Conventional Coronary Heart Disease Risk Factors in Shahedieh Cohort Population: Yazd, Central Part of Iran

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Research Article

Keywords: coronary heart disease, Risk factors, Prevalence, Yazd

Posted Date: October 13th, 2021

DOI: https://doi.org/10.21203/rs.3.rs-924801/v1

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Abstract

**Background:** The prevalence of coronary heart disease (CHD) is increasing worldwide. The main purpose of this study was to investigate the prevalence of CHD and related risk factors in the population of Shahedieh cohort in Yazd, central Iran.

**Method:** This cross-sectional analytical study was performed on the data of the first phase of the Yazd Shahedieh cohort study, which started in 2016 and included about 10,000 people from the urban population of 35-70 years old in Yazd Shahedieh – Yazd, Iran. Descriptive statistics were used to describe the variables and Chi-square test and multiple binary logistic regression models were used for analysis by reporting the modified odds ratio. All analyzes were performed in SPSS 19 software with a significance level of 5%.

**Results:** The prevalence of the CHD was 8.08% (769 patients). The results of multiple binary logistic regression identified aging, low level of education, smoking, female gender, abnormal LDL, family history, diabetes and blood pressure as risk factors for CHD. The odds of getting CHD over the age of 60 was about 6 times than those aged 30-40, in the illiterate people it was about two times than the university. Smoking, family history, hypertension and diabetes increased the odds of getting CHD by 1.67, 1.59, 3.48 and 1.64. Smoking, family history, hypertension and diabetes increased the odds of getting CHD by 1.67, 1.59, 3.48 and 1.64, times than others, respectively.

**Conclusion:** The prevalence of the disease in Iran was relatively high. According to the effect size, the most important risk factors for the disease were age over sixty years and blood pressure.

Background

Cardiovascular diseases are a major contributor to worldwide mortality, and the number of deaths from cardiovascular disease is increasing every year(1). According to the World Health Organization, in 2019, cardiovascular disease caused about 18 million deaths in the world, which is a 32% share of the world’s total deaths (2). In addition to mortality, the burden of cardiovascular disease is increasing, so that the burden of cardiovascular disease has more than doubled from 1990 to 2019 (3).

One of the most important cardiovascular diseases is coronary heart disease, which is caused by blocked arteries and improper heart function. In Iran, coronary heart disease accounts for 46% of all deaths and 23% of the burden of disease (4). Estimation of the prevalence in various studies shows that the prevalence of coronary heart disease in the world was 1.72% (5), in Europe 3.5% (6), in Asia 1.44% (7) and in Iran 1.59% (8).

Identifying risk factors for heart disease and planning to change it is the most effective way to reduce heart disease mortality. Various epidemiological studies have listed several factors for the development of this disease, the most important of which are divided into two categories of modifiable and non-modifiable factors (1, 3, 9, 10): non-modifiable factors included age, patient gender, family history of heart
disease and patient ethnicity. Also, abnormal body mass index, underlying diseases such as hypertension, diabetes, hyperlipidemia, poor diet, poor lifestyle with low physical activity and the patient's anxiety and stress were introduced as modifiable risk factors for the disease.

Various studies have been performed to identify CHD risk factors in Iranian cities such as Tehran(4), Gilan(11), Sari(12), Mashhad(13), Isfahan(14), Shahrekord(15) and Yasouj(16). To the best of our knowledge there were no studies examining the risk factors for coronary heart disease in Yazd, central part of Iran. Therefore, the aim of this study was to estimate the prevalence of CHD and identify its risk factors based on the data from the Shahdieh cohort in central part of Iran.

Methods

The data used in this study were extracted from the first phase of Shahedieh cohort, which was one of the prospective epidemiological studies in Iran in Yazd, whose enrollment and data collection had started in 2016. Inclusion criteria include age (35 to 70 years), gender (both sexes), people without cardiovascular disease and exclusion criteria include: heart attack/ myocardial infarction, migration, death, age under 35 and over 70 years.

Data were collected through self-reporting and face-to-face interviews with participants. Study variables include age, gender, level of education, marital status, economic status, smoking, waist to hip ratio, waist to height ratio, waist circumference, cholesterol level, triglyceride level, HDL, LDL, Dyslipidemia, family history, diabetes, hypertension, having or not having physical activity, and body mass index (BMI).

