Thirty-year risk of cardiovascular disease in senior medical students – based on the StudHeart study

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Abstract

Introduction: Long-term risk functions highlight the need of prophylaxis in youth before the first symptoms of cardiovascular disease (CVD) occur.

Aim: On the basis of data obtained in the StudHeart study, the aim of this report was to evaluate the 30-year risk of CVD based on the risk scale developed by the Framingham Heart Study (FHS).

Material and methods: Seven hundred and one students aged 22–27 (mean age: 24 ±1.42) from the 5th and 6th year of the medical faculties of the Medical University of Lodz were included in the study. The StudHeart study was based on an anonymous survey comprising 12 questions. Based on the answers the authors evaluated the 30-year risk of CVD in each respondent using an on-line calculator that allows one to evaluate: general CVD risk including coronary death, myocardial infarction, coronary insufficiency, angina, ischemic stroke, hemorrhagic stroke, transient ischemic attack, peripheral artery disease, heart failure and hard CVD risk including coronary death, myocardial infarction and stroke.

Results: Elevated general 30-year CVD risk occurred in 23.18% of students, while hard CVD risk was elevated in 16.91% of respondents. In both cases elevated risk occurred more often in men (general CVD risk: 43.46% male vs. 8.93% female, $p < 0.001$ and hard CVD risk: 29.33% male vs. 8.19% female, $p < 0.001$). Elevation of the risk was mainly caused by overweight, obesity and smoking cigarettes.

Conclusions: Based on FHS 30-Year CVD risk, elevated risk occurred in almost one-fourth of students. Prophylactic actions should be performed, especially in men.

Key words: lifetime risk, risk factors, cardiovascular diseases, medical students.

Streszczenie

Wprowadzenie: Długoterminowe skale ryzyka podkreślają potrzebę prowadzenia profilaktyki wśród osób młodych przed wystąpieniem pierwszych objawów chorób sercowo-naczyniowych (ChSN).

Cel: Na podstawie danych z badania StudHeart celem badania była ocena 30-letniego ryzyka ChSN przy użyciu skali opracowanej przez Framingham Heart Study (FHS).

Materiał i metody: Do badania włączono 701 studentów w wieku 22–27 lat (średnio: 24 ±1,42 roku) studiujących na V i VI roku wydziałów lekarskich Uniwersytetu Medycznego w Łodzi. Badanie oparto na anonimowej ankiecie zawierającej 12 pytań. Na podstawie uzyskanych odpowiedzi obliczono 30-letnie ryzyko wystąpienia ChSN dla każdego z badanych studentów przy użyciu kalkulatora dostępnego on-line, który umożliwia oszacowanie ogólnego ryzyka wystąpienia ChSN (ryzyko zgonu z przyczyn wieńcowych, zawału serca, dławicy piersiowej, niedokrwiennego i krwotocznego udaru mózgu, przemijającego napadu niedokrwiennego, niewydolności serca) oraz ryzyka wystąpienia ostrych ChSN (ryzyko zgonu z przyczyn wieńcowych, zawału serca, udaru mózgu).

Wyniki: U 23,18% studentów stwierdzono podwyższone ogólne 30-letnie ryzyko ChSN, natomiast u 16,91% ankietowanych ryzyko wystąpienia ostrych ChSN było zwiększone. W obu przypadkach podwyższone ryzyko stwierdzano częściej u mężczyzn (ogólne ryzyko wystąpienia ChSN: 43,46% u mężczyzn vs 8,93% u kobiet, $p < 0,001$; ryzyko rozwoju ostrych ChSN: 29,33% u mężczyzn vs 8,19% u kobiet, $p < 0,001$). Zwiększone ryzyko wynikało głównie z nadwagi, otyłości oraz palenia papierosów.

Wnioski: Na podstawie skali 30-letniego ryzyka wystąpienia ChSN opracowanej przez FHS podwyższone ryzyko miała prawie 1/4 studentów. Działania profilaktyczne powinny być i prowadzone zwłaszcza wśród mężczyzn.

Słowa kluczowe: skala ryzyka, czynniki ryzyka, choroby sercowo-naczyniowe, studenci medycyny.

Introduction

The prolongation of life expectancy which is observed nowadays confronts us with the need to create long-term risk scales in medicine. The 30-year risk of cardiovascular disease (CVD) prediction algorithm which is based on the Framingham Heart Study (FHS) and was published in 2009 [1] lives up to these expectations. The first results of the StudHeart study assessed the 10-year risk of diabetes mellitus type 2 among a group of 506 medical students [2].

