Title: Young adult's knowledge and attitudes towards Cardiovascular Disease: a systematic review and meta-analysis

Abstract

Aims and objectives: To explore young adult's knowledge and attitudes of cardiovascular disease and its risk factors.

Background: Cardiovascular disease morbidity is rising and mortality is declining among young adults. However, the knowledge of cardiovascular disease by young adults is not well known.

Design: A systematic review with meta-analysis was used.

Methods: The databases of CINHAL, Medline Complete, PsychINFO and Psycharticles were searched for all studies published before June 2016. Search terms included cardiovascular disease, young adult, attitude and knowledge. Papers were included if they were published in English and reported quantitative research with a study population between the ages of 18 to 34 years, with a focus on knowledge and attitudes to cardiovascular disease. Meta-analyses were conducted to assess the extent of knowledge of risk factors on heart disease.

Results: Nine risk factors for cardiovascular disease were identified by the respondents; smoking (synthesized estimate of 55% of respondents identifying as a risk factor, 95% confidence interval of synthesized estimate 45-65%); obesity (27%, 95% CI, 26-29%); high blood cholesterol (33%, 95% CI, 12-54%); high blood pressure (25%, 95% CI, 18-32%); genetic factors (26%, 95% CI, 23-29%); physical inactivity (39%, 95% CI, 30-47%); stress (49%, 95% CI, 48-51%); advancing age (10%, 95% CI, 8-12%) and diet (55%, 95% CI, 54-56%).

Conclusion: Young adults demonstrate limited knowledge and poor attitudes regarding cardiovascular disease and its risk factors. The finding of this review demonstrates that there is an urgent need to build knowledge of cardiovascular risk identification in this population group.

Relevance to clinical practice: Increasing cardiovascular disease in young adults will put stress in the health care system financially and economically. There is a need of awareness of cardiovascular disease in this population group.

What does this paper contribute to the wider global clinical community?

- This study highlights that young adults demonstrate limited knowledge and poor attitudes regarding cardiovascular disease and its risk factors;
- The finding of this review demonstrates that there is an urgent need to build knowledge of cardiovascular risk identification in this population group.

Key words

attitude, cardiovascular disease, knowledge, risk factors, young adults.

Introduction

Cardiovascular disease (CVD) has been the major cause of mortality and morbidity worldwide in the past decade (Lozano et al., 2012; Wardle & Boniface, 2008; World Health Organization, 2014a, 2014b). During 2012 CVD killed 17.5 million people around the world (World Health Organization, 2014b) 80% of these deaths occurred in low and middle income countries (LMIC) (Pascal & Fred, 2012). It is also estimated that in 2030 CVD will kill 22.24 million people (World Health Organization, 2013). In Europe it is estimated that CVD contributes to over four million deaths each year (Nichols, Townsend, Scarborough, & Rayner, 2012). In the United Kingdom (UK) throughout 2012 CVD caused 161,252 deaths, 28% of all deaths for that year (Townsend, Williams, Bhatnagar, Wickramasinghe, & Rayner, 2014). In Palestine during 2010 40% of chronic disease's deaths were attributed to ischaemic heart disease (Mosleh, Aljeesh, & Dalal, 2016). In the United States (US) during 2012 approximately 787,431 people died from CVD (Centers for Disease Control and Prevention & National Center for Health Statistics, 2015). In Australia throughout 2012 CVD caused 43,946 deaths, 29.9% of the total deaths for that year (Australian Bureau of Statistics, 2014) with an estimated 3.4 million people living with CVD in 2007-2008 (Australian Institute of Health and Welfare, 2012). In the UK during 2012 there were more than 1.6 million episodes related to CVD throughout National Health Service hospitals, and it was estimated that 2.3 million people living in the UK were living with Coronary Heart Disease (CHD) (Townsend et al., 2014). Non- communicable diseases (NCD) such as CVD are not only associated with high mortality and morbidity, but also with a significant cost. Per person the annual losses due to NCD amount to an average of US$25 in low-income countries to US$139 in upper middle-income countries (Feigl, 2011). For example during 2009 CVD was estimated to cost within the European Union (EU) health care system just over €106 billion (Nichols et al., 2012). In England throughout 2012-2013 more than £6.8 billion was spent on treating CVD within National Health Service (Townsend et al., 2014). In the United States during 2011 the annual direct and overall cost resulting from CVD were estimated at an alarming US$273 billion and US$444 billion, respectively (Valderrama, Loustalot, Gillespie, George, & Schooley, 2011). In Australia throughout

2008-2009 the estimated healthcare allocated expenditure for CVD was AU$7,605 million, this was 12% of all allocated health expenditure (AIHW, 2014).