According to the guidelines of the WHO and literature review, the study variables were graded as follows: WHR: abnormal (men>0.9 and women >0.85), normal (men≤0.9 and women ≤0.85); WHtR : normal (<0.5), abnormal (>=0.5); WC: normal (men<102 and women<88), abnormal( men≥102 and women ≥88); HDL: normal (men≥40 and women ≥50), abnormal (men<40 and women<50); LDL-C: normal(<130), abnormal (>130).

Frequency and percentage were used to describe qualitative variables and mean and standard deviation (SD) were used for quantitative variables. To compare the prevalence of CHD in terms of demographic and anthropometric variables, Chi-square test and to investigate the relationship between demographic and anthropometric variables with or without heart CHD, multiple binary logistic regression were used so that with controlling the effect of other variables for each variable adjusted odds ratio (OR) and 95% confidence interval were provided. All analyzes were performed in SPSS 19 (SPSS Inc., Chicago, Illinois, USA) software with considering a significance level of 5%.

Results

Data of 9521 people with mean (SD) of age equal to 47.69 (9.62) were used. 50.03% (4763 people) were men, 95.75% (9116 people) married, 33.11% (2992 people) at age of 41 to 50 years old, 22.47% (2139 people) smoke cigarette, 60.78% (5787 people) had a family history of coronary artery disease, 18.10%
(1723 people) had diabetes, 21.29% (2027 people) hypertensive, 8.08% (769 patients) had coronary heart disease (Table 1). The mean (SD) age of CHD patients was 55.82 (8.54).
| Variables                      | Levels                      | N    | percent % |
|--------------------------------|-----------------------------|------|-----------|
| Marital status (9520)          | Single-widow-divorce       | 404  | (4.24)    |
|                                | Married                     | 9116 | (95.75)   |
| Age no: (9520)                 | 30-40                       | 2766 | (29.05)   |
|                                | 41-50                       | 3152 | (33.11)   |
|                                | 51-60                       | 2462 | (25.86)   |
|                                | 61-70                       | 1140 | (11.97)   |
| Education level (9519)         | Illiterate                  | 1570 | (16.49)   |
|                                | Primary school              | 2992 | (31.43)   |
|                                | Middle school               | 1589 | (16.69)   |
|                                | High school                 | 1896 | (19.91)   |
|                                | University/college          | 1472 | (15.46)   |
| Social Economic Status (9484)  | Low                         | 3547 | (37.25)   |
|                                | Medium                      | 4444 | (46.68)   |
|                                | High                        | 1493 | (15.68)   |
| Smoking cigarette (9511)       | Yes                         | 2139 | (22.47)   |
|                                | No                          | 7372 | (77.43)   |
| Waist to hip ratio (WHR) (9520)| Normal                      | 1675 | (17.59)   |
|                                | Abnormal                    | 7845 | (82.40)   |
| Waist to height ratio (WHR) (9520)| Normal                      | 1466 | (15.40)   |
|                                | Abnormal                    | 8054 | (84.59)   |
| Waist Circumference (WC) (9520)| Normal                      | 4477 | (47.02)   |
|                                | Abnormal                    | 5044 | (52.98)   |

WHR: ab-normal (men > 0.9 and women > 0.85), normal (men ≤ 0.9 and women ≤ 0.85)

WHtR: normal (< 0.5), abnormal (≥ 0.5); WC: normal (men < 102 and women < 88), abnormal (men ≥ 102 and women ≥ 88)

HDL: normal (men ≥ 40 and women ≥ 50), abnormal (men < 40 and women < 50)