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Aim

In this report we present the results of 30-year CVD risk among medical students based on the enlarged database of the StudHeart study. The aim of this report was to assess the 30-year CVD risk among senior medical students based on data obtained in the StudHeart study.

Material and methods

The StudHeart study was conducted from October to December in 2011 and 2012 among students of the 5th and 6th year of the medical degree course of the Faculty of Medicine and the Faculty of Military Medicine of the Medical University of Lodz. The exclusion criteria were as follows: students from other faculties, respondents over the age of 27 or below the age of 22.

From the examined group of 710 senior medical students, 9 respondents refused to take part in the StudHeart study. All students included in the research filled out an anonymous survey obtaining all data needed to establish the 30-year risk of CVD based on the FHS with the simpler model of risk calculation using body mass index (BMI) instead of high-density lipoproteins (HDL) cholesterol and total cholesterol. The risk of 'hard' and 'general' CVD can be established using this algorithm. Predictors and diseases included in 'hard' and 'general' CVD risk are presented in Table I.

The population of interest in this model comprises individuals 20 to 59 years old free of CVD and cancer at baseline examination; hence respondents with hypertension (HA) were excluded from the analysis. The measurable and numerical data needed such as weight, height, and blood pressure (BP) were obtained from respondents only by appropriate questions in the StudHeart survey [2].

All data were collected in the computerized database. The 30-year risk of CVD was calculated for each respondent using the on-line calculator available at http://www.framinghamheartstudy.com.

The calculator evaluates the 30-year CVD risk and the 'normal risk' for each individual. The 'Normal risk' is the risk found in a comparable individual (age, sex) with the risk profile as follows: 1) non-smoker; 2) non-diabetic; 3) not treated for blood pressure; 4) systolic blood pressure of 125 mm Hg; and 5) BMI of 22.5 kg/m². All respondents with calculated 'Your risk' higher than the 'Normal risk' were separated as the group of elevated 30-year CVD risk. In the study by Gozdzik *et al.* the range of risk is classified as low (less than 12%), intermediate (≥ 12% and < 40%) and high (40% or more) [3].

The StudHeart study was positively reviewed by the Bioethical Committee of Medical University of Lodz, Consent no. RNN/722/11/KB, October 18th, 2011.

Statistical analysis

The results were statistically analyzed. Elements of descriptive statistics were used to summarize the quantitative variables (arithmetic mean, median and standard deviation).

Nominal variables were characterized by cardinality and percentages. Independent groups of individuals (women vs. men) were compared by performing the Mann-Whitney U test. In order to detect a statistically significant correlation between the groups the χ^2 test of independence or Cramer's V test was used.

The statistical analysis was carried out using Statistica 10.0 PL software (StatSoft, Cracow, Poland). The results were considered statistically significant at $p < 0.05$.

Results

Demographic characteristics of the studied population are given in Table II. The study included 701 students aged 22-27, comprising 70.52% of 994 senior medical students of the Medical University of Lodz in 2011 and 2012. There were more women than men. Most of the respondents had a BMI no higher than 25 kg/m². Overweight (BMI over 25 kg/m²) was 8 times more frequent among men than women ($p < 0.001$). Differences in BMI according to gender are presented in Figure 1.

Only 81 of the respondents were smokers and most of them were men ($p = 0.003$). The onset of the smoking habit during studying at medical faculties occurred in more than one-third of smoking respondents. Further characteristics are presented in Table II. None of the students suffered from diabetes mellitus.

Results of the 30-year CVD risk are presented in Table III. Almost 25% of the respondents had general CVD risk ('Your risk' higher than 'Normal risk') elevated and more than 16% of students had the hard CVD risk elevated. Elevated general and hard CVD risk occurred more frequently in men than women ($p < 0.001$). Most students were in the group of low risk of both general and hard 30-year CVD risk (Table III). In the general risk group, only 2.56% of them had intermediate risk and 26% had the highest risk. In the hard 30-year CVD risk group, only 0.43% (3 men) of respondents had intermediate risk, and 16% had the highest risk. The elevation of 30-year CVD risk was mainly caused by overweight, obesity and smoking cigarettes.

Discussion

In this report we present the results of evaluating 30-year CVD risk based on the FHS in senior medical students.