The most common cause of CVD is atherosclerosis (Mendis, Puska, & Norrving, 2011), which has been found to begin during childhood (Hong, 2010; Oliveira, Patin, & Escrivao, 2010). This is not new information; these findings have been available for over a decade with the Bogalusa Heart Study (Berenson et al., 1998). In fact the first time that it was reported that young adults were found to have atherosclerosis, was after autopsies of young United States soldiers killed in action in Korea in the 1950's (Enos, Holmes, & Beyer, 1953). While atherosclerosis starts in childhood the clinical manifestation of CVD is not seen until adulthood, in part due to atherosclerosis progressing slowly and the human body being able to compensate as it develops (Deopujari & Dixit, 2010; Hong, 2010). However, CVD is usually associated with older people and not young adults (Rubin & Borden, 2012). The late manifestation may provide a false sense of security to young adults that perceive poor health as something that they do not need to worry or pay attention to until later in life (Bibbins-Domingo & Pena, 2010). This has not changed in the last decade (Lynch, Liu, Kiefe, & Greenland, 2006).

Background

The number of young adults with at least one CVD risk factor has increased over the past two decades often involving increase in body mass index and the incidence of diabetes in relation to increased waist circumference. For example, in Scotland a cross-sectional study from 1998 to 2008 revealed a rapid weight increase in young adults (Lean, Katsarou, McLoone, & Morrison, 2013). Similarly in England a study comparing the body mass index and waist circumference of adults in 2002/2003 with 1993/1994 found that the average increases were higher in young adults compare to older participants (Wardle & Boniface, 2008). The United States and Australia are also trending upwards. In the United States a study analysing the trends in obesity between 2003 and 2012 found that obesity prevalence remains high among young adults (Ogden, Carroll, Kit, & Flegal, 2014). In Australia in 1995 the proportion of young adults age 18-24 who were obese was just under 10%; in 2007-2008 the corresponding proportion was around 12.5%; and in 2011-2012 it was over 15% (Australian Bureau of Statistics, 2013b; Australian Clearinghouse for Youth Studies, 2012). The incidence of diabetes in young adults has also increased (Australian Institute of Health and Welfare, 2014d).

The definition of a young adult varies from study to study. Erik Erikson defines young adult as being between the ages of 20 to 40 years (Erikson, 1950). The Australian Bureau of Statistics defines young adults as being between the ages 18 to 34 years (Australian Bureau of Statistics, 2013a) while the Australian Institute of Health and Welfare defines young adults as those between the ages of 15 to 24 years (Australian Institute of Health and Welfare, 2014b). For this study, the definition of a young adult will be someone between the ages of 18 to 34 years. This range was selected in line with census data collection therefore the Australian Bureau of Statistics definition was used.
According to the Australian hospital statistics of 2012-2013, from 2008-2009 to 2012-2013 the approximate percentage of young adult males and females that were admitted and subsequently discharged from all hospitals rose by 4% and 7% respectively (Australian Institute of Health and Welfare, 2014a). In 2013 young adults were more likely to drink at harmful levels on a single occasion than the rest of the adult population (Australian Institute of Health and Welfare, 2014c). If trends in young adult's health continues in the current direction, the mortality and morbidity due to CVD will increase dramatically in the near future, as well as the costs associated with this increase (Juonala et al., 2011).

Methods

A systematic literature search was conducted using the databases CINHAL, Medline Complete, PsychINFO and Psycharticles. The databases were searched for papers published before 2017.

Search terms included ‘cardiovascular disease’, ‘young adult’, ‘attitude’ and ‘knowledge’. The search terms were not shortened to avoid unsuitable papers. Refer to table 1 research string.

The research of the databases located a total of 52 papers. There was one duplicate; therefore 51 papers were screened based on the title or abstract. Using the inclusion and exclusion criteria, 4 articles were identified for full text reads. After fully reading the articles, 4 were included in this review and meta-analysis. The included papers had a combined number of 11,220 participants (see table 2)

Figure 1 *PRISMA Flowchart of selected papers*

Design

A systematic review design was used. Results are presented in a PRISMA (Figure 1) (Moher, Liberati, Tetzlaff, & Altman, 2009), also a meta-analysis was undertaken to summarise the results of the studies .