LDL-C: normal (< 130), abnormal (> 130)
| Variables                  | Levels          | N    | percent% |
|----------------------------|-----------------|------|----------|
| Gender (9520)              | Male            | 4763 | (50.03)  |
|                            | Female          | 4757 | (49.96)  |
| Cholesterol (9520)         | Abnormal        | 966  | (10.15)  |
|                            | Normal          | 8554 | (89.84)  |
| TG (mg/dl) (9520)          | Abnormal        | 2438 | (25.61)  |
|                            | Normal          | 7082 | (74.38)  |
| HDL-C (mg/dl) (9520)       | Abnormal        | 472  | (4.96)   |
|                            | Normal          | 9048 | (95.03)  |
| LDL-C (mg/dl) (9398)       | Abnormal        | 1891 | (19.86)  |
|                            | Normal          | 7507 | (78.85)  |
| Dislepidemia (9517)        | Yes             | 3924 | (41.21)  |
|                            | No              | 5593 | (58.74)  |
| Family History (9521)      | Yes             | 5787 | (60.78)  |
|                            | No              | 3730 | (39.18)  |
| Diabetic (9517)            | Yes             | 1723 | (18.10)  |
|                            | No              | 7794 | (81.86)  |
| High Blood Pressure (9517) | Yes             | 2027 | (21.29)  |
|                            | No              | 7490 | (78.67)  |
| CHD (9517)                 | Yes             | 769  | (8.08)   |
|                            | No              | 8748 | (91.88)  |
| Physical activity (9520)   | Yes             | 8549 | (89.79)  |
|                            | No              | 971  | (10.20)  |
| BMI (kg/m2)                | <25             | 2255 | (23.68)  |

WHR: ab-normal (men>0.9 and women >0.85), normal (men≤0.9 and women ≤0.85)

WHtR: normal (<0.5), abnormal (>=0.5); WC: normal (men<102 and women<88), ab normal (men≥102 and women ≥88)

HDL: normal (men≥40 and women ≥50), ab normal (men<40 and women<50)

LDL-C: normal (<130), ab normal (>130)
The prevalence of CHD in terms of demographic and anthropometric variables showed disease was more prevalent in the age of over sixty years (21.2%), in illiterate people (17.6%), in smokers (11.2%), in diabetic patients (18.5%), in patients with hypertension (22.4%), in men (8.7%) and in women (7.5%), in BMI level higher than 30 (9%) and in individuals with family history (9%) (Table 2).
Table 2  
Demographic and anthropometric variables relation with CHD prevalence

| Variables             | levels                  | Non-CHD | CHD  |   |   |
|-----------------------|-------------------------|---------|------|---|---|
|                       | N          | %      | N    | %  |   |
| Marital state         | Single-widow-divorce   | 369     | 91.3 | 35 | 8.7| 0.661|
|                       | Married     | 8347    | 91.9 | 769| 8.1|      |
| Age                   | 30-40       | 2723    | 98.4 | 43 | 1.6| <0.001|
|                       | 40-50       | 3005    | 95.3 | 147| 4.7|       |
|                       | 50-60       | 2122    | 86.3 | 337| 13.7|      |
|                       | >60         | 898     | 78.8 | 242| 21.2|      |
| Educational level     | University/college   | 1405    | 95.4 | 67 | 4.6| <0.001|
|                       | illiterate    | 1294    | 82.4 | 276| 17.6|      |
|                       | Primary school  | 2728    | 91.2 | 262| 8.8|       |
|                       | Middle school   | 1520    | 95.7 | 69 | 4.3|       |
|                       | High school    | 1800    | 95   | 95 | 5 |      |
| Social Economic status| High        | 1334    | 89.4 | 158| 10.6| <0.001|
|                       | Low          | 3292    | 92.8 | 254| 7.2|       |
|                       | Moderate      | 4088    | 92   | 355| 8  |       |
| Smoke Cigarette       | Yes          | 1899    | 88.8 | 239| 11.2| <0.001|
|                       | No           | 6842    | 92.8 | 528| 7.2|       |
| WHr                   | Abnormal     | 7139    | 91   | 703| 9  | <0.001|
|                       | Normal       | 1609    | 96.1 | 66 | 3.9|       |
| WHtr                  | Ab normal    | 7354    | 91.3 | 697| 8.7| <0.001|
|                       | Normal       | 1394    | 95.1 | 72 | 4.9|       |

* Chi square test

WHR: Ab-normal (men>0.9 and women >0.85), normal (men≤0.9 and women ≤0.85)

WHtr: normal (<0.5), ab normal (>=0.5); WC: normal (men<102 and women<88), ab normal (men≥102 and women ≥88)

HDL: normal (men≥40 and women ≥50), ab-normal (men<40 and women<50)