Tab. I. Characteristics of 30-year risk of CVD based on Framingham Heart Study [1]

Predictors	Male sex, age, systolic blood pressure (SBP), use of antihypertensive treatment (yes/no), smoking, diabetes mellitus, total cholesterol, HDL cholesterol, body mass index (BMI) (replacing lipids in a simpler model)
Hard CVD	Coronary death, myocardial infarction, stroke
General CVD	Coronary death, myocardial infarction, coronary insufficiency, angina, ischemic stroke, hemorrhagic stroke, transient ischemic attack, peripheral artery disease, heart failure

Tab. II. Characteristic of studied population

Parameter	Overall		Women		Men		P-value
	n	%	*n*	%	*n*	%	
Cases [*n*]	701	100	412	58.77	289	41.23	
Parameter	**Overall**		**Women**		**Men**		**P-value**
	Mean ± SD	Median	Mean ± SD	Median	Mean ± SD	Median	
Age [years]	24 ±1.42	24	23.92 ±1.65	24	24.10 ±2.06	24	0.006
BMI [kg/m²]	22.11 ±3.40	21.97	20.57 ±3.37	20.45	24.29 ±3.41	24.29	0.001
Parameter	**Overall**		**Women**		**Men**		**P-value**
	n	%	*n*	%	*n*	%	
BMI [kg/m²]:							
> 25	110	15.69	16	3.88	94	32.53	< 0.001
20-25	405	57.77	219	53.16	186	64.36	0.005
< 20	180	25.68	172	41.75	8	2.77	< 0.001
Diet – fruit and vegetables consumption:							
Daily	377	53.78	245	59.47	132	45.67	< 0.001
2-3 times/week	262	37.38	144	34.95	118	40.83	NS
A few times/month	52	7.42	21	5.09	31	10.73	0.005
Less frequently	10	1.43	2	0.49	8	2.77	0.029
Diet – fast food consumption:							
Daily	4	0.57	2	0.49	2	0.69	NS
2-3 times/week	49	6.99	14	3.40	35	12.11	< 0.001
A few times/month	347	49.50	192	46.60	155	53.63	NS
Less frequently	301	42.94	204	49.51	97	33.57	< 0.001
Alcohol consumption at least one beer or 50 gs of vodka:							
Yes	656	93.58	379	91.99	277	95.85	0.040
No	44	6.28	33	8.01	12	4.15	
Daily	11	1.68	2	0.53	9	3.25	0.014
2-3 times/week	123	18.75	39	10.29	83	29.96	< 0.001
A few times/month	338	51.52	207	54.62	131	47.29	NS
Less frequently	185	28.20	131	34.56	54	19.50	< 0.001
Smoking:							
Yes	81	11.57	35	8.50	46	15.92	0.003
No	619	88.43	377	91.50	243	84.08	
Onset of smoking:							
< 5 years	29	35.80	5	14.29	24	52.17	< 0.001
≥ 5 years	52	64.20	30	85.71	22	47.83	
Physical activity at least 30 minutes without a break:							
Daily	93	13.27	36	8.73	57	19.72	< 0.001
2-3 times/week	283	40.37	153	37.14	130	44.98	0.037
A few times/month	226	32.24	153	37.14	73	25.26	< 0.001
Less frequently	98	13.98	70	16.99	28	9.69	0.006

The results show that most of the medical students involved in the study were at low risk of CVD. The studied population consisted of similar individuals (young medical students) who had almost completed the course of the faculty of medicine. Thus, they had all gained complete knowledge of modifiable risk factors of CVD. Nevertheless, our study shows that almost 25% of them had the 30-year CVD risk elevated (general CVD 'Your risk') in comparison to completely healthy individuals ('Normal risk'). The elevated risk occurred mainly in men. Despite the fact that the vast majority of examined students were in the group of low risk (according to Gozdzik *et al.*), it seems important to underline that in the young population with a high level of health awareness (medical students) there are some students in the group of intermediate 30-year CVD risk level and most of them are men. This fact emphasize the importance of using long-term risk functions at every age and the need to create such risk functions for easy use worldwide, as for example 30-year CVD risk based on the FHS.

Grundy *et al.* underline the need and importance of long-term prevention in young adults to minimize the future occurrence of coronary heart disease [4]. As the study states, short-term risk evaluation may not point out the need to reduce modifiable risk factors in youth while the risk estimated by long-term risk functions could be unacceptably high. Thus the elevated long-term risk is an early warning of a need of changes in lifestyle in these patients, for example inappropriate eating habits, overweight, smoking cigarettes, and an inadequate level of physical activity. Changing lifestyle is often the easiest way to prevent CVDs and can reduce the long-term risk.

