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Assessment of the knowledge level regarding cardiovascular disease risk factors: Comparison across age groups

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Abstract

Introduction: Varied education sources concerning cardiovascular disease (CVD) risk factors exist. This study was to assess the knowledge level of CVD risk factors across age groups and whether certain educational sources contributed to greater knowledge.

Methods: Participant groups were those who had completed outpatient cardiac rehabilitation, general adults, college students, high school, and elementary school students. The survey consisted of demographics, sources of CVD risk factor information, and 11 questions assessing CVD risk factor knowledge. Relationships between survey data and score on the exam were explored with multiple regression, chi-square, and t tests.

Results: 406 surveys were administered with 381 analyzed (93.8%). There were significant differences between groups' knowledge of CVD risk factors ($p=0.034$) with college students knowing the most (88% correct) and elementary students the least (77%). Significant differences between groups existed for knowledge from formal education and mass media ($p<0.001$), along with internet and family experience ($p<0.003$). Family discussion had the greatest odds ratio for high level of knowledge (-3.78).

Conclusions: Age groups received CVD risk factor education from different sources leading to small, but significant differences in knowledge. Knowledge levels in this study were high over all age groups.

Introduction and Purpose

Cardiovascular disease (CVD) remains the greatest cause of mortality in the United States and a large portion of health care costs [1-3]. Efforts to improve CVD mortality rates have included medications, surgical interventions, preventive measures, and public education on the disease and associated risk factors. In 2017, the Center for Disease Control (CDC) was budgeted to spend $77 million on the Heart Disease and Stroke Prevention Program and the Million Hearts Program [4]. Both of those programs were designed to improve heart disease and stroke prevention through various methods which included education about CVD risk factors. Increasing CVD knowledge has been shown to have the potential to decrease an individual's actual CVD risk [1].

Although many studies have tried to assess specific populations' knowledge of CVD risk factors, [5-14] no studies have examined this knowledge level across multiple age groups. Also, despite educational efforts, CVD mortality rates have remained high. Increased knowledge of CVD risk factors has been seen as the first step to disease prevention by helping initiate lifestyle adjustments to prevent disease [10,12]. A recent systematic review examined the impact of health nutrition and physical activity counseling on improving dietary habits and physical activity levels [15]. There were 88 studies included in the review and the results showed that there were improvements in the dietary habits and physical activity levels of participants after the various counseling sessions/programs. However, the included studies did not have long term follow up periods. Furthermore, the review showed no statistical or clinical improvement in CVD morbidity, mortality and health related quality of life [15]. Specific components of the counseling and education sessions weren't examined to determine whether certain parts were more or less effective on behavior change either.

Little to no research exists to examine which type of education provides the greatest translation to knowledge of CVD risk factors. Of the studies that have examined education of CVD risk factors, they haven't examined the participant's overall knowledge level, but instead were specific to that study's educational intervention only. These specific educational interventions have occurred with specific patient populations as well. There are no studies examining various sources of information or at various age populations. It is important to know if certain methods of education lead to better knowledge of CVD risk factors. If so, that would allow educators to focus on that method to achieve greater knowledge results. It is also important to know if there is an age group that has greater or lesser knowledge to guide delivery timing. CVD risk occurs starting at young ages and is disease that occurs due to cumulative exposure to poor diet, sedentary behaviors, etc. Previous theories have been to provide education about CVD risk factors at a young age and continue throughout the lifespan

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to prevent these cumulative behaviors, yet to date, no one has assessed if knowledge of these risk factors is different among age groups.

The purpose of this study was to determine whether differences in knowledge of CVD risk factors existed among age groups, whether the knowledge levels were related to specific source(s) of information, and whether different participant groups used different sources of information to formulate their knowledge.

Methods

Participants: Participant groups consisted of elementary school students in 4th or 5th grade (ES), high school students in 10th or 11th grade (HS), college sophomores or juniors not in health career majors (Coll), individuals who had completed an outpatient cardiac rehabilitation program (CR), or general adults who were > 40 years of age and who had not attended cardiac rehabilitation (Adult).

