mellitus were found to have a relatively lower CVD knowledge compared to healthy individuals, which raise the question whether the low level of awareness led them to develop their cardiac conditions and point to the need to invest more time in providing CVD patients with the adequate and sufficient instructions by their supervising healthcare professionals in order to ensure complete patients compliance with secondary prevention strategies. On the other hand, the internet was the most used method to search for CVD prevention information, this finding indicates that more time and resources should be invested to develop official and governmental public health websites, especially that participants showed a tendency to visit official websites to reach the needed CVD prevention information. Also, it might be useful to share CVD information using Instagram, Twitter, and Facebook in order

to reach the younger generation and reinforce CVD prevention concepts together with encouraging a healthier lifestyle among the youth since adolescence, which might be reflected as a reduced incidence of cardiovascular disease in the future leading to a reduced hospitalization, mortality rate and annual healthcare costs.

APPENDIX

TABLE III: THE PERCENTAGE OF EACH QUESTION ANSWERED CORRECTLY

Quiz statement (N=269)	Yes	No	Correct %
1. If you have a family history of heart disease, you are at risk for developing heart disease	240	29	89.2%
2. Smoking is a risk factor for heart disease	262	7	97.3%
3. A person who stops smoking will lower his risk of developing heart disease	255	14	94.7%
4. High blood pressure is a risk factor for heart disease	263	6	97.7%
5. Keeping blood pressure under control will reduce a person's risk for developing heart disease	257	12	95.5%
6. Stress increases the chance of heart disease	240	29	89.2%
7. Heart attack is a disease caused by narrowing or blockage of blood vessels to the heart	266	3	98.8%
8. Regular physical activity will lower a person's chance of getting heart disease	262	7	97.3%
9. Walking and gardening are considered exercise that will help lower a person's chance of developing heart disease	250	19	92.9%
10. A person who has diabetes can reduce their risk of developing heart disease if they keep their blood sugar levels under control	254	15	94.4%
11. A person who has diabetes can reduce their risk of developing heart disease if they keep their weight under control	266	3	98.8%
12. People with diabetes rarely have high cholesterol	22	247	91.8%

DATA AVAILABILITY

The data is securely stored and protected by the University of Chester to ensure participant confidentiality. For further information, please contact the corresponding author: 2020093@chester.ac.uk, or the Faculty of Medicine and Life Sciences Research Ethics Committee at the University of Chester: frec@chester.ac.uk.

CONFLICT OF INTEREST

Authors declare that they do not have any conflict of interest.

AUTHORS' CONTRIBUTIONS

A.H: collecting the data, writing the manuscript, and statistical analysis. H.H: examining the results, statistical analysis, and reviewing the manuscript.

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