The results of our research show that elevated risk occurred more often in students with overweight or obesity. Elevated BMI (> 25 kg/m^2) seems to be the greatest risk factor in the studied population. Nowadays, one of the most important problems of the world population is the outbreak of the obesity epidemic. According to the World Health Organization worldwide obesity has doubled since 1980 [5]. Excessive body weight leads to elevated CVD risk and mortality overall [6]. Moreover, the results of the StudHeart study show that dietary habits of some medical stu-
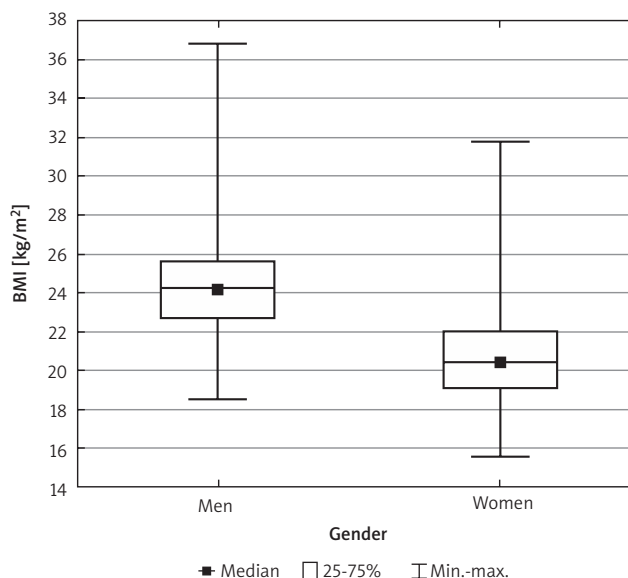

Fig. 1. Differences in BMI according to gender ($p = 0.001$)

dents are reflected not only in elevated CVD risk but also the risk of type 2 diabetes mellitus (T2DM) [2]. More than 15% of medical students have BMI over 25 kg/m^2, but more worrying is the fact that almost one-third of men in the StudHeart study are overweight (32.53% of men vs. 3.88% of women, $p < 0.001$). This observation is similar to many studies worldwide. For example, in the research conducted among 989 third-year medical students in Crete, 39.5% of men and 23.3% of women were overweight or obese: BMI 25-29.9 kg/m^2 – 34.4% of men and 19.9% of women ($p < 0.001$); and BMI > 30 kg/m^2 – 5.1% of men and 3.4% of women ($p < 0.001$) [7]. When comparing the results of the StudHeart study to the study conducted by Kardjalik *et al.* in 2010/2011 among 280 students of the Medical University of Lodz, BMI over 25 kg/m^2 was also more common among men than women (26.6% vs. 6.5%). Moreover, 45% of students reported fast-food consumption a few times per month and 2.5% a few times per week [8]. It is worrying that in comparison to our results fast food consumption

Tab. III. Overall results of 30-year CVD risk in studied population

Variable	Overall		Women		Men		P-value
	n	%	n	%	n	%	
General 30-year CVD risk:							
'Your risk' > 'normal risk'	159	23.18	36	8.93	123	43.46	< 0.001
Low risk (< 12%)	683	97.44	411	99.76	272	94.12	
Intermediate risk (≥ 12% and < 40%)	18	2.56	1	0.24	17	5.88	
High risk (> 40%)	0	0	0	0	0	0	
Hard 30-year CVD risk:							
'Your risk' > 'Normal risk'	116	16.91	33	8.19	83	29.33	< 0.001
Low risk (< 12%)	698	99.57	412	100	286	98.96	
Intermediate risk (≥ 12% and < 40%)	3	0.43	0	0	3	1.04	
High risk (> 40%)	0	0	0	0	0	0	

among students is increasing (49.5% a few times a month and 7.56% at least 2-3 times a week in the StudHeart study). In another study conducted among 610 students of the Medical University of Lodz in 2007 excessive body weight was also more common among men than women (35.2% vs. 5.7%) [9]. The results mentioned above are in agreement with the results of the StudHeart study. Bad dietary habits among medical students are also present among medical doctors, as was found in the study of Niedźwiedzka *et al.*, where 9.4% of 150 medical doctors reported fast-food consumption a few times a week [10].

Another study conducted in 2010 among students of Bialystok University of Technology (Poland) showed excessive bodyweight in 21.69% of men and 4.48% of women [11]. Compared with the StudHeart study, overweight is more common among medical students. Body mass reduction not only leads to reduced CVD risk but also brings clinical benefits for patients. A meta-analysis of 25 randomized clinical trials showed that for each kilogram of weight loss in obese and overweight patients, the systolic and diastolic blood pressure decreased by about 1 mm Hg [12]. Moreover, lifestyle modifications can substantially delay or even prevent the occurrence of hypertension [13].