For recruitment for survey administration locations for minor populations (ES and HS), grammar schools and high schools were contacted and approval for research was obtained. For administration to Coll student participants, approval to contact students was obtained at various institutions based on faculty willingness to notify their students of the study. Recruitment for those in the CR group were via contact to phase III cardiac rehab centers in Western NY. For locations for survey administration to the Adult group, churches, and senior centers were contacted and fliers put out about the study prior to data collection.

Data collection for ES and HS students occurred in New York, USA. ES also had subjects in California, USA. Coll were from New York, Ohio, and Pennsylvania, USA and Ontario, Canada. For Adults, data collection occurred in New York, USA. CR subjects were recruited from NY, USA phase III cardiac rehab programs.

The study was approved by the institutional review board at D'Youville College Buffalo, NY, USA and registered with National Institute of Health Clinical Trials, ID: NCT03936686. Prior to administration of any surveys to minors, both parental/guardian written consent, as well as student written assent were obtained. Written consent was also obtained prior to administration of any surveys to all other study participant groups. Inclusion criteria were specific to age for each population group and then also included full completion of the survey. For the CR group, inclusion criteria also included attendance in a phase II cardiac rehab program for a minimum of 24 sessions. Exclusion criteria were age outside of specified population and incomplete survey. Additionally, in the Adult group, participants were excluded if they had attended any portion of cardiac rehab. Consent and assent forms, as well as surveys, were available in English and Spanish.

Instrument and Design: This was a non-experimental comparative study design examining baseline knowledge levels regarding CVD risk factors among different age groups. A survey tool containing three parts was distributed to five groups of participants. Part one of the survey requested demographic information. Part two asked about potential educational sources of CVD risk factors and part three consisted of 11 statements regarding CVD risk factors with five choices presented using a Likert scale. Within each category for information sources, participants were asked to "circle any ways you've heard about heart attacks or heart disease."

For methods of education, participants were given choices under topic headings (formal education, TV, family, other, and internet). The specific choices under each topic heading were kept the same as much as possible between group surveys. However, certain choices were adapted to be appropriate to that age/group. For example, "health or gym class" for ES and HS participants, "health or wellness related class" for Coll participants, or "health or wellness related education session" for CR and Adult participants. See Table 1 for full description of choices under each heading for each participant group.

The one variance was the topic of "Internet." This topic was not included on ES surveys due to the thought that most children that age did not use the internet for health-related information. The HS and Coll participants were only asked if they obtained information from the internet but were not given specific choices about where that information had been obtained on the internet. The CR and Adults were asked specifics about location of internet information. The HS and Coll

Table 1. Methods of education – choices on survey based on participant group

Participant Group	Formal Education	TV	Family	Other	Internet
Elementary School (ES)	School • Health or Gym Class • Class video or talk • Assembly or school wide presentation	• News report • Special program about heart attacks • Brief commercial or informational spot	• Family member experience • Family discussion	• Radio • Books or magazines • Community group (Boy Scouts, Girl Scouts, church group, sports team, other)	None
High School (HS)	Same as ES	Same as ES	Same as ES	Same as ES	Yes or No
College Students (Coll)	School • Health or wellness related class • Class video or talk • School wide presentation	Same as ES	Same as ES	Same as ES	Yes or No
Cardiac Rehab Participants (CR)	Cardiac Rehab • Phase I (inpatient) • Health or wellness related education session (phase II or III) • Cardiac rehab program video or talk (phase II or III) • Cardiac rehab staff discussion (phase II or III)	Same as ES	Same as ES	• Radio • Books or magazines • Community group (service organization, senior center, church groups, recreational clubs, other)	• General Websites • Online Journals • Medical oriented websites (such as WebMD, etc.)
General Adults	Medical Staff • Health or wellness related education session • Physician, nurse, or physician assistant discussion • Brochure or handout	Same as ES	Same as ES	Same as CR	Same as CR

surveys were administered slightly before the CR and Adult surveys. It was determined by the researchers to add the internet location choices based on questions raised once HS and Coll survey administration had begun. It was not feasible at that time to re-administer surveys to HS or Coll participants, therefore, data for HS and Coll participants only has internet use as a yes or no choice.