Data collection

Papers were included in this review if they were published in English and reported quantitative research with a study population between the ages of 18 to 34 years. Papers were excluded if they did not have a focus on knowledge and attitudes of young adults in relation to cardiovascular disease, theses, qualitative research articles, commentaries and articles not published in scientific peer reviewed journals.

Meta-analyses were conducted to assess the extent of knowledge of risk factors on heart disease. All outcomes were dichotomous, expressed as proportions of the sample identifying a particular risk factor.

Sub-group analyses and meta-regressions were not planned *a priori* or subsequently undertaken. No common factors used to define outcomes in any of the included studies provided main outcome results. Hence single proportion meta-analyses were conducted.

Random effects analyses were conducted in all cases due to identified clinical and design heterogeneity. Identified heterogeneity included:

- economic background: developed world (Lynch et al., Steptoe and Wardle, Vale); developing world (Dabbak & Arafa);
- educational status of participants: university undergraduates (Dabbak & Arafa; Steptoe & Wardle); general population (Lynch et al., Vale);
- questioning method: prompting (Steptoe & Wardle); no prompting (Dabbak & Arafa, Lynch et al., Vale);
- differences in the condition(s) for which participants had to identify risk factors: CHD (Dabbak & Arafa); heart attack/stroke (Lynch et al.), heart disease (Steptoe & Wardle, Vale).

For all outcomes, the odds ratio for the factor under consideration, with associated confidence intervals, was calculated and presented in a forest plot together with a synthesized estimate (and associated confidence intervals) calculated using Mantel-Haenszel weightings; and tabulated summaries of proportions of events experienced in each group. Funnel plots were not constructed due to the limited number of studies included in the meta-analysis.

For all meta-analyses, statistical heterogeneity was assessed using Cochran's Q statistic approximately follows a χ^2 distribution on n-1 degrees of freedom. The corresponding I^2 statistic and the between-study variance of the intervention effect (τ^2) were also derived. A *Z*-test for overall effect was also conducted in all cases; however, it was expected that the proportions of participants identifying each risk factor would be significantly different to zero.

Meta-analyses were conducted using the Stata statistical software (Version 14 I/C) (StataCorp., 2015).

Results

Smoking

Identification of smoking as a risk factor was included in all 4 included studies. A single-proportion random effects meta-analysis conducted on this outcome determined that a synthesised estimate for the proportion of participants who identified this factor as a risk factor was 0.55 (95% confidence interval [CI] 0.45 to 0.65). A *Z*-test for overall effect revealed strong evidence that this proportion was non-zero ($Z=10.75$, $p<0.001$). Individual estimates ranged for the proportion ranged from 0.47 (Dabbak & Arafa) to 0.63 (Vale).

Cochran's Q test revealed strong evidence for statistical heterogeneity ($\chi^2_{(3)}=232.3$; $p<0.001$). The I^2 statistic was 98.7%, indicating substantial statistical heterogeneity. The τ^2 statistic (between-study variance) was calculated to be 0.01.

Results are summarised in a forest plot (Figure 2).

Obesity/overweight

Identification of obesity (body mass index ≥ 30 Kg/m2) or being overweight (body mass index ≥25 - 29.9 Kg/m2) as a risk factor was included in 2 included studies (Dabbak & Arafa and Lynch et al.) A single-proportion random effects meta-analysis conducted on this outcome determined that a synthesised estimate for the proportion of participants who identified this factor as a risk factor was 0.27 (95% confidence interval [CI] 0.26 to 0.29). A *Z*-test for overall effect revealed strong evidence that this proportion was non-zero ($Z=42.4$, $p<0.001$). Individual estimates ranged for the proportion were 0.42 (Dabbak & Arafa) and 0.26 (Lynch et al.)

Results are summarised in a forest plot (Figure 3).

High blood cholesterol

Identification of high blood cholesterol as a risk factor was included in 3 included studies (Dabbak & Arafa, Lynch et al. and Vale). A single-proportion random effects meta-analysis conducted on this outcome determined that a synthesised estimate for the proportion of participants who identified this factor as a risk factor was 0.33 (95% confidence interval [CI] 0.12 to 0.54). A *Z*-test for overall effect revealed strong evidence that this proportion was non-zero (Z=3.12, p<0.001). Individual estimates ranged for the proportion ranged from 0.14 (Lynch et al.) to 0.49 (Vale).

Cochran's Q test revealed strong evidence for statistical heterogeneity ($\chi^2_{(2)}$=148.2; p<0.001). The I^2 statistic was 98.7%, indicating substantial statistical heterogeneity. The τ^2 statistic (between-study variance) was calculated to be 0.03.