Besides overweight, the next risk factor of CVD that should be mentioned as the cause of CVD risk elevation in the StudHeart population is smoking cigarettes. The StudHeart study shows that more than every tenth student smokes cigarettes. Most of the smokers are men (15.92% of men vs. 8.50% of women; p = 0.003). In comparison, in a study conducted in Greece more than two decades ago among medical, dental and nursing students (n = 832) the percentage of smokers was at a comparable level to the StudHeart study (respectively 10.1% vs. 11.57%) [14].

The results of the Global Health Professions Student Survey (GHPSS) that was conducted among medical students in 47 countries and Gaza Strip/West showed that over 20% of the students currently smoked cigarettes (results obtained in 26 sites) [15]. In 37 sites the percentage of smoking students was higher in men than in women. Similar observations were made in our study. In spite of the wide knowledge gained during medical studies of the risks associated with smoking cigarettes, the percentage of students addicted to nicotine seems to be excessive. However, fewer students are addicted to nicotine in the StudHeart population in comparison to the group who have taken part in GHPSS. Fewer students smoke cigarettes in the StudHeart population in comparison to studies conducted among other medical faculties in Poland. Addiction to nicotine is more common among medical students of the Medical University of Wroclaw (18%) [16] and Gdansk Medical University (29%) [17] than respondents of the StudHeart study.

Reducing risk factors in youth is very important in order to reduce the occurrence of CVD. An example of the role of prophylaxis focused on reducing risk factors is shown in the report by Vartiainen *et al.* [18]. The authors reported 80% reduction of coronary mortality in Finland in a 35-year period (since 1972), and as the main cause of this trend

they underline the role of a great decline of risk factor levels. In a randomized controlled trial of multifactorial lifestyle modifications Ziv *et al.* state that broad lifestyle improvement results in an improved glucose/lipid profile and significant reduction of blood pressure [19]. Moreover, data from 5 prospective, large population-based studies show that lifestyle free of three major risk factors of CVD (serum cholesterol level, blood pressure, smoking) leads to longer lifetime expectancy [20]. However, young people are usually not aware of the danger. The awareness of medical students, though higher than in the general population, seems still insufficient. The use of long-term risk scales, such as 30-year risk of CVD based on the FHS, could bring better results in reducing risk factors. It derives from the fact that assessing short-term risk in youth could show a very low level of the risk, while the long-term risk could be importantly elevated. The 30-year risk scale enlightens youth on the real impact of improper lifestyle habits on their future. Moreover, they might be more likely to make necessary lifestyle changes if they know their long-term risk of CVD, including coronary death, myocardial infarction and stroke.

Even though CVD risk functions based on the FHS are very useful and popular worldwide, they are not free of disadvantages. Hippisley-Cox *et al.* point that the CVD risk scores based on the FHS may overestimate the risk in contemporary northern European populations due to the fact that the FHS was developed during a period with a high level of CVD incidents in America [21]. Moreover, the FHS risk function does not take into consideration family history of CVD as a risk factor. The authors also state that the population of the FHS is white in most cases and the risk may be overestimated in ethnically varied populations. However, in the case of the StudHeart study population, which is entirely white, this point seems irrelevant.

The main limitation of the StudHeart study is the method of collecting the data – the anonymous survey itself. The authors cannot be certain whether all of the respondents' answers are consistent with the actual status. Despite the fact that the risk level obtained by the on-line calculator of 30-year CVD ('Your risk') is given with the 'Normal risk' for each individual to compare, the next important limitation of the study is the lack of a control group (for example students from other faculties or universities). Comparison of results from the control group and the studied population could give the answer to the still unanswered question about the influence of medical knowledge gained during studying medicine on the changes in lifestyle and awareness of the risk of CVDs in medical students.

Conclusions

Despite the fact that most of the students are in the low risk group, almost one-fourth of them have the general 30-year CVD risk elevated and one-sixth have the hard CVD risk elevated, in comparison to individuals with an optimal risk profile ('Normal risk'). Among this population, elevated risk occurs particularly among men. The main risk factors causing elevated CVD risk in students are overweight, obesity

and smoking cigarettes. Evaluating long-term risk and prophylactic actions should be performed, especially in men.

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Disclosure

Authors report no conflict of interest.

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