LDL-C: normal (<130), ab normal (>130)
|                     | Abnormal | Normal  |
|---------------------|----------|---------|
| WC (cm)             |          |         |
| Abnormal            | 4590     | 91      |
| Normal              | 4158     | 92.9    |
| Gender              |          |         |
| Male                | 4347     | 91.3    |
| Female              | 4401     | 92.5    |
| Cholesterol         |          |         |
| Abnormal            | 900      | 93.3    |
| Normal              | 7848     | 91.8    |
| TG (mg/dl)          |          |         |
| Abnormal (>150)     | 2216     | 91      |
| Normal (<150)       | 6532     | 92.2    |
| HDL-C (mg/dl)       |          |         |
| Abnormal            | 427      | 90.5    |
| Normal              | 8321     | 92      |
| LDL-C (mg/dl)       |          |         |
| Abnormal            | 1578     | 94      |
| Normal              | 7065     | 91.4    |
| Dislipidemia        |          |         |
| Yes                 | 3607     | 92      |
| No                  | 5138     | 91.9    |
| Family History      |          |         |
| Yes                 | 5264     | 91      |
| No                  | 3482     | 93.4    |
| Diabetic            |          |         |
| Yes                 | 1404     | 81.5    |
| No                  | 7344     | 94.2    |
| Hypertensive        |          |         |
| Yes                 | 1572     | 77.6    |
| No                  | 7176     | 95.8    |
| Physical activity   |          |         |
| Yes                 | 7865     | 92      |
| No                  | 883      | 91      |
| BMI (kg/m2)         |          |         |
| <25                 | 2116     | 93.8    |
| 25-30               | 3741     | 92      |

* Chi square test

WHR: Ab-normal (men>0.9 and women >0.85), normal (men≤0.9 and women ≤0.85)

WHtR: normal (<0.5), ab normal (>=0.5); WC: normal (men<102 and women<88), ab normal (men≥102 and women ≥88)

HDL: normal (men≥40 and women ≥ 50), ab-normal (men<40 and women<50)

LDL-C: normal (<130), ab normal (>130)
The results of multiple binary logistic regression showed that the odds of getting CHD in the age group over 60 years, 50-60 old years, and 40-50 old years was about 6 times, 4.45 times and 2.10 times than those 30-40 old years, respectively, illiterate and primary school 1.73 and 1.43 times than university or college educational level, respectively, cigarette smoking about 1.67 times than non-smokers, people with abnormal LDL-C about 1.65 times than those with normal level of LDL-C, people with family history of CHD 1.59 times than those without family history, diabetic people 1.64 times than non diabetic individuals, hypertensive peoples 3.48 times than healthy individuals, female about 1.20 times than male (Table 3).
Table 3
Results of multiple logistic regression in assessing CHD risk factors in Shahedieh cohort population

| Variables                  | levels                     | Sig.  | OR   | 95% CI for OR   |
|----------------------------|----------------------------|-------|------|----------------|
|                            |                            |       |      | Lower          |
|                            |                            |       |      | Upper          |
| Marital state              | Single-widow-divorce       | .793  | 1    |                |
|                            | Married                    | 1.053 | .714 | 1.555          |
| Age                        | 30-40                      | Ref.  | 1    |                |
|                            | 40-50                      | <0.001| 2.107| 1.469          |
|                            | 50-60                      | <0.001| 4.456| 3.119          |
|                            | >60                        | <0.001| 5.891| 3.968          |
| Educational level          | University/college         | Ref.  | 1    |                |
|                            | Illiterate                 | .001  | 1.734| 1.235          |
|                            | primary school             | .022  | 1.435| 1.054          |
|                            | Middle school              | .829  | .960 | .665           |
|                            | High school                | .611  | 1.093| .776           |
| Social Economic Status     | High                       | Ref.  | 1    |                |
|                            | Low                        | .572  | .949 | .792           |
|                            | Moderate                   | .843  | 1.024| .813           |
| Smoke Cigarette            | Yes                        | <0.001| 1.668| 1.338          |
|                            | No                         | Ref.  | 1    |                |
| Waist to Hip ratio         | abnormal                   | .740  | .946 | .682           |
|                            | Normal                     | Ref.  | 1    |                |
| Waist to Height ratio      | abnormal                   | .229  | 1.227| .879           |
|                            | Normal                     | Ref.  | 1    |                |
| Waist Circumference (cm)   | abnormal                   | .896  | .986 | .796           |