An individual was considered to use "Formal Education" as a source of information if at least 2 subcategories were circled. A category of "Mass Media" was determined from the TV and radio categories. A participant was considered to have used "Mass Media" as a source if the person chose at least 2 subcategories. Under the category of "Family," family member experience and family discussions were found to be independent across all 5 groups of participants and were therefore, treated as separate independent variables in analyses. Under the category of "Other," if participants selected at least 2 of the 4 choices, it was considered as a source of information. Ultimately, community group was analyzed separately from the rest of the "Other" category choices as it was almost never selected. For HS and Coll participants, "Internet" was considered a source of information if they selected it. For the CR and Adult participants, "Internet" was considered a source of information if participants chose at least 2 of the sources.

For part 3 of the survey, the testing instrument portion, the five choices for each statement were "Completely Untrue," "Somewhat Untrue," "Not true, but not untrue," "Somewhat True," and "Completely True." Correct answers were determined by several American Physical Therapy Association Board Certified Specialists in Cardiovascular and Pulmonary Care. Statements were slightly modified for age appropriateness. Answers were scored as multiple-choice questions. Each response could receive a maximum of 5 points for a correct response. Lower scores for a statement were given based on how far on the scale the response was from a correct response. The maximum score achievable was 55 and the minimum score was 11. Raw scores were divided by 55 to obtain a percentage score.

The instrument was developed by the primary researcher. It was initially reviewed by two independent physical therapists and then modifications were made based on their recommendations. Then the survey was administered to a few participants (not included in final analysis) to ensure ease of use and clarity of questions. The survey was then also shown to have internal validity based on the Cronbach Alpha test. Internal validity was determined using participants from each age group.

Data Analysis: The frequency of usage of different sources of information among the five groups was tested by chi-square with post-hoc analysis as described by Shan and Gerstenberger [16] to determine which groups used a source more or less than others.

Data from surveys were analyzed using SPSS 22 for Mac. Independent variables were information sources that subjects chose, age, and group (CR, Adult, Coll, HS, or ES). The sources of information were collapsed into six variables: formal education, internet use (for all groups except ES), mass media, family experience, family discussion, and community resources. Age was the only demographic information employed as an independent variable. The usefulness of age in the analysis was diminished by the homogeneity of age within the ES, HS, and Coll groups. Scores were not related to gender of the subjects and analyses were, therefore, done with genders pooled within groups. Categories such as race, school, and geographical information did not have sufficient numbers of subjects within categories to produce meaningful analysis and were also pooled within groups. The dependent variable was the percentage score on the CVD knowledge instrument. Multiple regression was used to determine the contributions of each independent variable to the dependent variable. A Multivariate Analysis of Variance (MANOVA) was used to determine the effects of group membership, the use/non-use of the six information sources, and interactions among these seven factors on survey "test" score. Because MANOVA demonstrated significant interactions between sources of information and group, unpaired t tests on the dependent variable were performed between subjects who used and those who did not use each source of information.

Using a cut-off score of 80%, odds ratios for achieving this score were computed based on the use/non-use of each of the six different information sources.

Results

Survey completion: Initiation and completion rates for each group are as follows: ES participants initiated and completed 131 surveys (100% completion rate). HS students initiated 116 surveys, but 6 were incomplete, so 110 were analyzed (94.8% completion rate). Coll participants initiated 37 surveys, completed 32 surveys (86.4% completion rate). Adults initiated 71, completed 59 (83.0% completion rate). CR participants initiated 51, completed 49 (96% completion rate). Overall, the completion rate was 93.8%.

Gender: Gender was not asked of the ES children, so no data were available for that group. HS participants self-identified as 37% male, 63% female; Coll participants as 31% male, 69% female; Adults as 54% male, 46% female; and CR participants as 65% male, 35% female. Overall, 47% of participants self-identified as male and 53% as female.