Results are summarised in a forest plot (Figure 4).

High blood pressure

Identification of high blood pressure as a risk factor was included in 3 included studies (Dabbak & Arafa, Lynch et al. and Vale). A single-proportion random effects meta-analysis conducted on this outcome determined that a synthesised estimate for the proportion of participants who identified this factor as a risk factor was 0.25 (95% confidence interval [CI] 0.18 to 0.32). A *Z*-test for overall effect revealed strong evidence that this proportion was non-zero (Z=7.01, p<0.001). Individual estimates ranged for the proportion ranged from 0.17 (Vale) to 0.32 (Dabbak & Arafa).

Cochran's Q test revealed strong evidence for statistical heterogeneity ($\chi^2_{(2)}$=17.2; p<0.001). The I^2 statistic was 88.4%, indicating substantial statistical heterogeneity. The τ^2 statistic (between-study variance) was calculated to be less than 0.01.

Results are summarised in a forest plot (Figure 5).

Genetic or hereditary factors

Identification of genetic or hereditary factors as risk factors was included in 3 included studies (Dabbak & Arafa, Lynch et al. and Vale). A single-proportion random effects meta-analysis conducted on this outcome determined that a synthesised estimate for the proportion of participants who identified this factor as a risk factor was 0.26 (95% confidence interval [CI] 0.23 to 0.29). A *Z*-test for overall effect revealed strong evidence that this proportion was non-zero (Z=18.3, p<0.001). Individual estimates ranged for the proportion ranged from 0.25 (Dabbak & Arafa, Lynch et al.) to 0.37 (Vale).

Cochran's Q test revealed no evidence for statistical heterogeneity ($\chi^2_{(2)}$=3.40; p=0.018). The I^2 statistic was 41.2%, indicating moderate statistical heterogeneity. The τ^2 statistic (between-study variance) was calculated to be less than 0.01.

Results are summarised in a forest plot (Figure 6).

Physical inactivity/lack of exercise

Identification of physical activity / lack of exercise as a risk factor was included in all 4 included studies. A single-proportion random effects meta-analysis conducted on this outcome determined that a synthesised estimate for the proportion of participants who identified this factor as a risk factor was 0.39 (95% confidence interval [CI] 0.30 to 0.47). A Z-test for overall effect revealed strong evidence that this proportion was non-zero (Z=9.17, p<0.001). Individual estimates ranged for the proportion ranged from 0.25 (Dabbak & Arafa) to 0.49 (Steptoe & Wardle).

Cochran's Q test revealed strong evidence for statistical heterogeneity ($\chi^2_{(3)}$=159.4; p<0.001). The I^2 statistic was 98.1%, indicating substantive statistical heterogeneity. The τ^2 statistic (between-study variance) was calculated to be 0.01.

Results are summarised in a forest plot (Figure 7).

Stress

Identification of stress as a risk factor was included in 2 included studies (Dabbak & Arafa and Lynch et al.) A single-proportion random effects meta-analysis conducted on this outcome determined that a synthesised estimate for the proportion of participants who identified this factor as a risk factor was 0.49 (95% confidence interval [CI] 0.48 to 0.51). A Z-test for overall effect revealed strong evidence that this proportion was non-zero (Z=68.9, p<0.001). Individual estimates ranged for the proportion were 0.24 (Dabbak & Arafa) and 0.53 (Lynch et al.)

Results are summarised in a forest plot (Figure 8).

Advancing age

Identification of advancing age as a risk factor was included in 2 included studies (Dabbak & Arafa and Vale) A single-proportion random effects meta-analysis conducted on this outcome determined that a synthesised estimate for the proportion of participants who identified this factor as a risk factor was 0.10 (95% confidence interval [CI] 0.08 to 0.12). A *Z*-test for overall effect revealed strong evidence that this proportion was non-zero (Z=8.31, p<0.001). Individual estimates ranged for the proportion were 0.21 (Dabbak & Arafa) and 0.02 (Vale).

Results are summarised in a forest plot (Figure 9).

Diet

Identification of at least one dietary factor as a risk factor was included in 2 included studies (Lynch et al. and Steptoe & Wardle) A single-proportion random effects meta-analysis conducted on this outcome determined that a synthesised estimate for the proportion of participants who identified this factor as a risk factor was 0.54 (95% confidence interval [CI] 0.55 to 0.56). A *Z*-test for overall effect revealed strong evidence that this proportion was non-zero (Z=124.7, p<0.001). Individual estimates ranged for the proportion were 0.29 (Lynch et al.) and 0.71 (Steptoe & Wardle).