WHR: abnormal (men>0.9 and women >0.85), normal (men≤0.9 and women ≤0.85)

WHTR: normal (<0.5), abnormal (≥0.5); WC: normal (men<102 and women<88), abnormal (men≥102 and women ≥88)

HDL: normal (men≥40 and women ≥50), abnormal (men<40 and women<50)

LDL-C: normal (<130), abnormal (>130)
|                      | Normal       | Ref. | 1     |
|----------------------|--------------|------|-------|
| Gender               | Female       | .011 | 1.19  |
|                      | Male         | Ref. | 1     |
| Cholesterol          | abnormal     | .520 | .883  |
|                      | Normal       | Ref. | 1     |
| TG (mg/dl)           | Non-normal (>150) | .563 | 1.115 |
|                      | Normal       | Ref. | 1     |
| HDL-C (mg/dl)        | abnormal     | .395 | .839  |
|                      | Normal       | Ref. | 1     |
| LDL-C (mg/dl)        | abnormal     | .021 | 1.646 |
|                      | Normal       | Ref. | 1     |
| Dyslipidemia         | Yes          | .753 | .936  |
|                      | No           | Ref. | 1     |
| Family History       | Yes          | <0.001 | 1.594 | 1.344 | 1.891 |
|                      | No           | Ref. | 1     |
| Diabetic             | Yes          | <0.001 | 1.644 | 1.378 | 1.960 |
|                      | No           | Ref. | 1     |
| Hypertension         | Yes          | <0.001 | 3.480 | 2.913 | 4.158 |
|                      | No           | Ref. | 1     |
| Physical activity    | Yes          | .300 | .870  |
|                      | No           | Ref. | 1     |
| BMI (kg/m2)          | <25          | Ref. | 1     |
|                      | 25-30        | .301 | 1.062 |
|                      | >30          | .668 | 1.183 |

WHR: abnormal (men>0.9 and women >0.85), normal (men≤ 0.9 and women ≤ 0.85)

WHtR: normal (<0.5), abnormal (>=0.5); WC: normal (men<102 and women<88), abnormal (men≥102 and women ≥88)

HDL: normal (men≥40 and women ≥50), abnormal (men<40 and women<50)

LDL-C: normal (<130), abnormal (>130)
Discussion

Heart disease is an important part of the problems of health systems worldwide, which is spreading rapidly in both developed and developing countries and is considered as the most important cause of death(1). The aim of this study was to determine the prevalence of common risk factors for coronary heart disease in the population aged 30-70 years in Yazd.

Results of our study showed that the prevalence of CHD was 8.08%. A study by Ghaemian et al. 2020 estimated the prevalence of CHD in Iran and in the city of Sari to be 9%, which is in line with our study(12). Our results also showed that the highest prevalence of CHD was in older patients especially in the age range of 50 to 60 years and most often in men. So the risk of coronary heart disease was about 6 times higher in people over 60 than those in range of 30-40 years. Ghaemian et al. 2020 showed that the risk of CHD at the age of 60 years was about 10.5 times higher than the age group 40-49 year (12).

Kazemi et al. 2017(17), Hedaegh et al. 2009(18), Janghorbani 2006(19), Wong 2018 (20)all acknowledged that aging is directly related to the incidence of CHD.

Consistent with our findings, the 2017 study by Bots et al.(21) showed that the prevalence of disease and mortality was higher in men than women and this difference in prevalence at older ages was significant. Ahmari et al. 2017 in their study in Saudi Arabia also showed that the prevalence of CHD was significantly related to age and gender (22), so that the prevalence of the disease was twice as high in men than women. In other studies that calculated the risk of CHD, men were at higher risk than women (4, 23–25).

The result of Chi-square test in our study showed that the prevalence of the CHD was significantly different in education levels, so that the highest prevalence of the disease was in illiterate people with 17.6%. In 2019, Alquins et al. in study of 2,997 heart patients in Saudi Arabia declared that low education as factors associated with CHD prevalence(23). Nakhaei et al. 2018 in their study on Iranian population emphasized that people with higher education have a lower risk of CHD(16).