Ethnicity: ES participants self-identified as 39% Caucasian, 19% African American, 32% Hispanic, 2% Asian, 5% Native American, and 3% other. HS participants were 81% Caucasian, 8% African American, 8% Hispanic, 3% Asian, and <1% Native American. Coll students were 66% Caucasian, 11% African American, 0% Hispanic, 17% Asian, and 6% Native American. Adults were 82% Caucasian, 6% African American, 10% Hispanic, and 2% Asian. CR participants were 86% Caucasian, 12% African American, 0% Hispanic, and 2% Asian. Overall, 71% of participants self-identified as Caucasian, 11% as African-American, 10% as Hispanic, and 8% as other. Due to heterogeneity of race and other demographic data, no meaningful analyses could be conducted on these factors.

Sources of Information: Differences in uses of sources of information were found for formal education, internet, mass media, and family experience. No differences were found in family discussion or community groups (Table 2). Coll and ES groups cited use of formal education less often and HS students cited it more often. With respect to internet use, the CR and Adult groups used it less and HS students used it more than other groups. Adults and HS groups cited mass media use more and ES students less. Family experience was cited as an information source more by Adults and less by Coll subjects (Table 3). The "test" score and the percentage using each source of information for each age group are depicted in Figure 1.

Effects of group and sources of information: Multiple regression failed to identify a combination of factors that determined score on the knowledge test. MANOVA was used to determine the effects of subject group, the use/non-use of the six information sources, and interactions among these factors on test score. Overall, the mean score on the assessment of CVD risk factor knowledge was 44.47/55 or 80.9% correct. Significant differences were found among groups (p=0.034).

Table 2. Chi square analysis for distribution of sources of information cited between groups and p value.

Source	Significance
Group X Formal Education	<.001*
Group X Websites	0.003*
Group X Mass media	<.001*
Group X Family experience	0.001*
Group X Family discussion	0.625
Group X Community	0.138

*Statistically significant

Table 3. Distribution of whether a source was used by a group and results of post-hoc analysis. *Overall Chi square not significant

Formal Education	**p**	**Yes**	**No**
CRP	0.1326	47.9	52.1
Adult	0.4953	59.7	40.3
College aged less than expected	0.0089	39.4	60.6
HS* more than expected	0.0000	86.2	13.8
ES less than expected**	0.0000	42.7	57.3
Websites	**p**	**Yes**	**No**
CRP less than expected	0.0004	27.1	72.9
Adult less than expected	0.0204	32.3	67.7
College aged	0.5000	42.4	57.6
HS more than expected	0.0000	54.3	45.7
Mass Media	**p**	**Yes**	**No**
CRP	0.4996	33.3	66.7
Adult more than expected	0.0000	48.4	51.6
College aged	0.4997	33.3	66.7
HS more than expected	0.0002	41.4	58.6
ES less than expected	0.0000	18.3	81.7
Family Experience	**p**	**Yes**	**No**
CRP	0.4891	56.3	43.8
Adult more than expected	0.0000	77.4	22.6
College aged less than expected	0.0115	36.4	63.6
HS	0.3332	50.9	49.1
ES	0.3300	51.1	48.9
Formal Education	**p**	**Yes**	**No**
Family Discussion	**p**	**Yes**	**No**
CRP	0.068	31.3	68.8
Adult	0.500	41.9	58.1
College aged	0.499	42.4	57.6
HS	0.473	43.1	56.9
ES	0.385	44.3	55.7
Community Resources	**p**	**Yes**	**No**
CRP	0.0971	25	75
Adult	0.2631	14.5	85.5
College aged	0.4124	15.2	84.8
High school	0.00280744494441754*	12.9	87.1
Elementary school	0.00171850187279066*	23.7	76.3

Coll participants had the greatest scores (88% correct), followed by Adults (86%), CR participants (84%), HS students (83%), and then ES students (77%). In terms of sources of information, those who indicated using family experience scored better than those who did not (Table 4). However, MANOVA revealed multiple interactions among group and sources of information. Therefore two-tailed, unpaired, t tests for unequal group size were performed on each of the six sources of information comparing scores of those who cited using that information source to those who didn't.