Results are summarised in a forest plot (Figure 10).

Of the 9 risk factors identified, smoking, stress and diet were identified by the largest proportion of respondents. Advancing age was identified by the smallest proportion of respondents.

Table 3 *Summary of risk factors findings*

Discussion

Knowledge of CVD and its risk factors minimises the incidence of the disease (Altman, Nunez de Ybarra, & Villablanca, 2014), however the commonness of CVD is increasing in young adults, and therefore this review was undertaken to explore young adult's knowledge and attitudes of cardiovascular disease and associated risk factors. Several papers were rejected as they did not focus on knowledge and attitude of cardiovascular disease and others papers their study population was outside the ages of 18 to 34 years. This highlights the gap in the literature and the importance of this review.

The findings indicated that diet and smoking were the most commonly identified risk factors for CVD by young adults. This could be due to a general increased awareness regarding these risk factors and their effects through the media and broadly within the general population. Worldwide awareness and education about the effects of diet and smoking had been increasing at the time when two of the early studies were published (Mackay & Eriksen, 2002; WHO/FAO, 2003) and the use of television advertising and pictorial health warnings in various countries has demonstrated to be successful in increasing public health knowledge, with particular regard to smoking (Brennan, Durkin, Cotter, Harper, & Wakefield, 2011; Thrasher et al., 2012).

Smoking and physical inactivity were the only two risk factors examined by all the included studies in this review. The reason for this could be that these risk factors are seen as important, since they are known risk factors for other major non-communicable diseases such as cancer (Stewart, 2014) and diabetes (World Health Organization, 2016). Physical inactivity is also a major risk factor on its own with regard to other CVD risk factors, because physical inactivity has been associated with obesity, hypertension, high cholesterol and stress (Archer & Blair, 2011; Mendis et al., 2011).

There were some interesting findings in this review. Notably, diet was an identified risk for CVD by 55% of the study sample, whereas obesity was identified by only 27% of the sample as a risk for CVD. This contradiction may be attributed to a perception among young adults that diet is more significant given that obesity is often the result of an unhealthy diet (Roberts & Marvin, 2011). Stress scored higher than obesity as an identified risk factor for CVD (49) possibly attributed to perceiving stress as a health issue and obesity as an image issue (Sand, Emaus, & Lian, 2015; Sweeting, Smith, Neary, & Wright, 2016). This perceptual difference is important since the majority of young adults sampled in the included studies under rated the significance of obesity as a risk factor for CVD (Garg, Maurer, Reed, & Selagamsetty, 2014). The review revealed advancing age as the lowest perceived risk and could quite simply be a reflection of the age of the samples of the included study, as it has been argued that young adults have limited knowledge about advancing age and may consider it as something that they do not have to be concerned about for a long time (Lucacel & Baban, 2014). Overall the findings confirmed a paucity of empirical evidence related to perceived CVD risk by young adults, particularly related to obesity and high blood pressure readings. High blood pressure awareness by young adults had been studied previously and findings were similar to those in this review, where the majority of young adults with hypertension were unaware of their hypertensive state (Gooding, McGinty, Richmond, Gillman, & Field, 2014). The findings of this review and meta-analysis provide evidence for age related factors with regard to knowledge and attitudes of CVD risk, and public health initiatives and healthcare practices need to be tailored accordingly.

Limitations

This study excluded grey literature, therefore publication bias should be considered. The number of studies that have explored young adults' knowledge and attitudes towards cardiovascular disease is small. The studies identified by this review used different methods to measure knowledge in young adults, making it difficult to compare studies. There were no Australian studies found that measured young adults' knowledge and attitudes of cardiovascular disease.

Conclusions

Even though the studies identified were conducted in different countries, using different techniques, resources and tools, they all point towards young adults demonstrating low knowledge of CVD risk factors and poor attitudes towards CVD prevention. At the same time the number of young adults with cardiovascular risk factors is significant and increasing. Combining these two significant points paints an alarming picture of the future of young adults potentially developing CVD and requiring long term health care services. This last point has several implications for governments and health care systems. There is therefore a need to build community/public knowledge of CVD and its risk factors in this population group, which could be achieved through a range of platforms such as social media, online programs and education programs.

Relevance to clinical practice: As the number of young adults potentially developing cardiovascular disease increases, the requirements of long term health care services will increase too. This has several implications for governments and health care systems.

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