Iran's population is changing and aging in the meantime. Diabetes is one of the diseases that is increasing. The results of the study showed that the prevalence of CHD is associated with diabetes. Other studies have acknowledged this (10, 26, 27).

High blood pressure is a major factor in heart disease. STEP 2016 study(28), Nelwan etal. study in 2017(29), which examined cardiovascular risk factors in Indonesia, identified blood pressure as a major risk factor. In the present study, the prevalence of CHD was associated with high blood pressure, so that 22.4% of the prevalence of the disease was seen in people with high blood pressure.

Increased BMI is directly related to the risk of cardiovascular disease (Azarnejad et al. In 2020 stated that high body mass index is the cause of 18.8% of deaths in Iran (10). In the study of Kazemi et al. 2018 in Iran, age, gender and BMI was associated with CHD (17). Other studies have suggested a close association between cardiovascular disease and BMI (13, 14, 30, 31).
The findings of our study showed that there is a significant relationship between family history and the prevalence of CHD. In line with the present study, Wang et al. 2019 examined the risk factors associated with CHD in women and stated that family history is also a risk factor for the disease (20).

The results of MLR in the present study showed that age, education, gender, smoking, LDL-C, family history, diabetes, blood pressure are risk factors for CHD. The odds of getting CHD over the age of 60 was about 6 times than those aged 30-40, in the illiterate people it was about two times than the university education level. Smoking, family history, hypertension and diabetes increased the odds of getting CHD by 1.67, 1.59, 3.48 and 1.64, times than others, respectively. Ghaemian et al. 2020 in the study of factors related to CHD, age, drug use, low physical activity, diabetes, hypertension, abnormal amounts of HDL and LDL and total cholesterol and triglycerides as risk factors for the disease (12). Most studies in the field of CHD agree on the risk factors of age, diabetes, and blood pressure (4, 6, 16, 20, 23). In the present study, these three factors are also among the identified risk factors.

One of the limitations of this study is generalizability because the population studied in this study includes the population of 30 to 70 years in the city of Yazd in central Iran may not be generalizable to the entire population of Iran. Another limitation can be the lack of trust and honesty of the respondents about the questions. To solve this problem, the questioner tried to establish a close relationship with the respondents and assure them that your answers will not be abused in any way.

One of the strengths of this study is the relatively high sample size and many recorded parameters that can provide a good picture of the overall CHD in Yazd. Another advantage of this study was the relatively small amount of missing data, which was minimized by sufficient experience of experts in the study collection phase.

**Conclusion**

The prevalence of the disease in Iran was relatively high. In the present study, the identified risk factors for CHD included age, low education, smoking, female gender, LDL, family history, diabetes, and hypertension. According to the effect size, the most important risk factors for the disease were age over sixty years and blood pressure. Due to the aging population of Iran and the increasing prevalence of diseases such as hypertension and diabetes, the probability of increasing heart disease such as CHD is high, so it is necessary for health system and the Ministry of Health to pay special attention to heart diseases and with sufficient awareness reduce their incidence in the future.

**Declarations**

**Ethics approval and consent to participate:** The article's proposal was approved by the ethics committee of Yazd University of Medical Sciences with the ID of IR.SSU.REC.1398.090. Due to the retrospective nature of the study, no study specific consent form was used. We received administrative permission from (Secretary of University/Regional Research Ethics Committee, Yazd University of Medical Sciences)
to access and use the data. Data used in the study were anonymized. The ethics committee approved this procedure with the above ethical code. The present study was conducted in terms of the principles of the revised Declaration of Helsinki, which waived requirement for informed consent.

Consent for publication: Not applicable.

Availability of data and material: The data-sets used and/or analyzed during the current study available from the corresponding author on reasonable request.

Competing interests: All authors declare that they have no conflict of interest regarding this study.

Funding: This Study Was Part of MSc Thesis Supported by Yazd University of Medical Sciences. In this project, part of the research costs were paid to the researchers.

Authors' contributions: H.D and A.D have designed the study and supervised the thesis. H.F AND M.S collected the data and analyzed it. They also prepared the first draft of the manuscript. A.D AND M.S has edited and finalized the manuscript. All authors read the manuscript and approved it.

Acknowledgements: We thank all those who participated in the Shahdieh cohort and also the officials of Shahid Sadoughi University of Medical Sciences in Yazd for launching it.

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