Significantly greater scores were found for those who cited receiving information from formal education and those citing mass media (Table 5). Those who cited internet use, family experience, family discussion, and community groups did not achieve greater scores.

Odds Ratios: Computation was based on use of a cut-off score of 80% as a "passing" score for the exam. Family discussion had the greatest odds ratio-3.78, followed by mass media 2.72, formal education-1.69, websites-1.57, family experience-1.18, and community resources 0.97.

Discussion

Although education on CVD risk factors is commonly cited as a means of improving the mortality associated with CVD, it is currently not known which sources of information are used by different age groups; or what information sources contribute to the greatest knowledge of CVD risk factors. This study attempted to determine what information sources were used across age groups. A second purpose was to preliminarily determine whether some sources of information might be more effective than others for knowledge of CVD risk factors.

Not unexpectedly, different groups demonstrated different patterns of information sources. For example, less use of internet by the older groups compared with younger groups. However, one would expect internet use to become more uniform in the future.

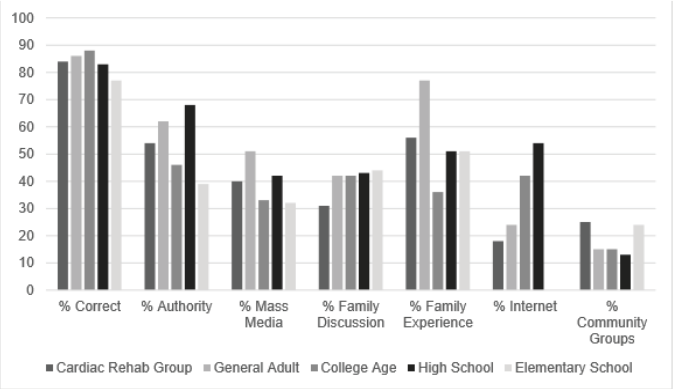

Figure 1. Mean score on testing instrument and percentage citing use of each source of information across groups of subjects. Cardiac Rehab Group, General Adult, College Age, High School, Elementary School

Table 4. MANOVA results for group and source of information.

Source	Significance	Post-hoc tests
Group	0.034*	CRP > ES; Adult > HS, ES; Coll > HS, ES; HS > ES
Authority	0.285	NA
Internet	0.345	NA
Mass media	0.089	NA
Family experience	0.030*	yes > no
Family discussion	0.784	NA
Community	0.804	NA

*Statistically significant

Table 5. Effect of sources of information on examination score. **Significantly greater score on knowledge assessment. Values are means (SD) standard deviation. p based on two-tailed, unpaired, unequal size t tests.

Source	Score yes	Score no	p
Formal Education	83.4 (SD) 9.8**	80.1 (SD) 10.6	0.001
Website	85.3 (SD) 9.1	84.0 (SD) 9.3	0.242
Mass media	85.5 (SD) 9.1**	80.3 (SD) 10.4	< .001
Family experience	82.7 (SD) 10.0	81.2 (SD) 10.6	0.158
Family discussion	82.4 (SD) 10.9	81.8 (SD) 9.8	0.557
Community services	81.5 (SD) 10.3	82.2 (SD) 10.3	0.617

Of greater concern, was the efficacy of formalized education about CVD risk factors. One might expect that individuals who completed an outpatient cardiac rehabilitation program would cite this as an information source and perform better on the testing instrument due to the formal CVD risk factor education that is a component of the rehabilitation program. However, fewer than 50% of those in the CR group cited using the cardiac rehab program as a source of information. They most often selected physician discussion or family member experience as the source of their knowledge of CVD risk factors. In addition, the CR participants did not score as well as Coll participants and only performed equally as well as the Adult and HS groups in knowledge. This should cause rehabilitation staff in this area to question previous education methods used and speak to patients about what methods would benefit them to understand the risk factors better.

Mass media is wide reaching, but not assured of having as good of quality as formal education. However,

"Mass Media" and "Formal Education" both appeared to improve knowledge of CVD risk factors, in all groups, with no difference in the effectiveness between the two. Patterns of use of these information sources were similar across subject groups, indicating that formal education may not be producing any better results than what is being transmitted over television or radio.

Another finding was the general lack of citing community groups as information sources. Formal education through healthcare professionals, professional educators and family experience were cited much more than community groups. Moreover, formal education and mass media were associated with better results on the CVD risk factor knowledge instrument than community groups. Since only formal education is provided by health care providers, it is important to continue with that form of education to the public. Health care providers should also look for ways to utilize family member experiences and mass media to further their message since these were also frequently selected as sources of information. By doing so, the health care provider could help guide what information the public receives about CVD risk factors. Due to the lack of community group selection in this study, health care providers may want to explore those settings as a further means of educating people (children and adults) about CVD risk factors.

The effectiveness of family discussion as a source of knowledge was more difficult to interpret. Examining the scores of those who did and didn't cite family discussion showed no difference, but the calculated odds ratio showed that those who cited family discussion were much more likely to achieve a score of 80% or better than those who didn't. Odds ratio for formal education and mass media were consistent with comparison of scores of those who did vs. did not use these sources in that those who cited using formal education and those who cited using mass media performed better on the knowledge instrument.

Overall, the subjects in this study did have good baseline knowledge of CVD risk factors. All participants selected more than 2 sources of information demonstrating that the public is receiving CVD risk factor education from various sources which may help in the retention of the information. Coll students scored the highest on the survey, while ES students scored the least. ES students' knowledge levels may be lower due to less exposure over time to sources of information on CVD risk factors.

This study had some limitations. The groups had uneven numbers of subjects and the demographics varied among groups. Much of this is likely attributable to geographical differences among groups due to the subjects available to the researchers for this study. This variation led to inability to fully account for gender and demographic variables. The assignment of partial credit for distance along a scale from correct to incorrect also compresses the range of scores compared with scoring each as all or none for each of the 11 questions. Coll subjects, who likely have the greatest experience and aptitude for answering multiple choice questions scored the best on the instrument. Within the Adult and CR groups, age was negatively correlated with score. Although researchers attempted to recruit a group of "general adults" in the same range of age as those who completed a cardiac rehabilitation program, the average age of the CR group was older and may have depressed the knowledge score for this group.

This study was unique in its evaluation of the level of baseline knowledge regarding CVD risk factors and not evaluation of risk factor knowledge after a specific educational intervention. A recent study from Sweden showed that the lower health literacy a person had, the higher level of CVD risk scores and presence of carotid artery plaque [17]. It would be expected that there would be a direct relationship between knowledge of CVD risk factors and the practice of healthy habits. However, based on the almost yearly rise in rates of CVD mortality, knowledge of the CVD risk factors may not be translating to behavioral change. Future research should focus on developing and evaluating programs that include both education and behavioral interventions in order to possibly have a greater impact on CVD rates. This study's results should demonstrate the need for rehabilitation care providers to initiate new physical activity programs and other forms of behavioral intervention programs to try to combat the rates of CVD. Education, although valuable, is not decreasing rates of CVD. Therefore, new programs to encourage and guide people in behavioral change are important. The results of this study, although not 100% generalizable, showed that across multiple age groups participants had good knowledge levels of CVD risk factors. It was demonstrated that baseline knowledge of CVD risk factors came from multiple sources/methods of education. Formal education by schools or health care providers, as well as information from TV or radio showed high levels of CVD risk factor knowledge. Also, family discussion had the greatest odds ratio for knowledge level. These results show as part of a new behavioral change program, education should be included.

Including a person's family will also positively impact the knowledge retained based on the fact that education by a health care provider and family discussions had the highest correlation to knowledge. Health care providers should use the results of this study to guide their education of CVD risk factors to all age groups in a continued effort to combat CVD incidence and mortality rates.

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